Mobile Learning: Landscape and Trends

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Mobile Learning: Global Landscape and Trends

Table of Contents

■ Executive Summary

Right now, the mobile market is incredibly dynamic. Devices and tools are in almost constant development. Yet opportunities already exist that are trend-independent.

Mobile devices are becoming ubiquitous, and mobile learning is increasingly an option. The important issues are to understand the basic value-proposition mobile offers, and then to consider the opportunities unique to mobile.

The proliferation of mobile devices should be obvious. The competition in smartphones, tablets, and handheld gaming is intense. The omnipresence of mobile phones of any variety is hard to ignore, particularly when, despite repeated pleadings, someone still forgets to turn theirs off in the theatre.

Capitalizing on these technologies requires understanding that the easy entry point is access to mobile content. Whether looking at media files, audio, or video when convenient, or accessing information from documents or Web pages, the availability of the information when and where desired has immediate benefits. Similarly, being able to communicate with anyone, by voice, text message, or social media platform has equal if not greater benefits.

Going beyond these obvious points, however, are additional opportunities. Using devices to capture local context with recorders (camera or microphone), thoughts via notes, or location-based information (coordinates, compass heading, or more) is one largely untapped opportunity, and the computational capabilities of the devices, as well as combinations thereof, are just being explored.

However, to truly take advantage, you have to think beyond formal learning, and start thinking about performance support. As of yet, the characteristically quick access of these devices as needed is more suited to *in situ* help than it is to large-scale skill development.

Currently, the use of mobile devices to support organizational outcomes is still nascent. Only 10%–20% of organizations have an implementation in any of the possible categories. However, interest is growing, and the tools are ripening. More importantly, people are seeing real returns.

There are both real and imagined barriers. The maturation of support is recent, yet awareness lags. On the other hand, barriers in terms of standardization and costs still exist. Many simple mobile possibilities are now easy, yet more detailed but powerful opportunities are still somewhat complex.

If you have not yet done so, it is now both possible and desirable to put in place a mobile experiment to create an mLearning strategy articulated with the overall learning, performance, and technology strategy. The opportunities are out there, and new and powerful ones are increasingly limited only by our imaginations. If Google is now designing for mobile first, shouldn't you at least have mobile in your game plan?

■ Introduction

Mobile learning is not just a fad, but is instead a transformative opportunity both for learning, and the learning organization. Mobile learning means both augmenting formal learning, and moving to performance support, informal, and social learning as well.

The actual implementation of mLearning is growing faster in some capabilities than others. *The eLearning Guild* collects research data on the subject, and according to the survey results, the use of mLearning for social networking and communication is more prevalent than it is for the development of custom applications, with 38.1% of organizations either implementing, designing, or building the business case for social networking and only 25.7% for custom application development. The research collected shows much personal use, and 70.2% of respondents are using their personal mobile devices for business use. Of those who have conducted an mLearning implementation, 50% are seeing positive returns.

In this report, we:

- establish a foundation for discussion with some context, and a discussion of devices and major categories of application,

- look at the current "state of play" – what we are seeing in terms of data about how people are currently using mobile, and

- follow-up with a discussion of implementation issues, to support "mobilization," before looking to the future.

Why mobile?

It's no longer hype, it's official: mobile is for real. First, the devices are out there; the International Telecommunications Union indicates that in the developed world, mobile phone uptake is tapering off, but only because it's reached saturation: 116 subscriptions per 100 people! Even in the developing world, predictions were that mobile penetration would reach 68% by the end of last year. Now, mobile phones aren't the only mobile devices, but they certainly are the most ubiquitous. Or, as Steve Jobs told us at the launch of the iPhone back in 2006, more mobile phones were sold worldwide than PC's, MP3 players, cameras, and game consoles, *combined*. Now, of course, smartphones *are* MP3 players, cameras, game machines, and personal computers.

The second question is, are there any real applications? And again, the answer is positive. Phil Wainewright of ZDNet has predicted that, for enterprise computing in 2011, "Significant numbers of enterprise software vendors will … develop for mobile first." No less than Google has shifted to a "Mobile first" strategy. Mobile is the focus for the future, and all enterprise software will be mobile accessible. With people looking to their mobile device for more and more of their answers, how about for their learning?

http://www.zdnet.com/blog/saas/in-2011-mainstream-means-mobile/1235

http://googlemobile.blogspot.com/2010/02/barcelona-mobile-first.html

So the important question is when you are going to take advantage of this opportunity? You should not miss or dismiss the opportunity to make your employees more effective, wherever and whenever they are.

The goal in this report is to help you understand what is happening in mobile, and what is available, so you can contextualize it for your organization. The component steps are to establish some definitions, map out the trends, see what others are saying, talk about some examples, and provide you with some guidance going forward. As you will see, the core concept is *augmentation*; that is, extending our learning and our capabilities in time- and location-independent ways, and even in location-specific ways.

■ The Necessary Foundations

Let's be clear about what we are talking about. As one of the survey respondents expressed it: "I'm not really even sure what mLearning is." When we were writing *The eLearning Guild's* 2007 Mobile Learning 360° Research Report, we defined mobile as:

> Any activity that allows individuals to be more productive when consuming, interacting with, or creating information, mediated through a compact digital portable device that the individual carries on a regular basis, has reliable connectivity, and fits in a pocket or purse.

In addition to the expected "compact digital portable device," the important bits to notice are the fact that it is largely not about courses but instead about being more productive, and it's about something that's *always* with you. It's about *performance*, first and foremost. And it's about a device you'll have with you when needed. If you don't have it with you when you need it, you're not going to see the value.

So, just what *does* qualify? Increasingly, the answer is a mobile phone, either what they call a "feature" phone (a basic mobile phone with a few added features such as a camera and a Web browser) or a smart (*or app*) phone. In fact, it's unlikely that a mobile phone you purchase today is *without* a browser, though it's not useful without the additional purchase of a data plan, which can be an expensive capability to take advantage of. The boundaries between feature phone and smartphone are blurring as well.

There are other devices: media players (e.g. the iPod) and eReaders (Kindle, Nook, etc.) still exist, as do PDAs, though dedicated devices are decreasing. Many folks have portable gaming platforms (e.g. PSP or Nintendo DS) too. Of course, the platforms are converging: eReaders are getting browsers, gaming platforms are incorporating cameras, and PDAs may have a GPS as well.

Tablets, while long-standing, have enjoyed a revolution with the iPad, and are now becoming a major player. While sharing much of the capabilities of the smart or app phone, particularly portability and apps, they are also share some resemblance to the desktops and netbooks in sporting large screens. The question is how to categorize them. Tablets are different than laptops in that interaction with them is different; you

hold tablets close as opposed to arms length, and the screens are touched directly. They are also more easily portable. Tablets are different than mobile phones in that they're typically not pocket-sized, and therefore not likely to be with a person as ubiquitously as a mobile phone.

I prefer to think of them as a separate category of mobile: still portable but in a different class than the phone. The phone is *always* with you, and therefore a truly mobile device. The tablet can *often* be with you, and in particular has some unique dedicated utility, such as in hospitals and airplanes. The tablet is likely to have longer-term usages than the quick access typical of a cell phone, and may be more appropriate to a full learning experience. Particularly when cross-platform interactivity standards (beyond eBooks and media play to include programmed interactions) will support simulation games, we are likely to have some powerful tablet learning opportunities. They can also, however, serve in that quick reference mode of the smart phone *if* they are with the user at the time. Still, the capabilities of the tablet are equivalent to the smartphone; it's only the form factor (the physical characteristics or geometry: dimensions of width, length, thickness, and the ratios thereof) that differs.

In fact, the convergence of capability, regardless of form factor, is what is fueling the mobile revolution. The latest new devices have rich capabilities: input via touch screens with built-in or onscreen keyboards and noise-cancelling microphones; output via vibrant screens and quality audio; sensors such as GPS, cameras, compasses, and orientation sensors; and connectivity via multiple networking methods including Wi-Fi, Bluetooth, data via phone service, and cables (Quinn, 2011; see Figure 1).

Figure 1:
The Converged Device
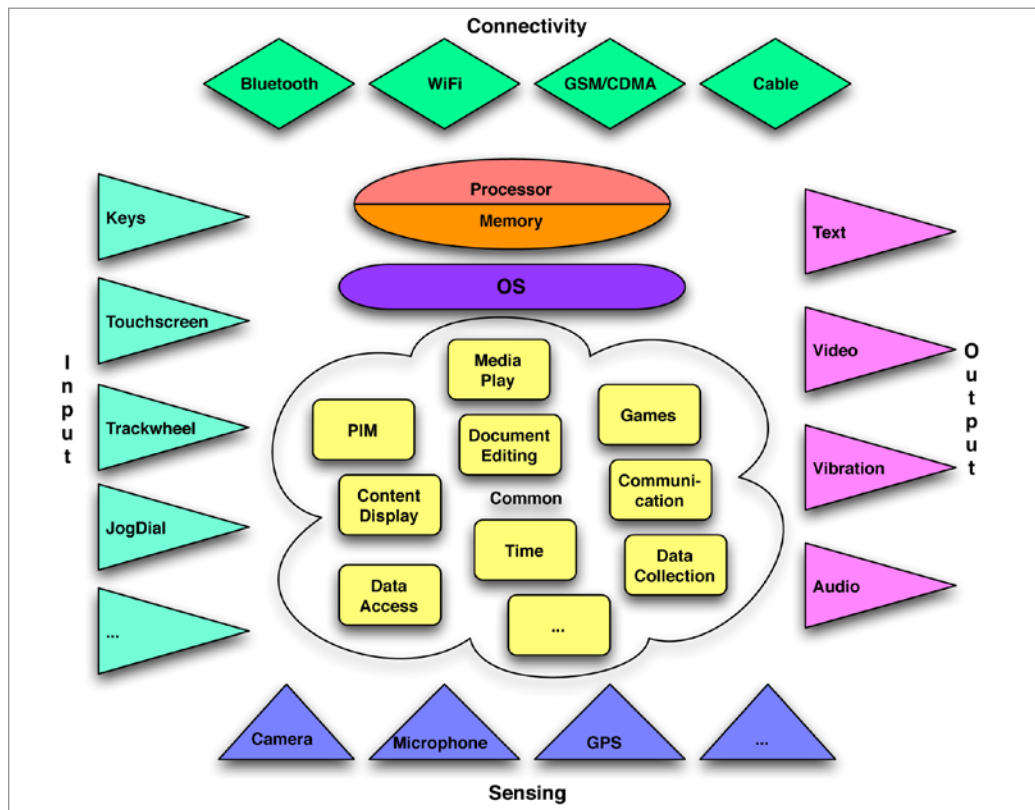
This convergence also provides a rich source of channels for supporting learning. For mobile devices in general, we are now talking not only documents (text and graphics) but audio. We typically have e-mail, the Web, and instant messaging, too. Video is almost ubiquitous now. Adding phone capabilities, we have voice and text messaging (SMS), and, increasingly, multimedia messaging (MMS). These channels are pretty much a given; the only thing that provides an extra level of challenge is in developing interactivity, but even here there are some solutions and more on the way. These channels provide new opportunities to think about how we might support learning.

mLearning Channels

- SMS/MMS
- Voice
- Document
- Audio
- Video
- Interactivity

The result is a context-aware computational device that augments our capabilities, both for formal learning, and for informal and performance-support needs. The essence of mobile is, to me, augmenting our mental capabilities wherever and whenever we are. Our brains are very good at pattern-matching and pretty good at executive function, but very bad at rote memorization and complex computations. Computers, conversely, are the reverse, and from a problem-solving perspective we are far more capable when we combine the two. Mobile devices do that *and more*.

For practical purposes, other than when the organization provides the devices (and there are sound business reasons for doing so), the device that is almost certain to be available is a mobile phone. In the case of knowledge workers, it's more likely that it's a smartphone. Given that the "application-enabled" smartphone (the app phone) is gaining in market share and sports the most complete suite of capabilities, it is the obvious target for design unless the organization wants to consider or is already providing devices. Policies can make this even more compelling; organizations can choose to supply the devices (either one, or a controlled set), and ask individuals to pay for the phone plans, thus splitting off the unexpected cost but making a smart investment in commonality and generating good will.

However, when the organization does provide the device, the options may well be something other than a mobile phone. Beyond FedEx's use of PDAs, and the new eCommerce capabilities available on the iPhone, tablets, specifically the iPad, are coming into business use. Reports put the penetration (real or pilot deployments) at either 65% or 80% of Fortune 100 businesses. Similarly, the FAA now accepts iPads in cockpits as aids. Increasingly, the differentiator may be the form-factor: the size and shape of it, since all devices will have the generic components indicated above.

http://www.tuaw.com/2011/02/14/enterprise-ipad-adoption-up-to-80-percent-in-fortune-100/

http://www.tuaw.com/2011/02/13/ipad-receives-faa-certification-as-an-electronic-flight-bag/

The Four C's of Mobile

When we abstract across mobile capabilities, we achieve what I refer to as the four C's of mobile (Quinn, 2011; see Figure 2):

- *Content* – the delivery of media including documents, audio, and video

- *Compute* – the ability to perform calculations and have programmatic responses

- *Capture* – capturing data from the local environment such as photos, videos, audio, or information from sensors such as location or direction

- *Communicate* – the ability to reach others with text, voice, or even video

Figure 2:
The 4 C's of Mobile
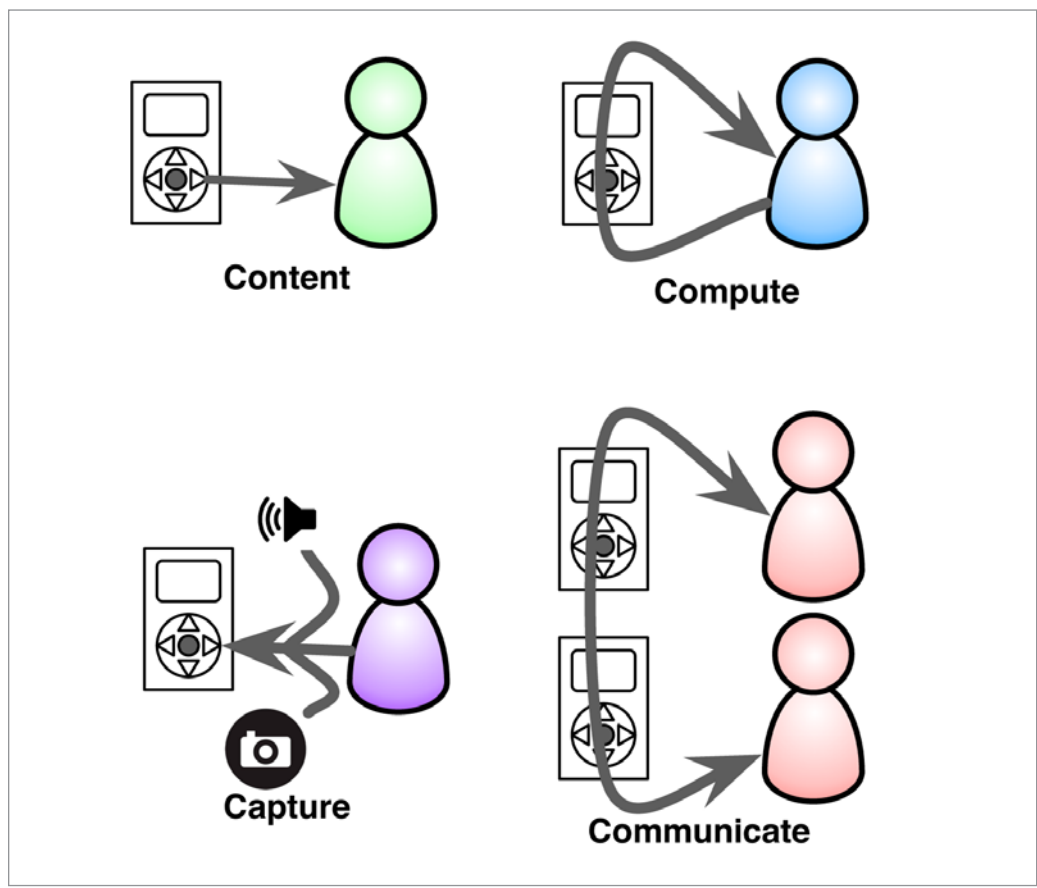
Three – content, compute, and communicate – are not unique to mobile but now augment our performance wherever we are, while *capture*, particularly combined with the other three, can do unique things. We can capture and communicate to others, or capture our location and use that to customize the content we receive to be context-specific. The point is to break out of our traditional design mentality and find a way to think more comprehensively about the opportunities that mobile provides.

A Mobile Take on Learning

When hearing the term "mLearning," many folks immediately converge on the idea of courses on a phone, whether reduced to the screen size or stripped down. This can lead to dismissal of the potential: "mLearning is not for anything in-depth, has limited interactivity, and is completely wrong for training that needs personal interaction," as one survey respondent put it. While there have been success cases for the course model (at least, the stripped-down version), that's not really the optimal value proposition for mobile learning. Really, the idea is course *augmentation*.

Figure 3:
Float Learning's Mobile Learning Primer
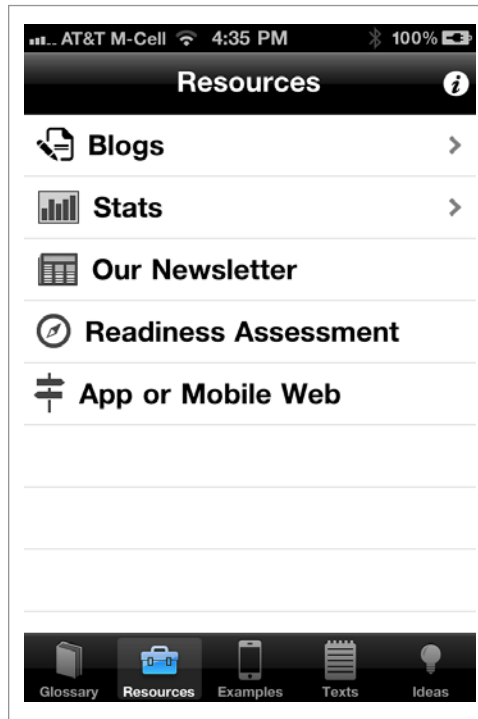
The elements that lead to effective learning are: introducing the learning, presenting appropriate concepts, demonstrating the application of those concepts within contexts, allowing the learner to practice that application in other contexts, and finally closing off the learning experience. How, then, do we augment this experience?

Too often we combine all the elements – intro, concept, example, etc. – into a single learning "event," yet research tells us that this approach isn't effective. For instance, massed practice isn't as effective as spaced practice. The forgetting curve on the event model is pretty severe. The proper way to support our learning goals of *retention* until needed and *transfer* to appropriate learning experiences is to space that learning over time (a model I like to call "slow learning").

Our cognitive architecture becomes saturated with a short amount of activation of any particular concept at one time, and further activation is not effective until there's been a break, typically sleep. Therefore, activating the knowledge a little bit over time is more effective than a large amount of activation at one time, owing to our cognitive architecture. This is hard in a face-to-face encounter (outside schools, which don't necessarily practice it either) and online, though the latter need not be so. However, mobile devices give us another channel to augment formal learning with more examples and practice, and we can extend the learning experience over time more conveniently.

One interesting example is Float Learning's free Mobile Learning Primer (see Figure 3). It does serve as a reference tool, with some decision aids, but it also supports initial investigation of mobile learning with a glossary, examples, and other resources to help brainstorm ideas. Augmenting formal learning is a natural role for mobile learning.

We can also continue to reinforce the message, maintaining or reinitiating activation as necessary. Similarly, we can capture and share relevant information so that learners are contributing to the experience, or use location information to create context-specific learning.

As an example, Grant Beever, Director of Online Services for Endeavour College, has taken the content from traditional classroom lectures and prepared it in Camtasia as narrated presentations for download via iTunes. The slides, the audio, and the combined presentations are all available separately to meet the diversity of devices and learner contexts and needs, and he's seeing 1,500 downloads a week out of a population of 3,000 full time students and 10,000 students taking at least one course. The lectures alone are not the entire course, with separate assignments and activities, so the total learning experience is not contained in the mobile component, but it is a useful adjunct.

Beyond Learning: Performance Support

The more common use of mobile learning is in performance support, in effect *augmenting* our brains. The goal is to take the digital support we can have at our desktops, and make a usable version available wherever and whenever we are. It's about bringing the capabilities our minds don't handle well to the problems we face: rote memory, complex computation, exact context capture, and distant communication.

Typical examples of mobile performance support include job aids, checklists, and more on phones (see Figure 4). Individuals can access price lists, product specifications, and more so that they do not have to memorize them. Moreover, data in the environment – bar codes, QR codes, and more – can provide additional information. This goes beyond mobile learning, although context-specific tagging can also augment formal learning.

Figure 4:
Hybrid Learning Systems Mobile Performance Support Example

Much of this is not unique to mobile: we have developed computers as the perfect complement to our brains, but the opportunity now is to untether that support from the desktop, and let it roam free. Mobile brings the power of digital augmentation, and more, to us wherever and whenever we are. However, there are ways in which mobile is unique.

As research Palm conducted more than a decade ago (yet aptly still relevant) demonstrates, usage of mobile devices is different. By and large (media players and handheld gaming platforms are likely the exception), mobile usage is more frequent during the day than on a PC, but for very short time periods. A call, a quick look up, a snap, or a quick note is the more likely usage (which is why the Palm succeeded with its "instant on" approach rather than requiring a boot-up time).

This means that while we can use our devices for content viewing for convenience (I've time on the drive/bus/plane/waiting in line), the just-in-time model is the big organizational opportunity to affect the performance indicators.

Our performance support can also be in terms of the same content/capture/compute/communicate model that applies to formal learning. Again, we are augmenting our cranial capability, or "accessorizing" our brain. However, now we can focus on supporting a momentary need:

The 4 C's Relative to Performance Support

- What information does someone need to have available?
- What computational ability might accelerate their success?
- What could they capture that would help them solve the problem?
- Who could and should they connect to?

These provide the frameworks we want to have in mind as we consider what is happening with mobile learning.

■ Where Are We Now?

With these foundations established, we can ask about the state of the industry. Things aren't static, but we have snapshots of the current state of play and can project some trajectories.

Global Growth

The International Telecommunications Union annually surveys the growth of Internet, telephony, and mobile. This year, they report that mobile technology growth has slowed, largely because, in the developed world, the market is saturated. That means that for many of you, you can safely assume that the handsets are out there. However, the developing world is still seeing massive growth, with prediction of saturation moving from 53% in 2005 to 73% in 2010.

Mobile phones are playing a major role in the developing world. Communication has created a more level playing field for Kenyan farmers, for instance, giving them up-to-date information on crop prices. Safe sex information is now available to gay men in South Africa via text-messages.

http://www.upi.com/Top_News/World-News/2011/04/04/Mobile-phone-app-aids-farmers-in-Kenya/UPIU-7661301739577/

http://mg.co.za/article/2009-04-15-can-cellphones-promote-safe-sex

The Pew Internet report from 2009 says that 83% of adult Americans currently own a mobile phone (and factor in that those are *all* adult Americans, including those not working or aged), and among 18- to 29-year-old mobile phone owners, 95% use text

messaging and 92% have taken a picture with their mobile phone. We can anticipate that the results are higher now. 77% of the population globally owns mobile phones.

http://www.pewinternet.org/Reports/2010/Social-Media-and-Young-Adults/Part-2/1-Cell-phones.aspx

http://mobithinking.com/stats-corner/global-mobile-statistics-2011-all-quality-mobile-marketing-research-mobile-web-stats-su

The growth of smartphones is coming, too. Google suggests that the growth is 30% per year. Nielsen estimates that smartphone purchases will exceed feature phone purchases in the U.S. by the third quarter of this year. It's fair to estimate, as well, that there is probably disproportionate ownership of smartphones among knowledge workers. When I talk to colleagues, most have a smartphone of one version or another. Globally, however, feature phones outsell smartphones by four-to-one.

http://blog.nielsen.com/nielsenwire/consumer/smartphones-to-overtake-feature-phones-in-u-s-by-2011/

Note also that mobile phones are a growing source of Internet access, as 500-million people accessed the Internet by cellphone in 2009, and, conservatively, that number should double in five years. Interestingly, we're seeing that many who access the Internet this way have mobile as their *only* mobile access mechanism.

The Constant Rate of Change

One of the most persistent trends in mobile devices is the rapid, almost furious, rate of change; a new announcement comes weekly if not daily. For example, in the past few days as I write this, HP has removed the name Palm from the webOS they acquired, while Nokia has adopted Windows Phone 7 as the smartphone platform for their phones previously built upon their own Operating System (OS), Symbian.

Apple tightly controls their hardware along with their software environment, but regularly releases new devices, while Google's Android has made it open to manufacturers sparking a vibrant evolution of devices. Others take intermediate stances, but the ongoing market pressures drive intense innovation. This is good for the market as a whole, but can make it hard to develop a strategy that won't be out of date in short order, even months!

There are also international differences. Europe and Japan are ahead of the U.S. in terms of mobile capabilities. Europe has been quick to develop mechanisms for using text messaging to accomplish bureaucratic transactions. Japan is ahead in mCommerce (using phones to conduct financial transactions such as purchases) and uses more mobile media and data. These capabilities are supporting a rich ecosystem of capabilities for information and consumer behavior. In 2006, Japan was already showing mLearning applications well ahead of where the U.S. largely still is. And Europe has had two separate EU-wide research projects on mobile, Mobilearn and M-Learning.

http://www.digitaljournal.com/article/298821

http://www.learningsolutionsmag.com/articles/209/mobile-learning-in-japan-why-the-future-has-already-arrived-in-asia

http://www.mobilearn.org/

http://www.m-learning.org/archive/background.shtml

Because the infrastructure in many countries (and even across countries, in the case of the European Union) is relatively homogenous and thus supports the ability to interoperate, any advances made can take advantage of a bigger market. In the U.S., despite some moves towards more interoperability, carriers and OS providers impede interoperability in a variety of ways.

Yet change is coming. Even in the developing world, technology advances are driving down the cost of data, and this trend is likely to continue. Africa, Latin America, and Asia are all seeing reductions in data costs.

http://whiteafrican.com/2010/10/28/snapshot-mobile-data-costs-in-east-africa/

http://www.hispanicprblog.com/hispanic-market-white-papers-research/mobile-content-services-growing-fast-in-latin-america-says-new-report-from-frost-sullivan.html

http://www.telecomasia.net/content/pacnet-upgrades-again-price-cuts-mobile-data-drive-demand

Classic Uses

The classic mobile example is content delivery. The easy answer is to put existing content online for mobile access, taking existing PDF, audio, and video files and making them downloadable. Similarly, one can make HTML mobile-accessible.

A second approach is to create new resources specifically for mobile delivery. Grant Beever from Endeavour College in Australia has taken the latter approach, creating lecture materials consisting of PowerPoint presentations and narration available through iTunes University. The presentations, the narration, or the combination, are all accessible separately to support different learner goals.

Research Data From the Survey

The eLearning Guild recently revised its mobile survey with some new questions, and reenergized data collection, resulting in a range in number of respondents to individual questions from 100 to 813. With this new data, and the historical data collected since 2007, we can not only present a snapshot of what is occurring now but also provide some comparisons over time and reveal the overarching trends.

Personal Use of mLearning Devices

The first area we looked at was individual use of mobile devices. Understanding where respondents are helps characterize the results we might expect (see Figure 5). Interestingly, we found that more than half of folks had more than one mobile learning de-

vice. While tablets are increasing in use, we might also hypothesize that respondents might have both a work and a personal device.

Figure 5:
Number of Personal Mobile Devices

mLearning Use of Personal Devices for Work

None	29.8%
One	45.9%
Two	23.4%
Three	1.0%

Source: The eLearning Guild Research
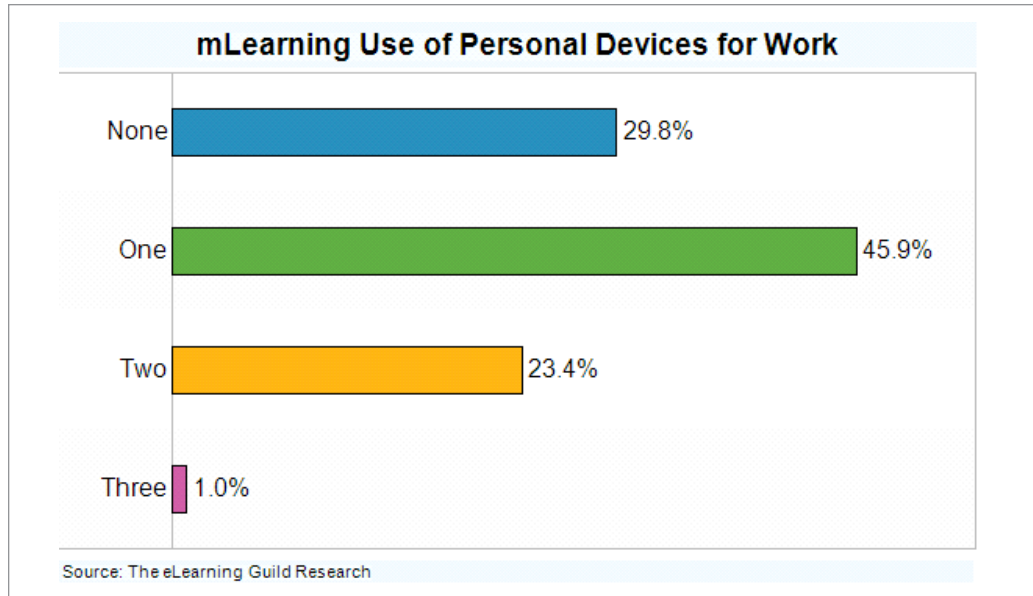
Further, the trend in usage over the past few years is similarly interesting (see Figure 6). While 2010 seems aberrant, it really isn't because adding those who own one device to those with two devices shows a growth total year-over-year. We do see decreasing use of owning many devices, and a convergence toward one device, though two devices are still prevalent. This decrease in device numbers parallels the increasing capability of phones. Nielsen predicts that the smartphone will overcome the feature phone by the third quarter of 2011. As devices become more capable, the need for more than one device decreases, though there may continue to be an interest in different form factors in a device, say a pocket-sized device to couple with a tablet.

Figure 6:
Number of Personal Mobile Devices Trend

Legend
- Five or more
- Four
- Three
- Two
- One
- None

mLearning Number of Personal Devices by Year

Year	One	Two	Three
2007	24.1%	38.1%	24.9% / 5.8%
2008	28.3%	41.3%	20.1%
2009	35.0%	37.2%	17.1%
2010	25.4%	49.8%	17.7%
2011	42.4%	40.3%	15.2%

Source: The eLearning Guild Research
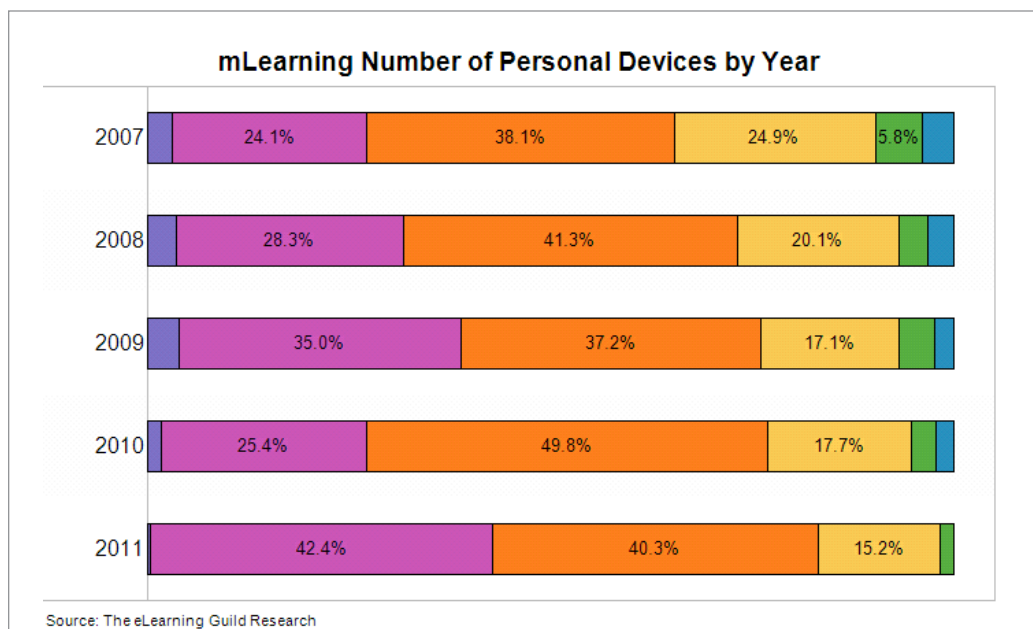
The fact that these devices are personal does not appear to be a barrier to their use for work purposes. We see a significant percentage of folks indicating that they are using their device for work (see Figure 7), whether phone calls, access, or however needed. Judy Brown, mobile learning lead for the Advanced Distributed Learning initiative of the U.S. Government, has said that part of the definition of a mobile device is a device that we know. So it may be more effortless for individuals to use their own device than to learn a new one, or perhaps organizations are encouraging the use of personal devices in the workplace to save expenses. On the other hand, many have concerns about using personal devices and work time (as well as personal data or voice costs) for contractual or principled reasons. As one respondent noted, "Unless there is compensation, or the devices are provided by my employer, mobile learning will just not happen."

Figure 7:
Work-related Use of Personal Devices

Use of Personal Mobile Devices for Work

No 29.8%

Yes 70.2%

Source: The eLearning Guild Research
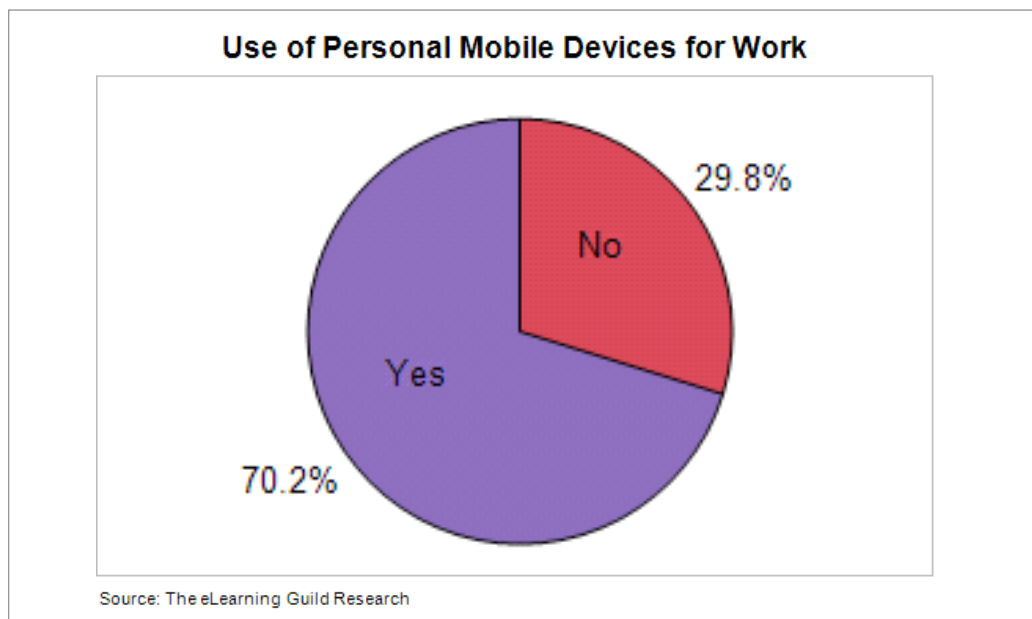
In short, the devices are out there, and people are using them. So what are organizations doing?

Organizational Use of mLearning

It's clear that, as of yet, social networking and communication is the biggest area of organizational mLearning focus (see Figure 8 on page 14). This may well simply be that social networking tools do, by and large, have mobile interfaces available. It may also be recognition of the fact that the ability to reach the right person *or network* when you're on the move can be very valuable. However, given that the ability to deliver content is arguably as easy, it is somewhat surprising that content delivery is relatively low (although more is planned). However, it is the largest area of endeavor, overall, which makes sense.

Figure 8:
Implementation of Mobile Capabilities

Legend
- No Plans
- Researching
- Building Business Case
- Designing First Offering
- Implemented

mLearning Stage of Capabilities

	Implemented	Designing First Offering	Building Business Case	Researching	No Plans
Content Delivery	11.1%	11.1%	5.8%	40.9%	31.3%
Content Capture and Uploading	14.3%	7.7%	5.6%	35.2%	37.2%
Custom Applications	8.4%	7.9%	9.4%	26.7%	47.5%
Social Networking and Communication	20.8%	5.1%	12.2%	26.4%	35.5%

Source: The eLearning Guild Research
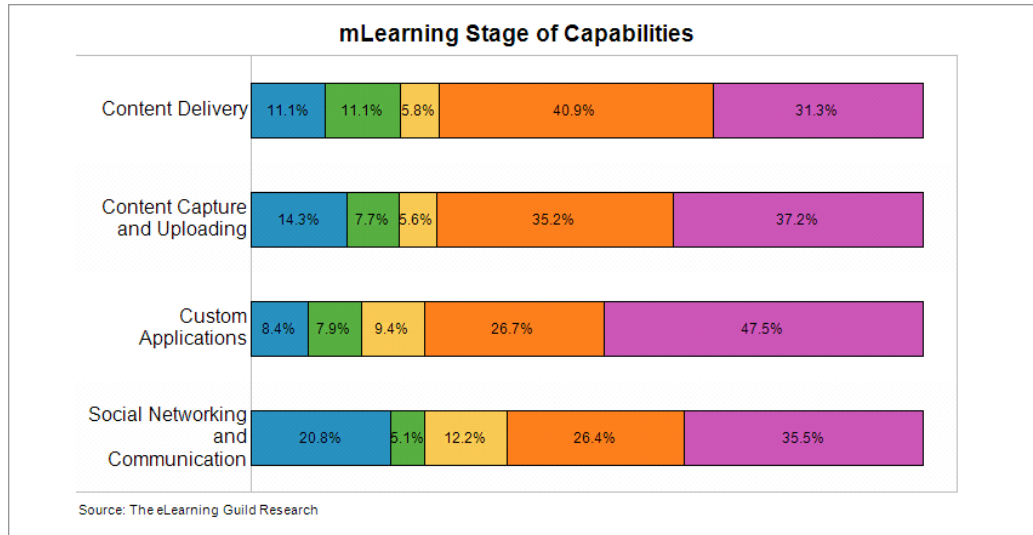
When looking at the devices targeted for mLearning development, it's not surprising that the smartphone is the obvious choice (see Figure 9). As the most-converged device, and more portable than tablets, they offer the greatest opportunity despite, as we see in the previous graphic, that custom applications are the slowest growth area owing to the difficulty of developing across platforms. Tablets are effectively new, and yet they've already established a respectable presence ahead of eReaders. The prevalence of media players is not surprising, given the ease of developing Podcasts, and the number of employees likely looking for ways to make commute time more valuable. Similarly, while we've seen that smartphones are on the rise, they're still a relatively small part of the picture, and focusing just on mobile phone technologies such as voice and SMS increases the potential reach of an initiative.

Figure 9:
Targeted mLearning Devices

Legend
- Do Not/Will Not Use
- Considering
- Use

mLearning Devices

	Use	Considering	Do Not/Will Not Use
Smartphones (e.g. iPhone, Android, Blackberry)	36.5%	57.3%	6.2%
Media players (e.g., iPods)	22.5%	49.1%	28.4%
Mobile phones	22.0%	51.7%	26.3%
Tablets (e.g. iPad)	18.0%	68.0%	13.9%
e-Readers	11.3%	38.3%	50.4%
Other		27.7%	68.1%

Source: The eLearning Guild Research
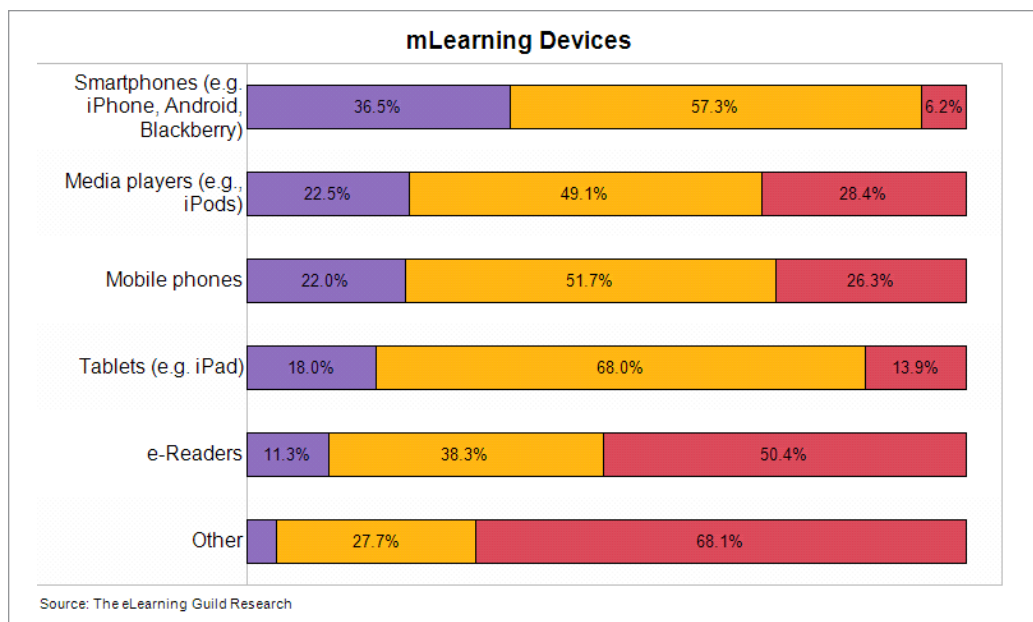
Along with the interest in devices, a concomitant interest is the platforms under consideration (see Figure 10). Smartphones and tablets can run on several different Operating Systems (OSs), so the question is which ones are seeing interest? We can see that the Blackberry is losing market share, and Android (Google) has come on strong even against the venerable iPhone. Windows Phone 7 has gotten a recent boost, and given the prevalence of Microsoft software in the organization it is not surprising, but the success of the new OS is still an open question. Palm's webOS is small, despite being one of the most respected platforms technically, but it has received a small boost with HP's acquisition of Palm and it is now selling as HP webOS 2.0. In situations with a dedicated or provided platform and perhaps custom development, webOS 2.0 might be the friendliest environment. For accessing a wide range of third-party software, iOS (the iPhone operating system) is still the leader, but again, Android is coming on very strong.

Figure 10:
mLearning Platform Trends

mLearning Development Platform Trend

Platform	Year	Percentage
iPhone	2008	17.7%
	2009	29.1%
	2010	35.4%
	2011	27.5%
Android (Google)	2008	0.0%
	2009	0.6%
	2010	8.1%
	2011	27.2%
Blackberry	2008	51.4%
	2009	52.0%
	2010	45.9%
	2011	24.8%
Windows Mobile	2008	24.7%
	2009	12.9%
	2010	7.9%
	2011	14.4%
Palm WebOS	2008	1.2%
	2009	1.1%
	2010	0.0%
	2011	3.5%
Symbian	2008	5.1%
	2009	4.3%
	2010	2.7%
	2011	2.7%

Source: The eLearning Guild Research
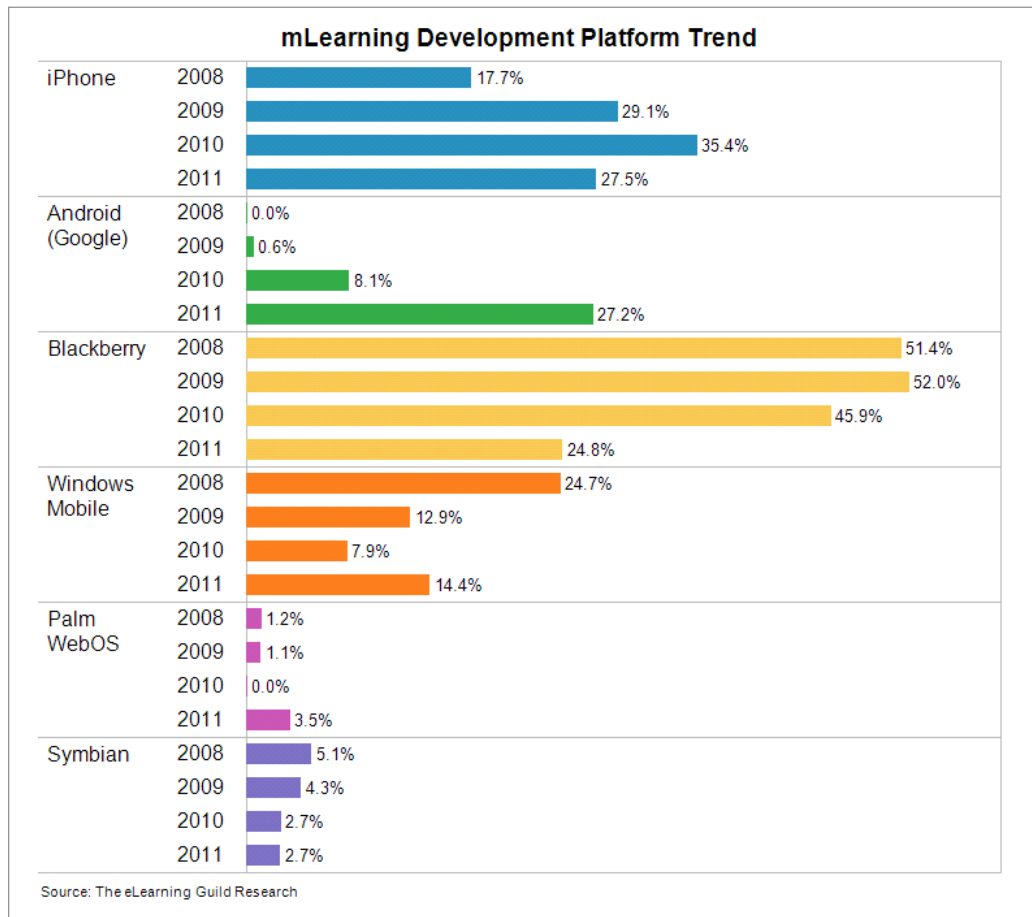
It is fair to ask what the intended audiences for those mobile initiatives are. Not surprisingly, employees lead, as they cover most of the other categories, but managers trail closer than the percentage of total population they represent (see Figure 11 on page 16). Similarly, executives, while a small percentage of the total, receive a relatively high percentage of focus. Sales reps are a predictable target, though you could also expect support reps to be a factor. More curious is why instructors and teachers would out-

number students as a focus, but perhaps they see instructor access as important for learning outcomes or quality of the learning experience.

Figure 11:
Audiences for mLearning

mLearning Audience of Learners

Audience	Percent
Employees	21.2%
Managers	17.7%
Executives	10.9%
Instructors/teachers	10.6%
Sales reps	10.5%
Students in education programs	9.7%
Partners/customers	9.2%
Support reps	6.4%
Engineers	3.8%

Source: The eLearning Guild Research
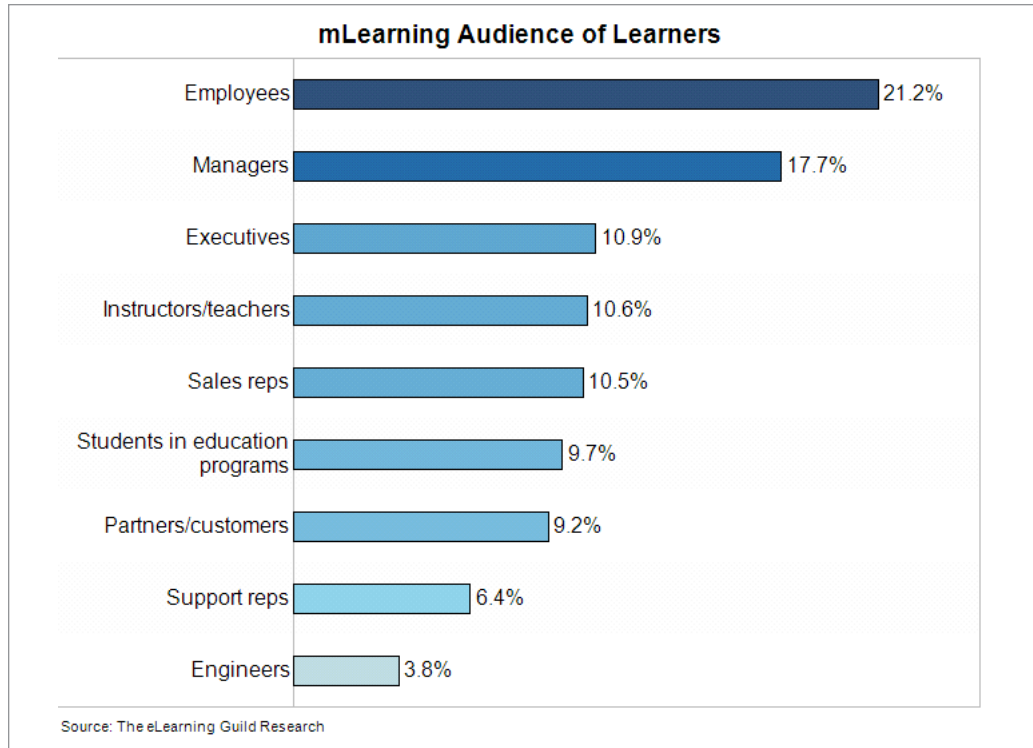
Outcomes of mLearning

Finally, and perhaps most importantly, we should look at the reported mLearning results (see Figure 12). Mobile benefit advocates will be enthused to learn that there are almost no negative impacts seen, with the exception of reducing costs (which isn't necessarily a reasonable expectation). On the positive side, we see modest-to-large improvements for learner access and needs, and at least half are finding benefits in the speed of content delivery and, importantly, improving user performance.

Figure 12:
mLearning Impact

Legend
- Significant negative
- Modest negative
- Neutral
- Modest improvement
- Big improvement

mLearning Amount of Impact on the Organization

Impact	Big improvement	Modest improvement	Neutral	Modest negative	Significant negative
Increase learner/user access and availability	42.6%	36.6%	20.8%		
Accommodate learner/user needs	32.7%	48.5%	18.8%		
Increase speed of content delivery	24.8%	27.7%	46.5%		
Improve learner/user performance	22.0%	34.0%	44.0%		
Reduce costs	6.9%	7.9%	66.3%	15.8%	

Source: The eLearning Guild Research

Looking at the mLearning Return on Investment or ROI (Figure 13), we see that exactly half are seeing a positive outcome, and almost as many are not yet sure. The figure for lack of return is small, a boon for mobile advocates. This may reflect careful attention to ROI on mobile projects for those who can measure.

Figure 13:
mLearning ROI

mLearning Return on Investment

Very Good ROI	17.0%
Modest ROI	33.0%
It is too early to tell	43.0%
We did not get a return on investment	7.0%

Source: The eLearning Guild Research
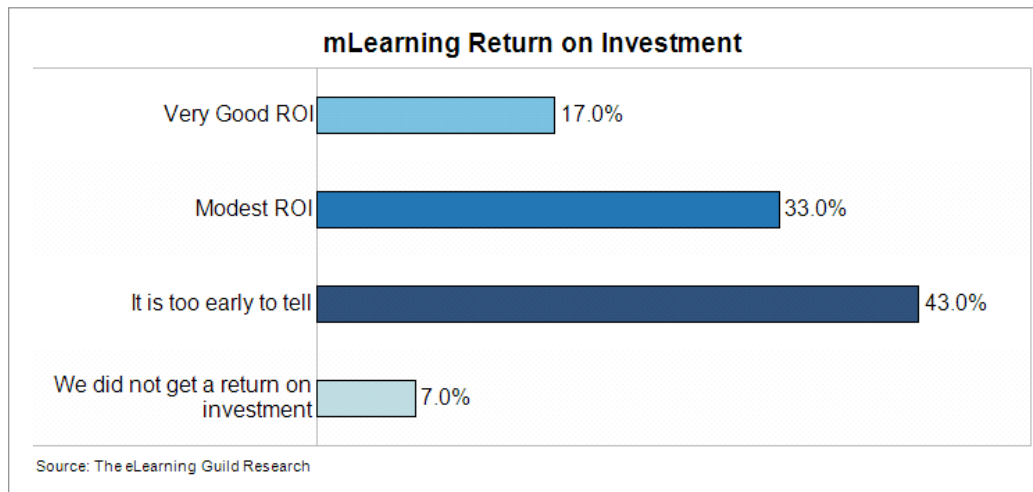
Interestingly, the mLearning measures chosen, overall, split equally between formal and informal (see Figure 14). While subjective data can be valuable, formal measurements are possible and desirable. Ideally, the results, as mentioned earlier, will couple to business outcomes. Overall, the percentage doing some form of evaluation is definitely a positive sign.

Figure 14:
Measuring mLearning

mLearning Measurement

Formally (metrics, assessments, tracking)	40.8%
Informally (anecdotes, preference scales, perception surveys)	40.8%
Other	12.2%
We do not measure or track	6.1%

Source: The eLearning Guild Research
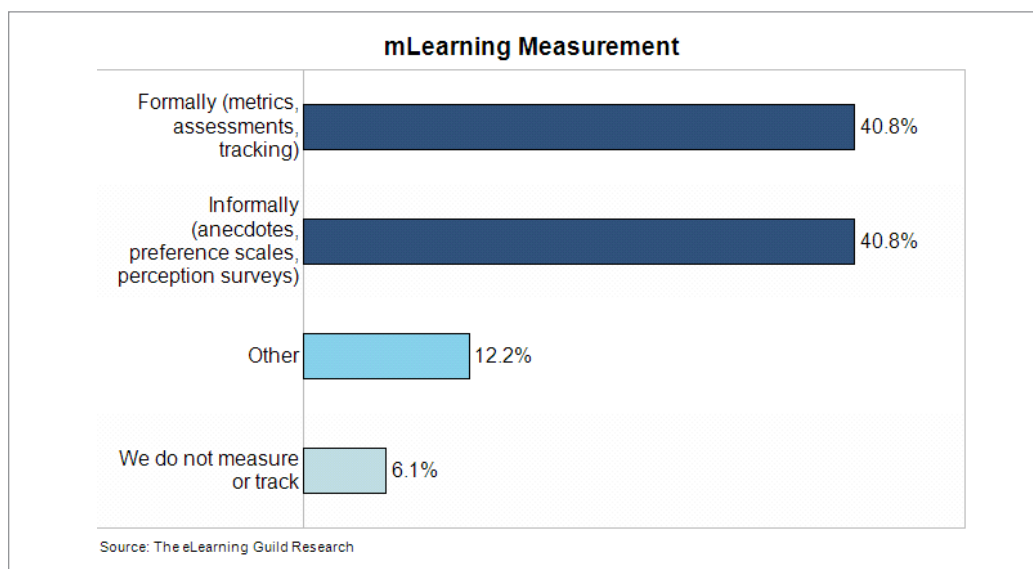
Going Forward with mLearning

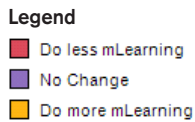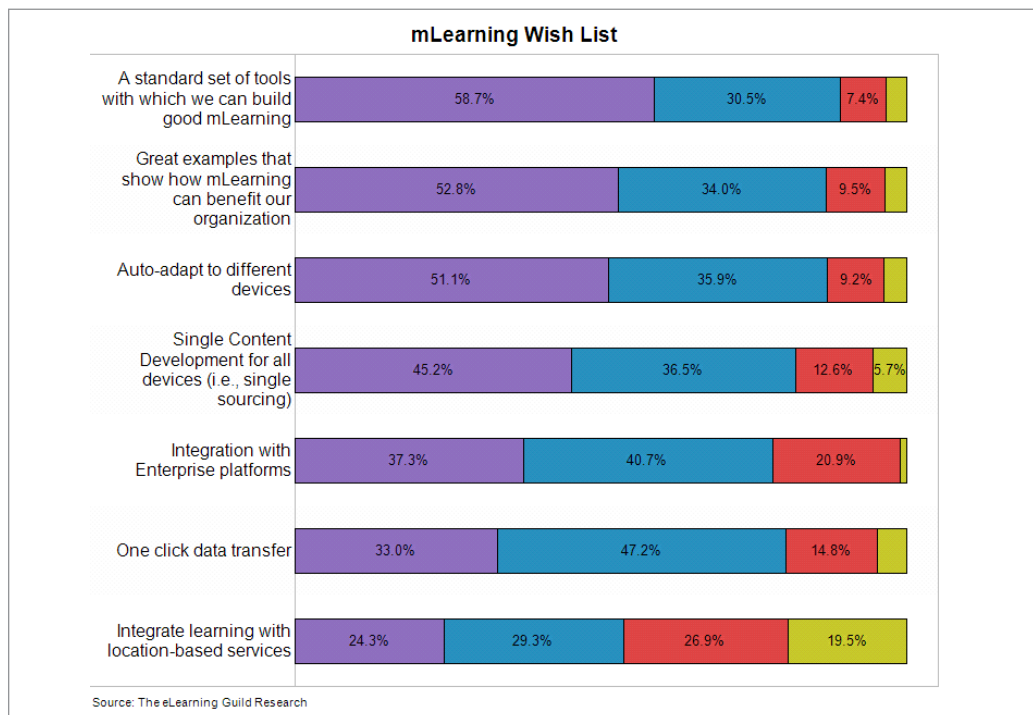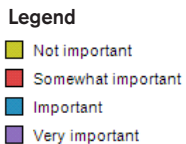Plans, going forward, are also of interest. It is clear that, despite the tough economic year that 2009 was overall, intentions to do more mLearning are growing (see Figure 15). Also, plans to do less mLearning remain essentially negligible.

Figure 15:
Trends in mLearning Intentions

Legend
- Do less mLearning
- No Change
- Do more mLearning

mLearning Plans by Year

Year	Do more mLearning	No Change
2007	38.5%	60.6%
2008	41.3%	57.3%
2009	38.4%	61.1%
2010	46.1%	51.6%
2011	51.0%	47.7%

Source: The eLearning Guild Research
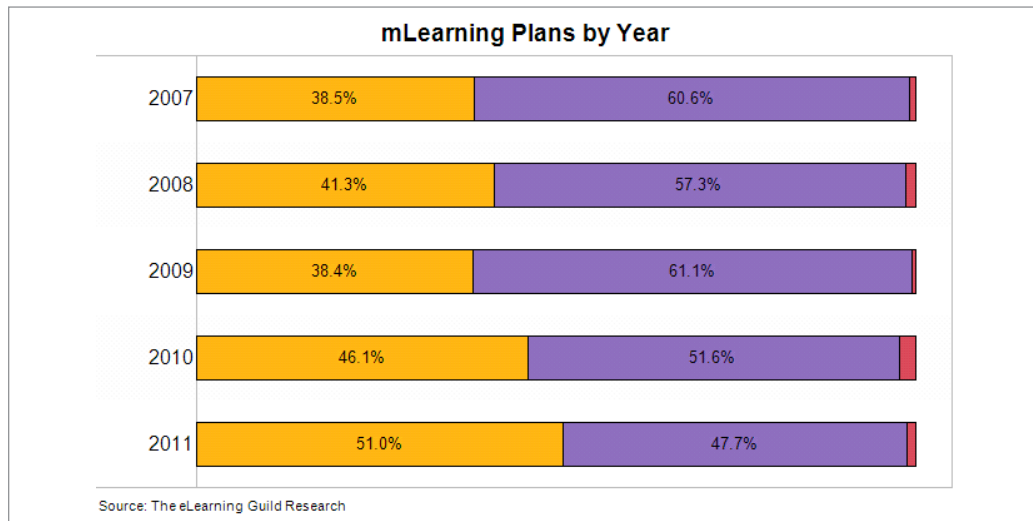
Wish lists of features that would support individuals in developing mLearning (see Figure 16) start with a standard set of tools (said one respondent, "I wish Adobe and Apple would stop fighting"). In fact, many tools now support mobile output, and more are on the way, but the lack of platform standardization limits the opportunity to build tools. Interestingly, examples exist, but their availability is clearly still an issue. Most of these are not surprising, but the low interest in location-based services suggests that context-specific mLearning is still not on most people's horizons.

Figure 16:
Desired mLearning Features

Legend
- Not important
- Somewhat important
- Important
- Very important

mLearning Wish List

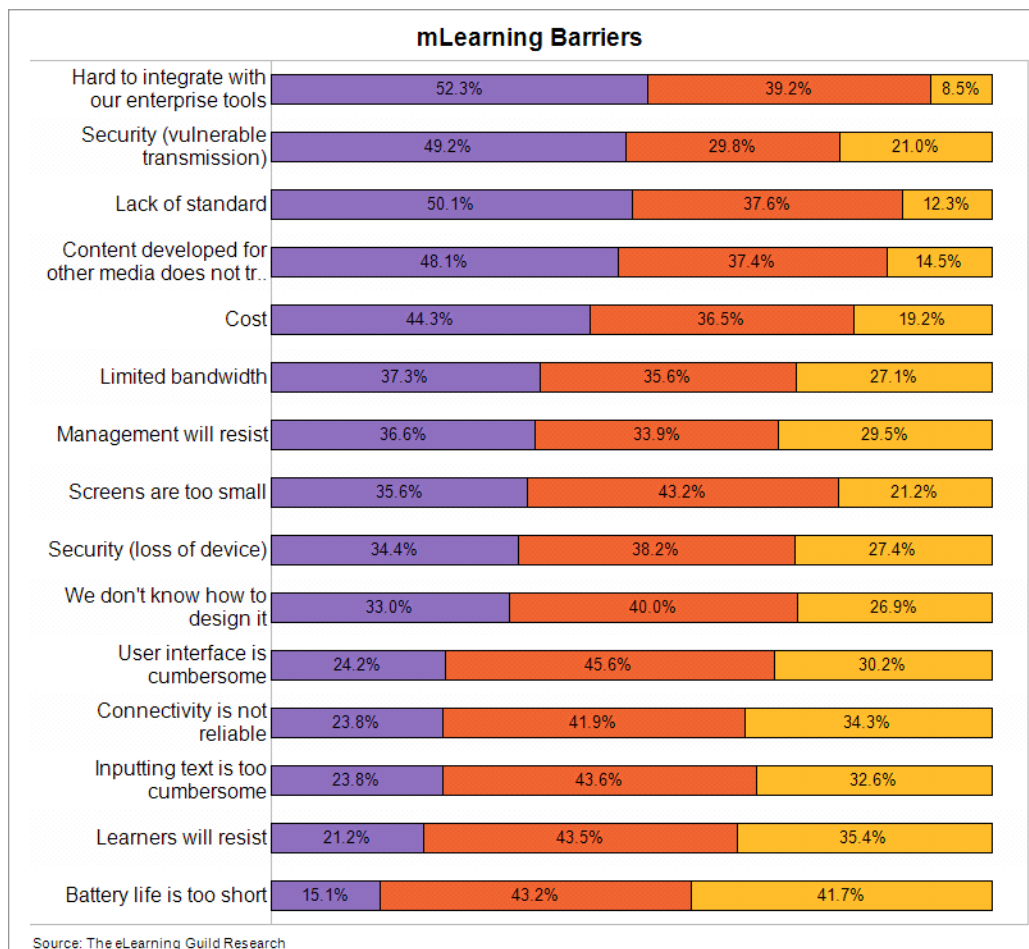| Feature	Very important	Important	Somewhat important	Not important
A standard set of tools with which we can build good mLearning	58.7%	30.5%	7.4%	
Great examples that show how mLearning can benefit our organization	52.8%	34.0%	9.5%	
Auto-adapt to different devices	51.1%	35.9%	9.2%	
Single Content Development for all devices (i.e., single sourcing)	45.2%	36.5%	12.6%	5.7%
Integration with Enterprise platforms	37.3%	40.7%	20.9%	
One click data transfer	33.0%	47.2%	14.8%	
Integrate learning with location-based services	24.3%	29.3%	26.9%	19.5%

Source: The eLearning Guild Research

There are also barriers to more rapid mLearning uptake (see Figure 17). The most prevalent problems topping the list include integration with enterprise tools (though, as indicated previously, there are indications that mobile accessibility is an enterprise tool area-of-focus) and lack of standards (noted one survey respondent, "The hostile atmosphere surrounding the standards for development and publishing"). Interestingly, another concern, security, has solutions (addressed below), yet this is a persistent problem, "mLearning security is a huge and potentially deadly issue" as one survey respondent put it.

Similarly, the fact that content developed for other forms of delivery doesn't transfer is decreasingly true; most content development tools already put out mobile-compatible formats, and there are free or inexpensive converters available as well. Device concerns on screen size, User Interface (UI), and text input exist ("From small screens, to bad input abilities, there's not much that it's good for" was one comment), although the vast consumer uptake of mobile devices suggests that these are not insurmountable barriers. Management resistance is, of course, a continuing issue, and to a lesser extent, learner resistance, though it would be of interest to assess that separately, as it may not be as extant as organizations perceive.

Figure 17:
Barriers to mLearning

Legend

🟨	Not a barrier
🟧	Small barrier
🟪	Large barrier

mLearning Barriers

Barrier	Large barrier	Small barrier	Not a barrier
Hard to integrate with our enterprise tools	52.3%	39.2%	8.5%
Security (vulnerable transmission)	49.2%	29.8%	21.0%
Lack of standard	50.1%	37.6%	12.3%
Content developed for other media does not tr..	48.1%	37.4%	14.5%
Cost	44.3%	36.5%	19.2%
Limited bandwidth	37.3%	35.6%	27.1%
Management will resist	36.6%	33.9%	29.5%
Screens are too small	35.6%	43.2%	21.2%
Security (loss of device)	34.4%	38.2%	27.4%
We don't know how to design it	33.0%	40.0%	26.9%
User interface is cumbersome	24.2%	45.6%	30.2%
Connectivity is not reliable	23.8%	41.9%	34.3%
Inputting text is too cumbersome	23.8%	43.6%	32.6%
Learners will resist	21.2%	43.5%	35.4%
Battery life is too short	15.1%	43.2%	41.7%

Source: The eLearning Guild Research

It would seem a safe inference that, as awareness of the opportunities and availability of mechanisms to overcome these barriers increases, the interest in mobile and mLearning will expand. Historically, there are reasons to expect that any such growth area will eventually precipitate a backlash, but the maturation of the market suggests that perhaps the real value available may bypass some of the concerns.

The Pragmatics of "Going Mobile"

We have to deal with some realities, even though things are changing rapidly. For one, the operating systems are in flux, as are the mobile service providers. The tools are changing as well, and there are organizational issues such as policies.

It is important to place mobile in the larger organizational context. Initially, mobile is a delivery channel for enterprise capability. As identified in the beginning of this report, mobile is becoming the first focus for enterprise development. Particularly for performance, the boundaries between work and performance are blurring, and the roles of portals and social media cover far more than formal learning.

Increasingly, we see the shift in perspective from looking only at formal mobile learning to include performance support, informal, and social learning as a necessary step in the evolution of organizational learning. As my colleagues in the Internet Time Alliance and others suggest, the learning function in the organization needs to start taking responsibility for performance in the broader sense, or what I term big "L" learning (to distinguish from just formal learning), including problem-solving, creativity, innovation, collaboration, design, research, and more. The role of the learning function in an organization moves from content creation to learning and performance facilitation. The overall space of learning responsibility is a continuum from formal learning through performance support to informal learning, creating an overall performance ecosystem, and mobile is a channel on this. Thus, in my strategic map as described in *Michael Allen's eLearning Annual 2009* (Quinn, 2009; see Figure 18), mobile is a component of *Broader Distribution*.

Figure 18:
eLearning Strategy
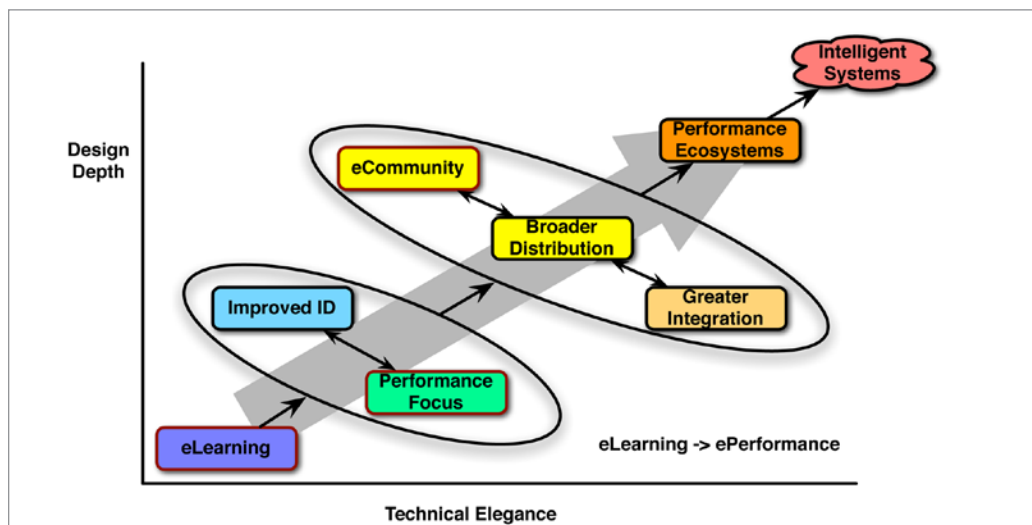
On the other hand, there are unique mobile capabilities to consider, specifically context sensitivity. New opportunities exist as well, such as augmented and alternate reality, whether for performance support or learning. We will talk more about these in the Looking Forward section.

Development Considerations

Devices do not exist in a vacuum, but instead, if we are going to be able to use them, we must consider some necessary standards. While eBook readers need only ePub formats, any time you want to run special software on the platform, you need to have an appropriate software development kit (SDK). These are Operating System (OS)-specific, so what you write for Android won't work on iOS, and what you write for webOS won't run on Windows Phone 7.

The easy solutions are in content delivery: most smart devices can play video and audio in certain standard formats, and read HTML and PDFs. Moving beyond, document formats that more elegantly separate out formatting from delivery, such as XML, provide even more flexibility. Kris Rockwell of Hybrid Learning Systems uses DITA, a standard for information representation, to develop and deliver performance support tools across mobile platforms (see Figure 19). Similarly, any device that has sensors like cameras and microphones typically can share that data. And the standards for communication are ubiquitous: voice, text messages, and e-mail all have standards. Similarly, most of the social media networks have clear winners in each category, so Facebook, Skype, and Twitter are fairly standardized. Proprietary versions of those typically have mobile interfaces developed as well. So content, capture, and communication are easy.

Creating interactivity is a separate issue. If you can use Web tools, such as forms, to handle computation, you are likely to be okay if you have Internet access. If not, however, creating an on-device App can range from straightforward to a custom-programming task.

The differences between these operating systems make it difficult to develop and deliver a common solution. While platforms for content can be, and are being, built on top of these systems, distributing interactivity across platforms is harder.

Figure 19:
DITA-developed Performance Support
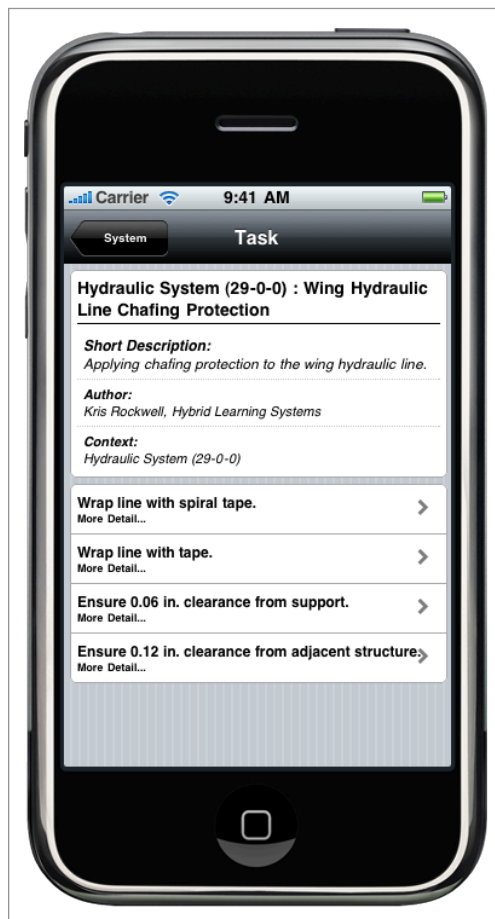
Tool Considerations

The standards mentioned above make it easy to take existing content and make it available for mobile delivery at little or no cost. There are free conversion tools available if the media-development tools you use don't already have output options for media delivery.

Further, most eLearning tools have, or will soon have, mobile outputs as well. Similarly, the LMS vendors are making mobile interfaces available for their systems, as are the portal developers, allowing access to content via mobile devices. And social-media systems similarly are making mobile interfaces to their systems.

On the other hand, while content delivery is pretty much a solved problem, the development of interactive capabilities, regardless of channel, is not so simple. Adobe's Flash, still the lingua franca of lightweight interactivity, runs problematically, if at all, on most mobile devices. No other alternative has reliably jumped into the fray. While simple interactions are possible, e.g. form filling and simple questions, more complex interactions like simulations require custom programming. And the custom programming solutions tend to be platform-specific. This doesn't mean you can't do a good design and implement with lower levels of interaction, but it does mean you need to be more thoughtful about what you want to accomplish before you consider delivery options.

Soon, mobile delivery will be an automatic outcome of your enterprise and learning tool sets. However, that does *not* mean you should just continue to develop your eLearning in the same old way. First, you should not continue to focus only on formal learning, as argued above. You should also be striving for minimalism on principle, but more so for the sake of mobile delivery.

Minimalism comes from the work of John Carroll (1990), who designed a set of reference cards that outperformed a full instructionally-designed manual. The principles used included giving the learner credit for some intelligence, focusing on their goals, and providing the least support necessary. These principles have turned out to be valuable for Web design and in learning experience design as well.

Consequently, the best advice as of now is to focus on analysis and design, and then choose the tool that will let you accomplish what you need to, and not to worry about tools until you are ready to move. When you decide to execute a mobile initiative is when you should evaluate the mobile toolsets available and likely to continue to be available. You'll want to know what's around then, and what's likely to have longevity commensurate with your mobile strategy.

Implementation Considerations

Other areas for consideration are the implementation issues such as security, support, and provision. We've already discussed provision a bit earlier, looking at the benefits of having a controlled delivery environment. However, there are more issues at stake.

Whatever solution you provide, it is plausible that not everyone will be able to access it, which can lead to equity issues. For example, in the U.K. they made a conscious decision to restrict mobile access of university administrative capabilities to text messages

for students despite the limitations, because not all students had smartphones. Such decisions require you to make mobile a "nice to have" rather than a "must use." Policies can make that less onerous, such as providing devices so you benefit from knowing the delivery environment. Other solutions support a limited suite of devices, such as subsidies, and for loss and voice costs, including potential penalties for personal use, or only providing the device but not the phone plan. On the other hand, allowing use of any kind of device reduces the necessary support costs.

Security is another issue. One possibility is loss of the device. Solutions to this include only getting data on demand, such as through mobile Web or text messages, so there's no persistent information on the device. Alternatively, most smartphone platforms now have mechanisms for passwords, location-discovery, and remote wiping of the stored information. A second possibility is for interception of incoming data. Mechanisms exist for secure transmission as well, though only for smartphones.

In addition to policies about devices, it might seem that there is a need for policies about how one can use the devices, and what you can access or communicate with them. Whatever policies, however, that already exist for desktop access of data and public communications apply to these devices. The one area that might make sense to create new policies for is providing location information if such information could be detrimental to corporate success. However, increasingly, the view is that empowering individuals with the important goals and resources to succeed is more powerful than attempts to control behavior.

Organizational Change Considerations

One of the issues in any intervention for organizational performance is consideration of the implementation to make a change, and mobile is no different. You need to consider a mobile initiative as an organizational change, and consider the same success factors. You also want to consider what you will measure to determine the long-term impact of the intervention, and the short-term evaluation.

As Jay Cross and Lance Dublin point out in *Implementing eLearning*, any eLearning (or, by implication, mLearning) initiative needs to tap into the well-researched success factors for organizational change. Elements such as having a clear vision, recruiting support, messaging the change, aligning incentives, and providing support are all part of a mobile initiative as well.

The choice of metrics used to determine the value received also is important. After launch, there is a decision to make with three possible results: 1) Is it good so we can let it continue as is; 2) does the approach need tweaking; 3) or is this not working sufficiently well to continue with it? (See Figure 20.) The measurements to use are, ideally, business impact: is the mobile initiative reducing costs or errors, increasing sales rates, or increasing customer loyalty? Less direct results may also be appropriate, such as employee demand (are they downloading Podcasts) or satisfaction (subjective evaluation of their assessment of the initiative).

Figure 20:
Evaluating Performance Interventions
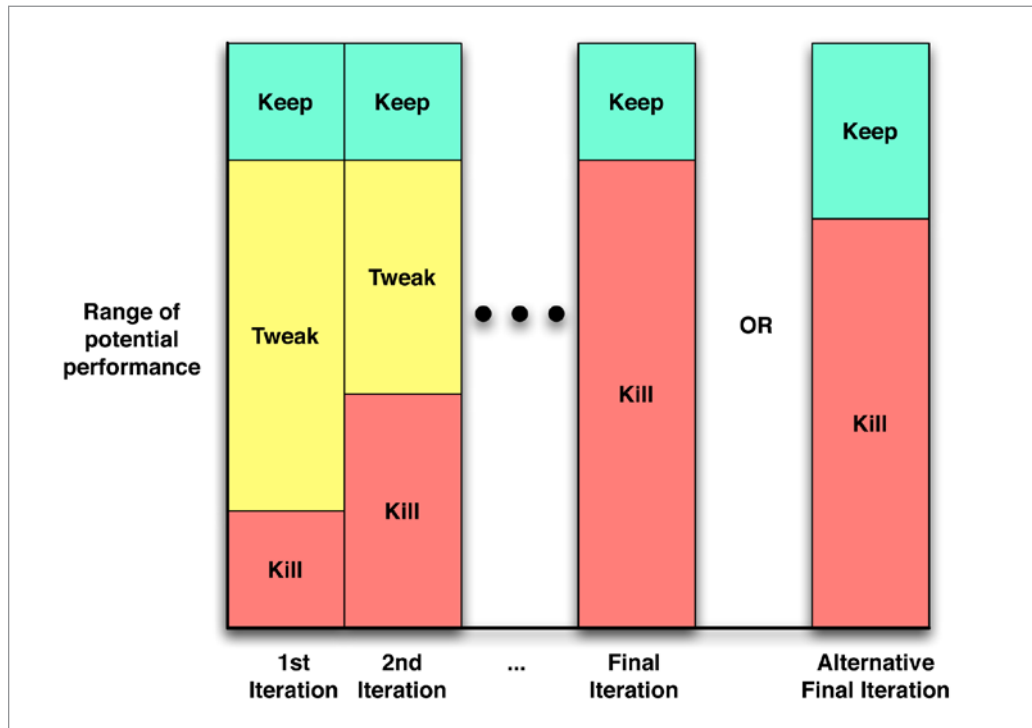
Similarly, criteria should be set for the decisions, and a timeline for evaluation and a final keep-or-terminate decision. The criteria may change, but having them established and making that decision consciously is important.

http://blog.learnlets.com/?p=1925

Looking Forward

This snapshot largely captures the current state of play. What's on the horizon? What's coming?

New Opportunities – Augmented and Alternate Reality

Given the relative newness of the two reality opportunities: augmented reality and alternate reality, there hasn't been real data to report on up front. Augmented reality means providing additional information on top of your current perceptions, best exemplified by "goggles" where you point the camera of your mobile device at the world around you, and on the screen you see the same view but with additional information appearing, such as the location and distance to restaurants. Alternate reality is where you lay out some additional reality that exists in parallel with your current one, in which separate events happen, best exemplified by games such as I Love Bees and The Beast that ran as marketing tools for the game Halo and the movie AI, respectively.

The opportunity for learning with augmented reality is high. Already, organizations are laying out information across locations that you can access, such as the London Museum letting you see pictures of a location from long ago to compare to modern day. The opportunities for performance support are even higher, where commerce applications like dining already use the ability to see what's relevant around you.

http://www.museumoflondon.org.uk/Resources/app/you-are-here-app/index.html

http://www.yelp.com/yelpmobile

Companies like Tandem Learning have already used alternate reality to support learning about sales tactics in one particular instance. A real opportunity exists to have a parallel learning opportunity play out in real contexts using real tools.

I think that one more model is worth thinking about. With ubiquitous access, we no longer need the "event" model of learning. We have the potential to step away from punctuated learning, and move to continuous learning. Indeed, we are likely to see more individual learning occur, and the question is what to do about it. I think that if we couple some "learning to learn" with a longer-term perspective of our relationship with our learners, we may want and need to shift to a "slow learning" perspective. The metaphor is drip irrigation rather than flooding (where evaporation removes most of the benefit and is a waste of resources). I'll leave you with that thought.

The Future

The only thing hard about predicting the future is getting it right.

It's fair to predict that the handheld platforms are only going to get more powerful and incorporate more capabilities and more sensors. Already, the new Android-powered Xoom tablet proposes to have a barometric sensor that can serve to both augment location with altitude and support weather capabilities. The processors onboard are getting more powerful too, with dual core processors now appearing.

And there will likely continue to be some incompatibilities that will hinder the ability to create a seamless performance ecosystem. Apple's iOS currently depends on their App store, which isn't compatible with Android's store. Similarly, for interactivity beyond content navigation, you need to develop separately for each platform. There is not a lot of reason to suppose that either has much interest in changing that, and there may be active opposition. On the other hand, there are tools that may find a common ground to develop once and deliver on either platform (or any others). This is already happening, so reasons for optimism continue.

We can also expect that new opportunities will resemble old ones until we come to grips with the capabilities. We will see, in the short term, more content delivery and upload as easy opportunities, and similarly the use of communication capabilities provided by vendors or systems (think Facebook and Twitter). Interactive opportunities, such as simulations, computational apps, augmented and alternate reality will be slower to come, but we'll see more examples soon, and eventually we'll realize the full potential on tap.

Closing

We have seen that the time is right for mobile. The devices are well and truly here to stay. However, we also have seen that mobile is not just a course on a phone or tablet, but is about performance support, and informal and social learning as well. It's a digital lifeline to support meeting our needs wherever and whenever we are.

Mobile is booming, and mLearning is following along. The research indicates that companies are progressing on the mobile front, and while the initiatives are as yet small, the trends are for more activity. We see an increase in percentage of companies that plan to do more mLearning from 38.5% in 2007 to 51% in 2011. We also are seeing worthwhile outcomes; we see the only negative area of any significance is in reducing costs (and that's less than 20%), while overwhelmingly positive impacts are seen for access and availability, accommodating needs, increasing speed of delivery, and improving performance. And the pieces to get started have fallen into place.

There are still issues: technical, social, and more, yet there are already sensible solutions to these issues. The future is only going to get brighter, as well. If you're interested in learning more, *The eLearning Guild* has started a new conference, mLearnCon, which will be held in San Jose June 21-23, 2011. The conference will have a suite of learning opportunities, including pre-conference workshops, inspiring keynotes, concurrent sessions for everyone from the novice to the experienced developer, an expo, and more.

Mobile is real. The devices are out there, the learning and performance opportunities exist, and the time is ripe. Distributing capability to where you need it, and tapping into the new opportunities, is possible. So the only remaining issue is for you to figure out how to start.

And so I encourage you to do so, and wish you the best in getting going.

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■ Glossary

Alternate Reality: a narrative thread or created world that parallels the real world but is fictional.

Android: Google's mobile operating system.

App phone: a smartphone capable of expansion via software applications (apps).

Apps: software applications able to be installed on smartphones.

Augmented Reality: a mechanism that provides information in addition to existing senses, so auditory or visual information annotates the existing world.

CDMA: a mobile telephony standard used broadly in the U.S. and a few other countries.

DITA: Darwin Information Typing Architecture, an XML standard that supports structured development and flexible delivery of documentation.

eBooks: delivery of books (text, images, and even media) on mobile devices.

ePub: a standard for delivering eBooks.

eReader: a device dedicated to reading eBooks, e.g. Amazon's Kindle, Barnes and Noble's Nook, or the Sony Reader.

Feature phone: a typical mobile phone with built-in features, typically including camera and Web-browser, but not expandable with new software applications.

GPS: Global Positioning System, hardware that uses geo-stationary satellites to triangulate position.

GSM: Global System Mobile, the mobile telephony standard more ubiquitous around the globe.

Handheld Game: a mobile platform dedicated to game playing but with increasingly wide variety of capabilities: the Nintendo DS line and the Sony PSP are prime examples.

iOS: Apple's mobile operating system that powers the iPad and iPhone (and iPod Touch).

iTunes University: Apple's resource for education-related media files.

Laptop: a computer sized to be portable.

Media player: a device largely dedicated to playing media, such as audio or video.

MMS: Multimedia Messaging System: text messages that can include media such as photos and videos.

MP3: a popular audio format.

MP4: a popular video format.

Netbook: a laptop computer diminished in size and capability to optimize portability and battery life.

OS: Operating System, the platform-specific software that supports applications.

PDA: Personal Digital Assistant, a mobile device expandable with software but without voice capabilities.

QR Code: a standard for 2-D barcodes to store text information such as URL's, phone numbers, or messages.

SDK: Software Development Kit, the tools to develop software for a specific operating system or OS.

Smartphone: a mobile phone with powerful data capabilities including Internet access and varied hardware often including cameras and geolocation sensors, capable of being expanded via software applications; also known as an app phone.

SMS: Simple Messaging System, also known as text messaging, a protocol that supports text messages over mobile phone networks.

Symbian: Nokia's mobile operating system, being replaced with Windows Phone 7 in their forthcoming smartphones.

Tablet: a mobile device with a larger form factor than a phone, with rich data capabilities, and typically operated with a touch screen.

webOS: Palm's latest mobile operating system now purchased by HP.

Windows Phone 7: Microsoft's mobile operating system.

XML: eXtensible Markup Language, a standard that supports development of delivery-independent information.

■ Resources

mLearning Sites

MobileLearning: Judy Brown's new Scoop.it site

mLearnopedia: Judy Brown's older mLearning site

ADL Mobile Learning Resources

Zen of Palm: Site with reflections on essence of mobile, based upon the success of the Palm Pilot

MoLeNet: Mobile Learning Network

International Association for Mobile Learning

mLearning Tools

.mobi: testing and development tools

W3C: mobile Web best practices

Float Learning's Mobile Learning Primer (iPhone) (Android)

Mobile Learning Blogs

Ignatia Webs: Inge de Waard

mLearning Trends: Robert Gadd

mlearnopedia: Judy Brown

Going Mobile: Cathie Norris and Elliot Soloway on K-12

Learnlets (mobile): Clark Quinn

Mobile Tweeple

@judyb Judy Brown, guru of mobile examples

@tomiahonen Tomi Ahonen, master of the mobile market

@hybridkris Kris Rockwell, developer extraordinaire

@writetechnology Michelle Lentz, mobile chronicler

@ignatia Inge de Waard, mobile learning maven

@robgadd4 Robert Gadd, mobile learning guru

@ronedwards Ron Edwards, mobile performance

@SNewco Scott Newcomb, K-12 mobile

@visualrinse Chad Udell, mobile development star

@quinnovator Clark Quinn, mobile author

◼ Author Bio

Clark Quinn, Ph.D., has been helping organizations deliver strategic learning technology solutions for over three decades. Clark combines a deep background in the learning sciences with broad experience in technology applications, which he applies to the corporate, government, education, and not-for-profit sectors. He's the author of *Engaging Learning: Designing e-Learning Simulation Games and Designing mLearning: Tapping Into the Mobile Revolution for Organizational Performance*. He supports learning experience design through Quinnovation, and organizational learning strategy as a principal in the Internet Time Alliance.