Mobile Learning Handbook

Advanced Distributed Learning (ADL) Co-Laboratories

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Introduction

This ADL Mobile Learning Handbook is compilation of mobile learning resources. This is a living document and will be regularly updated. Please send any suggestions for additions or changes to adlmobile@adlnet.gov. There is a condensed version (called the ADL mLearning Guide for demo use on a mobile device) also available through a browser at http://mlearn.adlnet.gov or in various platform stores.

This Handbook is separated into ten sections:

1. **Basics** - What mobile learning (or mLearning) means, its capabilities and use opportunities, potential benefits and common concerns.
2. **Planning** - List of choices to consider for appropriate use of mobile devices in learning, including questions to assist in planning.
3. **Examples** - Examples of mobile learning projects and initiatives of interest.
4. **Best Practices** - Lists of tips for instructional designers and developers.
5. **Learning Content** - Tips and best practices for mobile learning.
6. **Development Options** - Tools, native applications and mobile web apps; pros and cons of both types.
7. **Design Considerations** - Information on hardware models, features, operating systems, displays, accessibility, connectivity and other advanced mobile capabilities.
8. **Mobile Learning Tools** - Products available for the creation, deployment and management of mobile content.
9. **Resources** - Recommended links for additional information on mobile learning.
10. **Glossary** definitions.

> ***Note**: ADL does not endorse any products mentioned in this handbook. Specific devices and applications are provided for informational purposes only to help introduce the concepts related to mobile development for learning or human performance support.*

1. Basics

1.1 Definitions

There is no agreed upon denotation of mobile learning, but the following examples communicate the definition effectively:

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"The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning."
--MoLeNET

"Mobile learning, or m-learning, can be any educational interaction delivered through mobile technology and accessed at a student's convenience from any location."
--EDUCAUSE ELI

"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."
--eLearning Guild

ADL defines mobile learning as "the use of handheld computing devices to provide access to learning content and information resources."

Mobile learning has been called bitesize, handy learning, ubiquitous, portable, pocketable, learning on the go, my learning, untethered, informal, opportunistic, personal, private, situational, unstructured, learning in the moment, snack-learning, courselets, "bus stop" learning, a learning nugget or even a learning pill. Much of microlearning, reinforcement, and performance support are delivered on mobile devices as small chunks.

1.2 Capabilities

Mobile learning is definitely not just "e-learning lite." Consider the following possibilities for review, updates and reinforcement:

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Learning Modules	Performance Support
▪ Just-in-Time Learning ▪ Microlearning ▪ Reach-back/Review	▪ On-the-Job Support ▪ Alerts ▪ Reminders ▪ Procedures ▪ Job Aids ▪ Forms and Checklists ▪ Decision Support
Access to Information, Education and References	**Collaboration**
▪ Field Guides ▪ Presentations ▪ Podcasts ▪ Updates ▪ Audio Recordings ▪ Video Recordings	▪ Coaching ▪ Conferencing ▪ Feedback ▪ Mentoring ▪ Social Networking
Assessment	**Innovative Approaches**
▪ Quizzes ▪ Evaluations ▪ Tests ▪ Surveys or Polls ▪ Reporting ▪ Certification	▪ Games and Simulations ▪ Location-Specific Content ▪ Augmented Reality ▪ Contextualized Learning ▪ Spaced Learning
User-Generated Content	**E-books**
▪ Note Taking ▪ Transcription ▪ Translation ▪ Photos ▪ Videos ▪ Audio Capture	▪ Text Books ▪ Papers ▪ Manuals or Reference Guides

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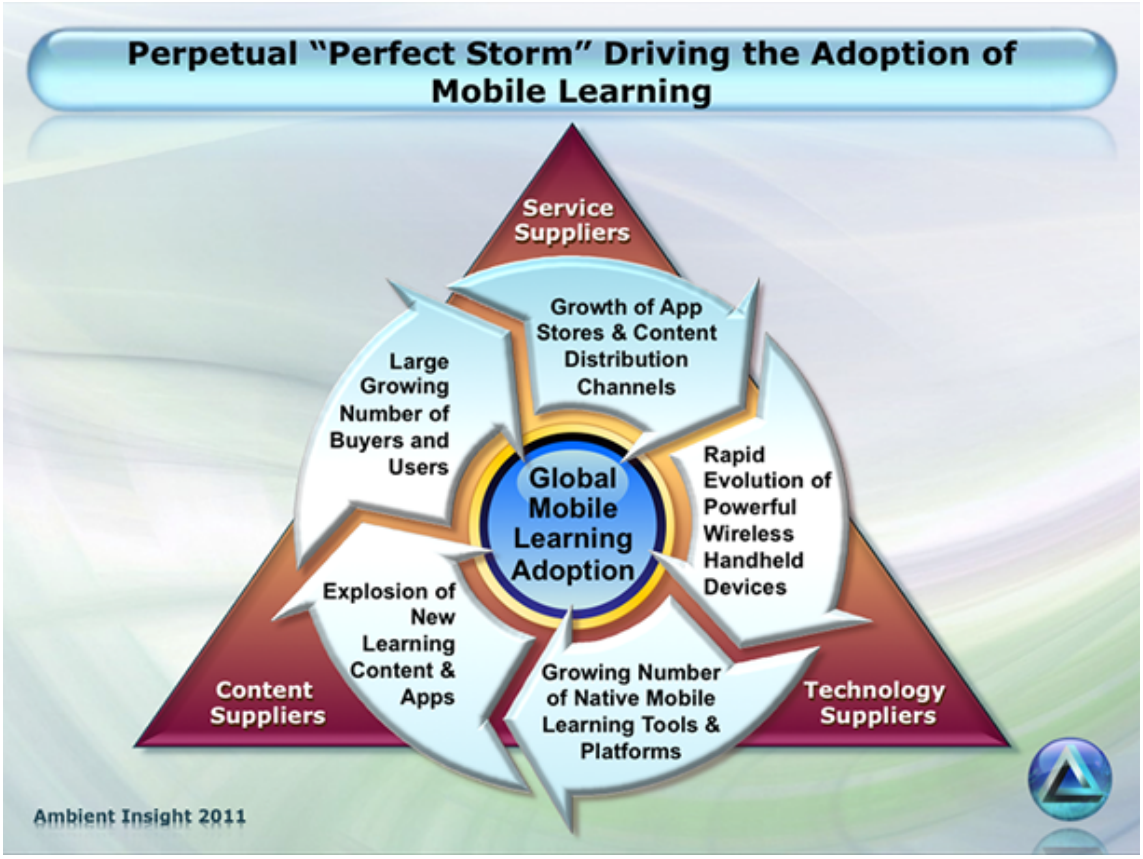
1.3 Industry Statistics

"Regarding the pace of change, we believe more users will likely connect to the Internet via mobile devices than desktop PCs within five years," according to Morgan Stanley's 2010 Mobile Internet Report (PDF). The same report noted that Consumer PC usage is down 20% since 2008.



This diagram from Ambient Insight, which has revised its forecasts upward in The US Market for Mobile Learning Products and Services: 2010-2015 Forecast and Analysis, illustrates the factors contributing to the Perpetual "Perfect Storm" Driving the Global Adoption of Mobile Learning.

1.3.1 Other Stats

From Tomi Ahonen, leading 3G strategy consultant:

- "Mobile is as different from the Internet as TV is from radio."
- Mobile phone accounts at the end of the year [2011] will be 5 times as big as the total number of fixed landline phones.
- The number of phones with a 'real browser' is almost 3 times as big as the total connected number of all personal computers of any kind that are connected to the web including desktops, laptops, netbooks and iPads.
- SMS text use is approaching global literacy rates. It literally can't get bigger. 85% of Europe's mobile subscribers are active SMS users. In China it's 90%. USA is past 74%.

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> By end of the year, we'll see 4.5 billion active SMS users. SMS is the most widely used data application on the planet.

From Chetan Sharma's State of the Global Mobile Industry - Half Yearly Assessment 2011

- 6 billion subscribers by the end of 2011
- US first market to exceed 50% in smartphone sales
- Japan leader in mobile data
- Mobile Data Traffic will be 95% of the global mobile traffic by 2015
- Mobile Ecosystem has become very dynamic and unpredictable
- There will be more changes in the next 10 years than in the previous 100

1.4 Expected Benefits

Expected benefits of mobile learning include:

- Continuous, ongoing, flexible
- Enables time for reflection
- Informal and formal learning
- Personalization
- Readily available
- Relevant
- Ubiquitous access

A UK Learning and Skills Network report identified "increased creativity and innovation, greater ownership of learning by learners, real world problem solving and the development of complex ideas and knowledge transfer" using mobile delivery.

See also JISC Potential benefits of mobile and wireless learning Google document here.

1.5 Frequent Concerns

Concerns to be addressed include:

- Battery life - This can vary greatly depending upon use and connections. There are considerations to conserve battery life in development as well as optional charging options until battery life improves.
- Connectivity - See Connectivity & Bandwidth in Design Considerations for details.
- Cost - Device costs continue to drop, whereas capabilities increase.
- Data charges - These costs vary greatly among carriers and can rise significantly during international travel.
- Device ownership - Will devices be furnished to the users?
- Screen size - See Displays in Design Considerations for details.

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- Security - Depending upon sensitivity of content, this may be the most difficult challenge. There are available solutions, but trainers need to work with their information systems team for the best solution.
- Technology changes - The global mobile industry is now the most "vibrant" and "fastest growing industry" on the planet. Expect improvements and changes.

Variables include:

- Network - Performance varies with connection speed. The needs of the disconnected user may also need to be addressed.
- Carrier - Not all carriers support all devices or versions of platforms. Global deployments need to consider carrier options.
- Device(s) supported - New devices continue to become available with varying capabilities and sizes. Unless your organization is furnishing all devices and regular updates, this can become difficult to support (unless standards are implemented).
- Platform(s) supported - Deloitte estimates the cost of developing for two OSs is 160 percent of the cost of developing for one.

The U.S. military in a survey conducted by ADL in early 2011 identified the following concerns and issues:

Personal Accountability: Measures ensure individuals are responsible for their actions.

Organizational Policy: Internal policy that provides guidance for content access and device usage.

Ownership/Life Cycle Management: Ownership and maintenance of content.

Assessment & Testing: Testing capabilities and offerings on mobile devices.

Data at Rest & Records Management: Determination if one's data is no longer valid and if/when it should be expunged from system.

Connectivity & Band-width: Ability to access the internet or other network connection and the speed of that connection.

User experience/Usability: Providing an optimal experience in terms of navigation and other user interactions.

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2. Planning

2.1 Learning Moments

Five Moments of Learning Need
by Dr. Conrad Gottfredson, co-author of "Innovative Performance Support"

- When learning for the first time
- When wanting to learn more
- When trying to remember
- When things change
- When something goes wrong

Which moments are most appropriate for delivery on a mobile device for your learners? What materials would be most appropriate at their moments of need?

2.2 Choices To Be Made

Mobile should be an integral part of your learning and information infrastructure / architecture. It should not be viewed as a replacement for other learning options, but a supplement or reinforcement for learning and performance support.

Depending upon the following choices - such as native app versus browser delivery, and connectivity concerns - options may be limited. Think about the users and their goals before making these decisions.

A review of the Five Moments of Learning Need should help to determine where mobile learning may be appropriate. A survey of your users and their needs and interests should also be one of the first steps. Then determine:

- Content development? (contract, COTS or in-house development)
- Native app or browser delivery? Or both?
- Connectivity
    - Standalone (cable to computer or SD card)
    - Connected (Bluetooth, broadband, cellular or wireless)
- Delivery and updates (maintenance)
- Support
- Security
- Tracking learner progress
- Planning Questions

Topics and associated questions to start the planning process:

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Objectives

- Why do you want to implement a mobile learning project?
- What unique result do you want to achieve?
- How will you know when you have achieved your goals?
- What do you really want to do?

Internal Forces

- Is the use of mobile devices increasing?
- Is the average age of learners decreasing?
- Are there training needs that are not being met for the mobile audience?
- Does important information change frequently?
- Is there sufficient support from IT and content owners?

External Forces

- Are mobile devices in use by the targeted audience?
- Are others leveraging mobile devices for learning?
- Who currently administers mobile devices?
- What future developments for mobile learning are on the horizon?

Instructional Strategies

- Is the proposed mobile learning project for formal learning programs, informal learning or performance support?
- What kind of user interface will be used?
- What content creation tools will be used?
- What interactions will be used?
- Who owns the rights to content?

Implementation

- Who is going to produce the content?
- What content product standards will be employed?
- What devices will be used/supported?
- What actions or activities need to be tracked?
- Does the content currently exist in another form?

Audience and Stakeholders

- For whom is your mobile initiative intended?
- Who are your major stakeholders?

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- What will your stakeholders need to be successful?
- Is there a champion in management that can help promote mobile learning?
- Have you involved both legal and IT?

Technical

- Where is the content going to reside?
- What content distribution methods will be used?
- Who will provide the service?
- What network will be used for distribution?

Evaluation

- How will you evaluate your effectiveness?
- How will you assess learning?
- What reports will be generated and for whom?
- Do you have a core group available for testing and evaluation?

Challenges

- What do you need to get the project done?
- How are you going to fund it?
- Who is going to pay for the equipment, the network and service charges?
- How will this new opportunity be communicated/marketed?
- How long will you be able to sustain it?

Opportunities

- Is there a specific initiative that will benefit from mobile learning?
- What current content can be re-purposed for mobile distribution?
- Is there an additional audience for your content?

Security

- What security mechanisms will you have in place?
- What training on securing devices will be available?

Support

- What user support do you need to provide?
- What user support will you provide?
- Will users need training on the use of the devices?

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3. Examples

3.1 Merrill Lynch GoLearn

The initial Merrill Lynch pilot, entitled GoLearn, involved offering three mandated courses both via MLU (Merrill Lynch University) and via the BlackBerry in 2007. Merrill Lynch is now a part of Bank of America.

Standards for delivery on the BlackBerry were established in design, technology, security and privacy. The goals of the pilot included proving the access, usage and the effectiveness of learning delivered via the BlackBerry to the global population. Additionally they sought to:

- Deliver training with no degradation to learning effectiveness
- Achieve 25% of eligible participation
- Achieve a comparable average score to the control groups, and
- Obtain a 10% higher completion rate in 10% less time

Over a seven-week period, the learning materials were wirelessly pushed to over 2,100 investment bankers and select support staff.

The outcomes exceeded the goals. Higher scores were obtained in half the time. Bankers who completed the training did so in 54 less minutes and tested higher on the final assessment tests than the remainder of the firm. Mobile users also completed their training twenty days earlier than those who trained via MLU.

VPs and higher leveraged the mobile materials the most. Of the 2100 eligible employees, 61% launched the content at least once. 317 people completed 704 courses. Overall the mobile learners obtained a 12% higher completion rate in 30% less time than the control group.

170 employees responded to a survey indicating:

- 99% felt the format and presentation supported the learning
- 100% would complete more training in this format
- More than 75% praised the benefits of convenience, time management and training with no distractions

With this successful pilot, Merrill Lynch moved into the next phase with additional training topics such as onboarding for new hires, ethical decision-making, performance management, market abuse, and sexual harassment. Additional information on this initiative is available here.

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3.2 MoLeNET

The MoLeNET initiative funded and supported 104 projects involving approximately 40,000 learners and over 7,000 staff, in the 3 years 2007/08, 2008/09 and 2009/10. In 2010 MoLeNET-2 report "Modernising education and training: Mobilising technology for learning" was released.

MoLeNET was a unique collaborative approach to introducing and supporting mobile learning in education and training via supported, shared-cost mobile learning projects. The LSN MoLeNET Support and Evaluation programme provided technical and pedagogic advice and support, materials development, continuing professional development, mentoring, facilitation of peer-to-peer support, networking and resource sharing, research and evaluation.

3.3 Pockets of Potential: Using Mobile Technologies to Promote Children's Learning

In January 2009, Carly Shuler, an Industry Fellow at the Joan Ganz Cooney Center, extracted from interviews with mobile learning experts as well as current research and industry trends to illustrate how mobile devices might be more broadly used for learning. Examining more than 25 handheld learning products and research projects in the U.S. and abroad, Shuler highlighted early evidence of how these devices can help revolutionize teaching and learning. Pockets of Potential also outlines mobile market trends and innovations, as well as key opportunities, such as mobile's ability to reach underserved populations and provide personalized learning experiences.

3.4 Project K-Nect

Project K-Nect is designed to create a supplemental resource for secondary at-risk students to focus on increasing their math skills through a common and popular technology – mobile smartphones. Ninth graders in several public schools in the State of North Carolina received smartphones to access supplemental math content aligned with their teachers' lesson plans and course objectives. Students communicate and collaborate with each other and access tutors outside of the school day to help them master math skills and knowledge. The smartphones and service are free of charge to the students and their schools due to a grant provided by Qualcomm, as part of its Wireless Reach™ initiative.

3.5 BLOOM

BLOOM (or Bite-sized Learning Opportunities on Mobile Devices) is a project funded by the eTEN office, which is designed to bridge the digital divide within the EU passenger transport and logistics sector. In 2008 the project addressed adult basic skills shortages and lifelong learning and demonstrated the potential of m-learning in addressing this need. One of the participating groups targeted taxi drivers in the Liverpool city region. Case study information is available here.

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4. Best Practices

4.1 Content

Methods and strategies you already know from instructional design and from web or e-learning development may also apply to mobile. However, additional attention should be paid to:

- Creating content that is short and to the point
- Creating the smallest possible modules - smaller chunks of context-independent content
- Creating a storyboard with modules that can be accessed from any point
- Designing non-linear content
- Considering using phrases like “For more information” or “To learn more”
- Guiding the learner to other content where they can catch up or explore further
- Using Post-It notes or stencils for storyboarding
- Using bullets to make contextual information more concise
- Developing the appropriate learning content or experiences for mobile
- Realizing that interactivity may not be nearly as relevant for performance support
- Knowing a good checklist could be worth much more than an interactive game
- Developing for users instead of for devices - don’t get excited about these "glowing rectangles"
- Thinking “transform” not “transfer”

4.2 Planning

- Confirming that mobile delivery makes sense
- Understanding the targeted end-users and their contexts
- Meeting the specific goals and requirements for the project
- Making a clear distinction between "learning" and "performance support"
- Determining tracking requirements
- Planning for the disconnected mobile user
- Knowing the limitations and capabilities of the technologies involved
- Prototype, prototype, prototype (start small, think big)

4.3 Other Recommendations

i4cp's 4-Part Recommendation from David Wentworth, 6 May 2011

- Try to remain agnostic. At this stage of the game, unless your organization is willing to provide employees with one device and platform, it may be best to approach mobile learning from a Web-based delivery perspective.
- Pilot programs. It is not necessary to develop a complete and polished mobile learning initiative right away. Start with small experiments. It is the only way to figure out what

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works without wasting time and resources.

- It has to make sense. Ask "Do we need to deliver this on a mobile device?" If there is no obvious benefit to delivering a piece of learning this way, it's not worth the effort.
- No fear. Mobile computing is not a flash-in-the-pan fad. It has become an acceptable and preferred method of accessing information for high-performing companies. Organizations need to embrace this and find ways to leverage the technology. Address internal barriers such as security and network concerns.

4.4 Development

4.4.1 Design

- Focus on designing the user interface, especially the navigation elements
- Increase use of color, bold, and font types to boost effectiveness / prevent loss of emphasis
- Avoid using pop-up windows, frames, tables and columns
- Do not requiring scrolling to the right; content should fit the screen dynamically
- Develop for the users instead of the devices
- Consider utilization of some of the new capabilities of mobile devices as long as it improves the user experience
- Flash is not universally supported

4.4.2 Graphics

- Avoid placing important text inside graphics
- Optimize the size of graphics for faster download
- Avoid background graphics
- .png is the preferred image file format (not .gif)
- Flash animations are not supported on most mobile devices

4.4.3 Coding for the Mobile Web

- Progressive enhancement is a best practice necessary to support low-end mobile devices
- Each device and browser-specific interface presents challenges for providing a consistent experience
- Device and browser detection is necessary for addressing device-specific interface features and browsers (e.g., Add to Home Screen on iPhone)
- Full screen mode (hide address bar) is consistently supported on most devices
- Some device and browser default settings must be configured
- Device detection is necessary for delivering video

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5. Learning Content

5.1 Think Differently

Much of the knowledge that instructional designers use for e-learning will transfer to mobile learning, but not all. Think outside the course. The power of mobile learning is definitely not a shrunken e-learning course. The most successful mobile designers are able to think differently.

In Howard Rheingold's "Smart Mobs" he states, "The mobile internet... will not be just a way to do old things while moving. It will be a way to do things that couldn't be done before." We now have the mobile tools to make a difference.

Perhaps the most significant potential of mobile learning is the ability to achieve what many performance support advocates believe has long been the learning profession's Mount Everest. As MIT professor and artificial intelligence pioneer Seymour Papert said, "You can't teach people everything they need to know. The best you can do is position them where they can find what they need to know when they need to know it."

Sophisticated users know it is now possible to deliver media-rich, interactive learning content to almost any smartphone. However, at the moment of need, the user may only need a checklist or reminder.

Design is the biggest differentiator between mobile learning success and failure. It is the link between learning and performance support, the tie between formal and informal learning.

Remember...

> *It's not about devices – it's about **capabilities***
> *It's not about the technology – it's about the **experience***

5.2 Spaced Learning

Research over the past one hundred years has proven that learning retention can be improved by spacing out the learning and providing repetition and an opportunity for reflection.

Value of Repetition

- Helps us absorb information we missed earlier
- Helps us remember things we'd forgotten
- Strengthens and enriches what we know
- Spacing may slow learning, but it improves remembering.

Mobile devices provide inexpensive capabilities to deploy reminders and refresher materials.

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Spaced learning can provide information to the user at the time of need. One of the most interesting current projects is Text4Baby at text4baby.org, which delivers appropriate SMS messages to pregnant women depending upon where they are in their term, and continues the service for the first year of their baby's life.

Consider how spaced or timed, relevant learning could be beneficial to your learners.

6. Development Options

6.1 Native or Web? Or Both?

The biggest difference between mobile web apps and native apps today from a development perspective is that native apps can require development for multiple platforms whereas mobile web apps can require support for many browsers. The bottom line is that native apps vs. web apps is not really a debate. There is no winner and there is no loser. The choice of which type to develop is an engineering and a design decision that should be based on a solid set of requirements. Mobile is bigger than just apps!

6.2 Native Apps

6.2.1 Definition

What are native apps? A native mobile application is specifically designed to run on a device's operating system and machine firmware. It typically needs to be adapted/adjusted for different devices. Deloitte estimates the cost of developing for two OSs is 160 percent of the cost of developing for one.

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6.2.2 When to Develop

- Charging for it (for profit)
- Games and 3D
- Using cameras or other features (e.g. Augmented Reality)
- Accessing the file systems
- Offline / disconnected

A native app is a lot more than just the look and the feel. Many things matter, like the way in which data is stored on the mobile. In a native app, most of the data is stored on the device. In a web app, most data is stored on the cloud.

With HTML5 you can use the cache manifest and local storage to store data. Google mail (Gmail) for mobile on the iPhone is the best example of using local storage. It even launches faster than the native app. This is because the iPhone's web browser is always kept in memory so it launches right away. On Gmail, not only is the data stored in the cloud, so is the state.

6.2.3 Platforms & Operating Systems

Below is a listing of the most widely used Application Platforms (aka Operating Systems). Sometimes the term, "platform" has been used rather loosely in the mobile world and this causes some confusion because there are such things as "development platforms". For the sake of consistency, when we refer to platforms we are referring to the operating system. Currently, in the desktop world, we primarily have to deal with different variants of Windows, Mac, and Linux. In the mobile world, we have to target many more if we are looking to develop a native application.

- Android from Google
- Bada from Samsung
- BlackBerry OS from RIM
- iOS from Apple
- Limo (Linux)
- Maemo from Nokia
- MeeGo from Nokia and Intel
- Symbian OS from the Symbian Foundation
- WebOS from HP
- Windows Mobile 6 from Microsoft
- Windows Phone 6.5 from Microsoft
- Windows Phone 7 from Microsoft

In terms of developing for Native Applications, there are so many Software Development Kits (SDKs) to choose from. This list is not all inclusive, but will give you an idea of how complicated it would be to try to develop for multiple platforms using multiple SDKs. While some of these do support limited cross-platform deployment there is no single SDK that supports every Native platform, but there are a few that come close.

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List of platform development environment / SDKs (list provided by Wikipedia)

6.2.4 Do-It-Yourself (DIY) Toolkits

DIY Toolkits provide a convenient way to create native apps without having to use an SDK or have a strong technical background. Some key points to remember about DIY Toolkits:

- Allow you to easily create content on-the-fly from RSS feeds or other data sources
- Require no programming or design experience (usually template-driven)
- Have drag & drop, browser-based interface
- Reduce time to market / publish (typically days instead of months)
- Most are offered as a service / cloud-based (SaaS)
- May include distribution to market or App store
- Usually require a startup cost or other recurring fee
- May only support one or more platforms

Examples of current DIY Toolkits (in alphabetical order):

- App.co
- Appanda
- AppBreeder
- App Inventor for Android
- AppMakr
- BuildAnApp
- eBookApp
- GameSalad
- Kanchoo
- MobBase
- MobileAppLoader
- MobileRoadie
- MyAppBuilder
- StoryDesk
- SwebApps
- Unity Mobile

6.2.5 Native Apps Pros and Cons

Pros:

- They offer a best-in-class user experience, offering a rich design and tapping into device features and offline use.
- They are relatively simple to develop for a single platform.
- You can charge for applications.

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Cons:

- They require a unique programming language.
- They cannot be easily ported to other mobile platforms.
- Developing, testing, and supporting multiple device platforms can be costly.
- They may require certification and distribution from a third party that you have no control over.

6.3 Mobile Web Apps

6.3.1 Definition

Mobile Web Apps are also referred to as Mobile Rich Internet Applications (RIA). The difference between mobile web app and native apps is anticipated to be less obvious by users in the near future. Modern mobile browsers can now gain direct access to the hardware capabilities of mobile devices (including accelerometers and geo-location).

The performance of browser-based mobile web applications continues to improve. Persistent storage and access to user interface functions (such as the address book) may further reduce the demand for platform-specific native apps. As far as today's mobile web apps are concerned, most of the data is stored in the cloud.

6.3.2 When to Develop

- When you seek cross-platform compatibility
- When you can't support the development of native apps using proprietary SDKs
- When accessibility is a requirement
- When the more advanced capabilities of the device aren't required

6.3.3 Standards

W3C Initiative

- Goal: "One Web"
- Creates web standards
- Founded by inventor of the World Wide Web, Tim Berners-Lee
- W3C Mobile Web Initiative: http://www.w3.org/Mobile
- Mobile Web Application Best Practices: http://www.w3.org/TR/mwabp

Widgets

The new concept of mobile widgets offers a great multi-device application platform, including local applications that don't require an always-connected Web with URLs and browsers. A widget is a local HTML / CSS / JavaScript web application. A mobile phone user

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downloads a widget once, and then the web application is stored locally on their mobile phone.

- Pioneered by Opera and Vodaphone
- Goal: "Write once, run anywhere"
- Based on a W3C specification: http://www.w3.org/TR/widgets/
- Highly endorsed by the Wholesale Applications Community (WAC)

WAC

Wholesale Applications Community (WAC)

- Goal: Portability of applications across devices, operating systems and network operators
- History: In July 2010, the BONDI initiative and the Joint Innovation Lab (JIL) merged into the Wholesale Applications Community.
- Will enable developers not only to write a web application that can function across different platforms and devices, but also can be deployed across the many different applications stores supplied by the WAC platform.

6.3.4 Mobile Web Pros and Cons

Pros:

- Uses basic HTML, CSS, and JavaScript knowledge
- Easy to deploy across multiple devices
- Content is accessible on any mobile web browser
- Can be packaged and ported as a native app! See mobile web app frameworks

Cons:

- The best user experience (interface) might not be available on all handsets
- Can be challenging (but not impossible) to support across multiple browsers
- Older devices don't support native application features, like offline mode, location lookup, file system access, camera, etc.

6.3.5 Frameworks

Mobile web app frameworks are easing the development process for those interested in the mobile web app approach. These frameworks allow mobile web apps to look and feel and function like native apps. They are typically available as configurable open source frameworks that you can download and begin working with by using pre-existing templates and themes. They provide anyone the ability to edit the existing files and are developed using web standards (HTML, CSS, JavaScript); the more recent ones support HTML5.

Some of these frameworks include APIs and some offer additional commercial tools or publishing capabilities for packaging the content as a native app. If you only care about

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targeting the newer smartphone touch devices or mobile devices that support HTML5, then this is a cost-effective alternative to native app development.

Framework	Comments
iPhone User Interface Framework(iUi)	File package containing HTML, CSS, JavaScript and images. Intended for iPhone, iPod Touch and iPad but works well on any mobile device that supports CSS 3 webkit extensions. First framework of it's kind. Requires basic knowledge of HTML; requires intermediate knowledge of CSS.
iWebkit	File package containing HTML, CSS, JavaScript and images. Intended for iPhone, iPod Touch and iPad but works well on any mobile device that supports CSS 3 webkit extensions. Has more templates than iUI. Requires basic knowledge of HTML; requires intermediate knowledge of CSS.
JQTouch	File package containing HTML, CSS, JQuery (JavaScript Library) and images. Intended for iPhone, but works on Android too. Has more interactions and features than iWebkit or iUI, but is limited to iPhone in terms of compatibility. Requires intermediate knowledge and understanding of HTML, CSS, and JavaScript.
Sencha Touch	File package containing HTML5, CSS3, JavaScript, and images. Provides a robust set of themes, templates, and targets mobile browsers supporting HTML5. Developed by one of the initial creators of JQTouch. Requires advanced knowledge and understanding of HTML5, CSS3, and JavaScript. Heavily based on JavaScript and most content is maintained within JavaScript files, not HTML.
JQuery Mobile	File package containing HTML, CSS, and JavaScript (JQuery library optimized for mobile), and images. The goal of this initiative is to provide a unified user interface system across all popular mobile device platforms. Its lightweight code is built with progressive enhancement, and has a flexible, easily themeable design. Requires advanced knowledge and understanding of HTML5, CSS3, and JavaScript.
The M Project	Uses the JQuery Mobile Framework, but expands on the implementation by providing a configuration management / life-cycle approach with a library of example Apps that you can work with. Features include: ▪ Model-View-Controller (MVC) implementation ▪ HTML5 Offline support (automatic cache manifest generation) ▪ JavaScript-all development cycle ▪ Rich User Interfaces ▪ DataProvider for local and remote storage persistence ▪ Internationalization (i18n)

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	▪ Open Source (MIT License) ▪ NodeJS based build tools (called Espresso)
PhoneGap	This is a nice compliment to of any of the above frameworks if you wish to turn your mobile web app into a native app. This app publishing framework supports several platforms. It allows you to use core features of the iPhone, Android, Palm, Symbian and Blackberry smartphones, including geolocation, accelerometer, contacts, sound and vibration. Requires additional software specific to the platform that is being developed, such as the iPhone SDK for the iPhone iOS, Android SDK for Android, etc. This is different than the above frameworks as it does not contain any file packages that you can customize. You are expected to create your own HTML, CSS, and JavaScript before using PhoneGap.
PhoneGap Build	Simply write your app using HTML, CSS or JavaScript, upload it to the PhoneGap Build service and get back app-store ready apps for Apple iOS, Google Android, Palm, Symbian, BlackBerry and more. By compiling in the cloud with PhoneGap Build, you get all the benefits of cross-platform development but can still build apps just the way you like.

7. Design Considerations

7.1 Devices

7.1.1 Models

Too often we start with the device, rather than the learning or the support requirements. The learning outcome should always be the main focus, but familiarity with the capabilities of the handheld devices that learners carry may open new doors, or require taking a step back.

When thinking about mobile device categories, remember that the mobile device is more than just a phone. Basic mobile phones are limited for mLearning. The following list identified in "Programming the Mobile Web" by Maximiliano Firtman provides a logical way to categorize mobile devices:

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Basic Mobile Phones	Call and SMS support
Low-end Mobile Devices	No touch support, poor web / browser support, limited memory, and may include basic camera and/or music player
Mid-end Mobile Devices	Medium-sized screen, basic HTML-browser support, sometimes 3G, a decent camera, a music player, games, and application support
High-end Mobile Devices	Usually non-multitouch, but have advanced features (accelerometer, high MP camera, and Bluetooth) and good web support
Smartphones	System-On-Chip (SoC), full browser / HTML support, Wi-Fi, 3G/4G, music player, GPS, video-capable, Bluetooth, touch support, accelerometer, 3D video acceleration, etc.
Non-phone Devices	Wi-Fi support, browser, other features, etc. iPod, iPad, e-Book readers, etc. This could also include PDAs (personal digital assistants), handheld game consoles or portable media players.

There is a new category called "Superphones", which was introduced by Google identified as *"optimized from a silicon perspective, a hardware perspective and a software perspective."*

Mobile device categories will continue to evolve both from a function and feature perspective and from vendor marketing messages. The main concern for mobile learning developers is what devices and/or features are supported for the intended learners.

7.1.2 Features

Devices are equipped with various features that could be used to enhance learning. Which features do your learners have?

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- Accelerometer
- Audio recorder
- Audio and video player
- Battery life
- Browser
- CAC support
- Camera (still or motion)
- Compass
- GPS
- Gyroscope
- Keyboard
- Memory
- Microphone
- Processor
- Screen
  - Color
  - Resolution
  - Size
  - Stylus
  - Touch
- Scanner
- Security (e.g. biometrics)
- Size
- Software (E-book reader, etc.)
- Storage
- Text messaging
- Video
- Wi-Fi Connectivity

7.1.3 Tablets

When defining mobile devices, we generally refer to devices which:

- Turn on instantly (don't require boot-up)
- Are carried in a pocket or purse most all the time and are gaining ubiquity
- Have sufficient power to last one day
- Have input and output capabilities and a processor

Tablets are not normally carried at all times, but their use is growing rapidly in education and training.

Other than differences in screen sizes, learning content for tablets require development very similar to mobile phone development. EPUB formats are growing in popularity for easily creating digital texts for viewing on tablets and other devices.

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7.2 Display

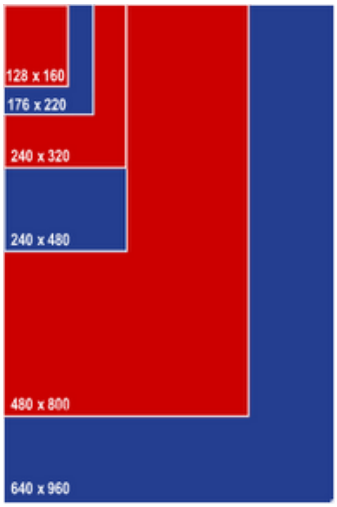
Display comparison between desktop computer, laptop computer, and mobile device

7.2.1 Screen

A mobile device has a small screen when compared to a desktop screen. In the desktop world, the sizes range 13, 15, 17, 19, and 21-inch screen sizes (diagonally). In mobile development the screen size range is usually 1.5 to 3 inches.

7.2.2 Screen Resolution

In the desktop world the most common screen resolution is 1024x768 pixels. In mobile development, the resolution is typically a quarter or half of that. How many pixels (width x height) are available on your target audience's device(s)? This is important to consider when creating graphics for mobile screens.



The most widely available screen resolution is 240x320 pixels. Some devices might have a resolution of 128x128 pixels, and some 800x600. However, since 2007 most mobile devices fall into four basic groups:

- Low-end devices: 128x160 or 128x128 pixels
- Mid-end devices (group #1): 176x220 or 176x208 pixels
- Mid-end devices (group #2) and high-end devices: 240x320 pixels
- Touch-enabled high-end devices and smartphones: 240x480, 320x480, 360x480, 480x800, 480x854, or 640x960 pixels

7.2.3 Aspect Ratio

This is the ratio between the longer and shorter dimensions of a display.

- Horizontal (landscape) devices have displays that are wider than they are tall
- Vertical (portrait) devices have displays that are taller than they are wide
- Square screens have the same width and height

Image of different screen shapes from "Programming for the Mobile Web"

Mobile content should be developed with an awareness of the rotation capability provided by accelerometers and should offer a good experience in any orientation.

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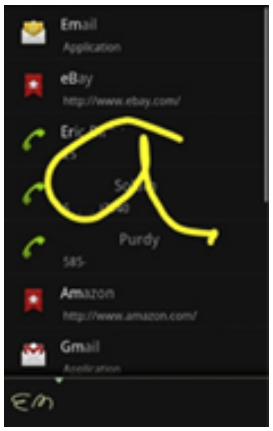
7.3 Accessibilities

7.3.1 Input Methods



Handwriting Recognition
(Gesture Search)

A mobile device may support only one input method or it can support many options. Possibilities include:

- Alphanumeric keypad
- Screen keypad (Touch)
- Multi-touch events
- External keypad
- Handwriting recognition (gesture search)
- Voice recognition

7.3.2 Navigation

Every mobile browser uses one or many of these modes of navigation:

- Focus navigation (e.g., using scroll wheel)
- Cursor navigation (e.g., ball or scroll wheel)
- Touch navigation
- Multi-touch navigation (e.g., double tap)

7.3.3 Browsing

There are several different approaches to opening more than one browser window at the same time. Here are some examples of the different behaviors on mobile browsers:

- Only one page support
- Multiple windows
- Windows stacks
- Tab navigation

iPhone Browsing (multiple windows)

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7.4 Connectivity & Bandwidth

For most users, bandwidth is becoming less and less of an issue with the availability of 3G and 4G networks. However, connectivity will always be an important consideration for mobile development strategy. Issues to consider when addressing device connectivity and bandwidth:

- Image Compression: Files must be optimized for quicker load times
- Transcoding: What is transcoding? A transcoder is a proxy that intercepts web content and reformats and compresses it with built-in or user-installed microbrowsers (e.g. Opera mini)
    - Sometimes cause problems and degrades content / breaks device detection
    - Alleviated by adding the Cache-Control: no-transform header to all your HTTP responses
    - Also by using mobile-specific MIME types and DTDs (XHTML Mobile Profile)
    - Setting up a hostname / domain with a pattern such as m.*, wap.*, or *.mobi will usually also help
- Caching lowers download times and costs but can also cause unwanted behaviors when creating web content for mobile devices
- HTML5
    - Provides a means for persistent local storage of data (for times of little or no connectivity)
    - Similar to cookie concept, but not auto transmitted back to the server
    - The data remains local as keyed name / value pairs to be stored within the browser
    - Limited to 5MB

7.5 Performance

Here are some of the top considerations when thinking in terms of performance. These can vary significantly from one device to another.

- Battery life
- Memory and storage
- Processor (SoC – System on a Chip)

7.6 Advanced Capabilities

Smartphone competition has increased the number of sensors and other advanced capabilities made available to consumers. The iPhone 4 was the first to offer a built-in, 3-axis gyroscope. Advanced capabilities such as this can offer an enhanced experience if it is supported on the device of your target audience.

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7.7 Caveat

All mobile devices are not created equal. Consider the following issues when deciding on a mobile development and design strategy:

- An emulator is not always consistent with the actual device
- Limited support for Flash player
- Poor / inconsistent support for pop up windows and framesets
- Limited video support (Varying formats supported)

7.8 Video Formats

Examples of the preferred formats supported on some mobile device platforms are identified below. Using video will likely require some form of device detection for delivering mobile web content. The most common video formats supported across most devices are MP4 and 3GP. However, video content packaged with a native mobile app may require a specific encoding type for each platform and playback may or may not be supported.

- Apple iOS: M4V, MP4
- Google Android: MP4, SWF
- Microsoft Win Mob/Win Phone7: WMV, 3GP
- Nokia Symbian: MP4, WMV
- PalmOS/WebOS: MP4/H263
- RIM BBOS: MP4, 3GP

8. Mobile Learning Tools

8.1 Tools Available

Many authoring tools can deliver content to mobile devices. The tools provide this capability by using a mobile device screen template and output files that work with the mobile device operating system.

However, tools are emerging that are specifically designed for mobile learning; for instance, providing authoring capability for audio learning content (e.g., spoken word, podcasts) along with associated interactive assessments and surveys. Other tools are optimized to provide e-learning content through the phone's web browsing capability.

There are several e-learning content authoring tools on the market that offer a mobile-friendly output version of your content. However, some of them are designed to run within their own platform and stand-alone portability isn't always possible. Some of these support SCORM output. Some of the tools that we've seen only target one screen size. This is not a definitive list

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of authoring tools.

8.1.1 Authoring Tools

- Achieve Labs LearnCast
- BlackBerry Pushcast Software (formerly Chalk Pushcast)
- dominKnow Learning Systems' Claro
- Emantras MOBL 21™
- eXact learning solutions eXact Mobile
- Harbinger Group's Raptivity
- MentorMate iQpakk (for iPad)
- OutStart Hot Lava Mobile
- Xyleme Pastiche (for iPad)
- Rapid Intake's mLearning Studio
- ReadyGo Mobile
- SumTotal ToolBook
- Trivantis' Lectora Inspire

8.1.2 Mobile Management

- Blackboard: Blackboard Mobile
- CertPoint VLS™ Mobile
- Desire2Learn's Campus Life
- LearningGuide Solutions
- Meridian KSI: Meridian Anywhere
- Saba Anywhere

8.1.3 Mobile Solutions

- Intuition Rubicon
- OnPoint Digital CellCast

8.1.4 Other

- Adobe (development tools also support mobile)
- QuestionMark's Perception
- Turning Technologies' ResponseWare

The ADL Mobile Learning Team is currently collecting information on available tools from vendors. Responses to date (27 July 2011) include 36 vendors in the spreadsheet and PDF files online.

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9. Resources

9.1 ADL Mobile Resources

- ADL Mobile Wiki - Wiki with additional information maintained by ADL mobile team
- ADL Mobile Learning Newsletter - Archive of weekly mobile learning newsletters since June 2010
- ADL Mobile Learning Overview - Presentation from February 2011
- Follow @adlmobile on Twitter - ADL mobile team twitter postings
- Mobile Learning Video - Sample mobile learning video

9.2 Articles & Sites

- 7 Things You Should Know About Mobile Apps for Learning (EDUCAUSE 2010)
- 10 Reasons to Consider Mobile Learning - Points made by Chris Thomas, Chief Strategist for Intel
- A Comprehensive Guide to Mobile Statistics - From Cloud Four - February 17, 2011
- A User-Centered Approach - Designing the user experience for mobile websites from Smashing Magazine, 2 May 2011
- About eBooks - Extensive information about ebook formats from eBookMall
- mLearning Is Not eLearning on A Mobile Device - Article from Float Mobile Learning, 14 April 2010
- Mobile Learning Myths - Experiences and resources from MoLeNET projects
- Mobile Learning: Obstacles and Solutions - Seven industry experts respond to three questions, 7 June 2010
- Mobile Web Application Best Practices (14 December 2010)
- The US Market for Mobile Learning Products and Services: 2010-2015 Forecast and Analysis - Executive Summary available for free download
- TIME's 50 Best Websites: The Mobile Edition - Gallery of the top mobile sites, 25 August 2010

9.3 Design & Development

- 8 Tools For Easily Creating a Mobile Version of Your Website - Mashable review, 16 December 2010
- Creating ePub files with Pages - Apple EPUB instructions and template
- Mobile Developer's Guide to the Galaxy - Free 7th edition booklet containing the basics of many facets of mobile development.
- Optimizing Web Media for Mobile Learning - Lessons from Upside Learning, 2 September 2010
- Tools for Developing Augmented Reality Applications - Shared experiences with AR by

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Upside Learning, 30 April 2010

- Yiibu - Rethinking the Mobile Web - Article and interesting slideshow by Bryan Rieger

9.4 Miscellaneous Sites

- DACS (The Data & Analysis Center for Software) Mobile Technology site. - Included in this Department of Defense (DoD) Information Analysis Center (IAC) are best practices, literature, tools, mobile devices, mobile operating systems and browsers, mobile security and more.
- Designing mLearning: Tapping into the mobile revolution for organizational performance - Resources and updates for Clark Quinn's book of the same name
- EDUCAUSE Mobile Computing - 100's of resources on mobile computing for academia
- Mobile Computing: A 5-Day Sprint (EDUCAUSE April 25-29, 2011)
- JISC Mobile and Wireless Technologies Review - The final version of a mobile and wireless review that was undertaken by Doug Belshaw of JISC infoNet for the JISC e-Learning programme in late 2010
- Links to JISC resources - Mobile Learning infoKit - Wiki with links to JISC and other mobile learning resources since 2007.
- Mobile Learning Portal from The University of Texas at Austin - This section includes journals, initiatives, policies, and other resources which may be of benefit for curriculum developers and teachers.
- Mobile Learning SIG - SIGML is the ISTE special interest group that is an advocate for mobile learning worldwide, and promotes meaningful integration of mobile devices in teaching and learning in formal and informal learning environments.
- Mobile Touch: A Guide to Implementing Mobile E-learning in Your Organisation (2011 Australian Flexible Learning Network)
- Recommended Standards for Mobile Platforms (2011 Australian VET system)
- Recommended Standards for Mobile Content Formats (2011 Australian VET system)

9.5 Research

- A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types, Yeonjeong Park, Virginia Tech, USA (February 2011) This paper compares mobile learning (m-learning) with electronic learning (e-learning) and ubiquitous learning (u-learning) and describe the technological attributes and pedagogical affordances of mobile learning presented in previous studies.
- "Directions for m-learning research to enhance active learning" (2007)
- International Journal of Interactive Mobile Technologies (iJIM) - The objective of the journal is to publish and discuss fundamentals, applications and experiences in the field of interactive mobile technologies in learning and teaching as well as in industrial and other applications. (Open access journal - no charge, but registration is required.)
- International Journal of Mobile and Blended Learning (IJMBL) - Provides researchers,

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practitioners, and academicians with insight into a wide range of topics such as knowledge sharing, mobile games for learning, collaborative learning, and e-learning, this journal contains useful articles for those seeking to learn, analyze, improve, and apply technologies in mobile and blended learning. ($)

- International Journal of Mobile Learning and Organisation (IJMLO) - IJMLO is a refereed, multidisciplinary journal for bridging the latest advances in mobile learning and organisation. ($)
- It's official. Mobile learning is effective - MoLeNET 2 report
- Literature database of the London Mobile Learning Group (LMLG)
- "Mobile Learning Transforming the Delivery of Education and Training" edited by Mohamed Ally (2009)
- Mobile learning via SMS at Open University Malaysia - This article describes Open University Malaysia's efforts at enhancing the blended learning approach for undergraduate distance learners with the successful implementation of the Mobile Learning via SMS initiative (2011)
- Report on one of the world's biggest handheld learning projects – MoLeNET 2 "Modernising education and training: Mobilising technology for learning" (2010)
- Selected References on the Spacing Effect - 11 papers on the spacing effect (vendor)
- Spacing Learning Over Time: A Research-Based Secret Objectives [PDF] Will Thalheimer, PhD, 2007 ASTD presentation on spacing learning over time
- Universal instructional design principles for mobile learning - The report extends a previous analysis of universal instructional design principles in distance education by applying them to the design of mobile learning - 2011

10. Glossary

3G: 3G is the third generation of mobile communications technology, up to 384 Kbps when a device is stationary.

4G: 4G is the newest generation of mobile communications technology, which can allow data transfer rates to and from mobile devices between 15 and 100 times faster than 3G networks.

Accelerometer: An accelerometer measures acceleration or movement and has been used in games or simulations. A gyroscope has been added to the iPhone 4, which also measures rotation around an axis and can be used in conjunction with the accelerometer.

API(s): API is an abbreviation for Application Programming Interface(s).

App(s): App is an abbreviation for application(s).

Augmented Reality: Augmented reality is the

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overlaying of digital data in the real world. There is significant potential usage for training. Some available applications includeMetaio, Layar Augmented Reality Browser, AcrossAir, junaio, Tochnidot, RobotVision, and Wikitude World Browser.

Bluetooth: A short-range radio technology aimed at simplifying communications among Internet devices and between devices and the Internet.

CAC: Common Access Cards are identification cards commonly used by DoD and other government agencies to enhance security of computer systems and facilities.

CDMA: Code Division Multiple Access (CDMA) is a digital wireless 2G technology that uses a spread spectrum technique to scatter a radio signal across a wide range of frequencies. CDMA carriers include: Sprint, NexTel, Verizon, Alltel and Telus.

Cell Phone: Shortened form of for cellular phone which connects to a wireless communications network through radio wave or satellite transmissions, and may also provide Internet access.

Cellular: Frequency allocated for digital communications. Several competing cellular systems exist, including GSM and CDMA.

Cloud: The practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or personal computer is called cloud computing.

COTS: Short for commercial off-the-shelf, an adjective that describes software or hardware products that are ready-made and available for sale to the general public.

CSS: Cascading Style Sheets (CSS) is a style language that describes how HTML markup is presented or styled. CSS3 is the latest version of the CSS specification.

E-book: An electronic version of a book. Reader applications for e-books are available for many cell phones.

Education: Education is an end in its own right. Through education we learn how to apply the knowledge and skills we've learned. Educational goals are generally negotiable. Education provides foundational self-development. Nearly all training includes some education. Nearly all education includes some training.

EPUB: EPUB (short for electronic publication; alternatively capitalized as ePub, EPub, or epub, with "EPUB" preferred) is a free and open e-book standard by the International Digital Publishing Forum (IDPF).

Feature Phone: Any mobile phone that is not a smartphone or PDA phone. Software for feature phones is often less powerful, less integrated with other features of the phone, and less integrated into the main user interface of the phone.

Firmware: Computer chips that have data or programs recorded on them are firmware.

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Games and Simulations: According to Nielsen, games are the most popular application category used on mobile devices. In June 2011 64% of smartphone users and 54% of feature phone users played games. Games, simulations and scenarios are becoming much more important in learning.

> *Brain fitness applications are also growing rapidly. According to Tyson Greer, CEO of Ambient Insight, brain fitness applications "are designed to enhance cognitive skills and to achieve what is known as 'transfer,' where the skills learned can be extended to new situations."*

Gestures: Uses of gestures on touch screens, starting with the iPhone, are becoming more pervasive. Users can change the size of the content with a pinch movement. Other gestures such as arm or hand movement above the screen or even eye movement are being tested in labs.

GPS: Global Positioning System (GPS) is a worldwide satellite navigational system generally used for navigation and location determination.

GSM: Global System for Mobile communications (GSM), a 2G technology, is the de facto European standard for digital cellular telephone service, and it is also available in the Americas. GSM carriers include: AT&T, T-Mobile, SunCom and Rogers.

Gyroscope: A gyroscope is a device with a rotating mechanism that can be used to provide stability or maintain a reference direction in navigation or stabilizers. Phones with built-in gyroscopes are commonly used in mobile games.

HTML: Hyper Text Markup Language (HTML) is the mark-up language of the web.

HTML5: HTML5 is the latest iteration of that markup language, and includes new features, improvements to existing features, and scripting-based APIs. It is designed to work on just about every platform and has been adopted by most mobile phone browsers. It provides for offline storage and does not require plug-ins.

JavaScript: JavaScript® (sometimes shortened to JS) is a lightweight, object-oriented language, most known as the scripting language for web pages.

Learning: 'Learning' in the ADL sense is a modification of what psychologists mean by the term. It gives us a catchall-term for education, learning, performance aiding, and decision aiding, all of which are goals of ADL.

Location: A growing trend in mobile phone applications is more location-based apps that know where you and/or your friends or co-workers are and utilize that data in some way.

> *Augmented reality apps use GPS coordinates to provide context-specific*

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information. Products such as Brightkite enable users to "check in" at various locations in the real world and see who else is there, has been there, and who is nearby.

Additionally, a number of learning and team-building activities have been built utilizing location information.

LTE (or 4G): Long Term Evolution (LTE) could allow data transfer rates to and from mobile devices between 15 and 100 times faster than 3G networks.

MIME: MIME is short for Multipurpose Internet Mail Extensions, a specification for formatting non-ASCII messages so that they can be sent over the Internet. There are many predefined MIME types, such as GIF graphics files and PostScript files.

Native App: A native app is an application that was written specifically to run on a specific device or operating system versus one written to be delivered via a browser on the web.

NFC: Near Field Communication (NFC) is a standards-based, short-range wireless connectivity technology that enables convenient short-range communication between electronic devices, used for access control, mobile payments, or peer-to-peer transfer of data.

OEM: OEM represents the Original Equipment Manufacturer.

OS: Operating System (OS) is software that controls the execution of programs and may provide various services for mobile devices.

PIM: PIM is short for Personal Information Management (or Manager).

QA: QA is used for Quality Assurance.

QR Code: Quick Response Code (QR Code) is a two-dimensional bar code, which can be read and decoded with a camera.

QR codes can be read via a camera on a mobile device and reader software to automatically browse to a website without having to type in a URL, receive text information, receive additional details, make a phone call, or a number of other actions. Another name is a Data Matrix code. Microsoft has its own version called Microsoft Tag. One use for support is to place a code on equipment with a link back to the operating instructions or manual. Both the creation tools and the readers are usually free.

RFID: Radio Frequency Identification (RFID) is a technology similar in theory to bar code identification used from clothing tags to missiles to pet tags to food. RFID eliminates the need for line-of-sight reading that bar coding depends on and can be done at greater distances than bar code scanning.

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RIA: Rich Internet Applications (RIA) are web applications that are delivered via a browser plug-in such as Adobe Flash, Java or Microsoft Silverlight.

ROI: ROI stands for Return on Investment.

RSS: RSS (most commonly expanded as "Really Simple Syndication") is a family of web feed formats used to publish frequently updated works—such as blog entries, news headlines, audio, and video—in a standardized format. [Definition from Wikipedia]

SaaS: Software as a Service (SaaS, typically pronounced 'sass') is subscription-based software deployment where all upgrades are provided during the term of the subscription. The software is hosted and updated on a central location, and does not reside on client computers.

SCORM: The Sharable Content Object Reference Model (SCORM®) integrates a set of related technical standards, specifications, and guidelines designed to meet SCORM's high-level requirements—accessible, interoperable, durable, and reusable content and systems. SCORM content can be delivered to your learners via any SCORM-compliant Learning Management System (LMS) using the same version of SCORM.

SDK: Software Development Kit is often called an SDK.

Sensor: A sensor is a device that measures a physical quantity (such as heat or pressure or light or motion, etc.) and converts it into a signal, which can be read by an observer or by an instrument.

> *Sensors are beginning to appear in mobile devices for health care, detection and security. Companies such as Fullpower are exploiting these capabilities. Currently these sensors are being used for physical fitness training with many more applications being developed in labs around the world.*

Smartphone: A smartphone is a mobile phone offering advanced capabilities, often with PC-like functionality.

SMS: Short Message Service (SMS) is the text communication service component of phone, web, or mobile communication systems, using standardized communications protocols that allow the exchange of short text messages between fixed line or mobile phone devices. SMS text messaging is the most widely used data application in the world.

SoC: System-on-a-chip or system on chip (SoC or SOC) refers to integrating all components of a computer or other electronic system into a single integrated circuit (chip). It may contain digital, analog, mixed-signal, and often radio-frequency functions – all on a single chip substrate. A typical application is in the area of embedded systems. [Definition from Webopedia]

Touch Screen: A touch-sensitive screen that serves as the interface on some smartphones for controlling applications or entering data with a software keypad.

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Training: Training is a means to an end. Training is done to learn how to do something—it provides the knowledge and skill to do a task or a job. Training objectives are generally non-negotiable. Nearly all training includes some education. Nearly all education includes some training.

Transcoding: Transcoding refers to the operation of changing data from one format to another, such as an XML to HTML, so the output will be displayed in an appropriate manner for the device.

Ubiquitous: Ubiquitous is a term used to describe existing or being everywhere at the same time, constantly encountered, widespread or pervasive. An adjective increasingly used to describe mobile computing as it is integrated into everyday activities.

UX: UX is a term used for User Experience.

Video: Not all devices support all formats of video. It is important to identify the proper format to use for the devices you are supporting. Some formats are MPEG-4, WMV, 3GPP and 3GPP2, SWF, and FLV. Software converters are available to create existing video in a different format. Some mobile platforms also do conversions on the fly according to the needs of the device. Video support is included in the new HTML5 specifications, which reduce the compatibility issues.

WAP: Wireless Access Protocol (WAP) is a technology that allows cell phones to display specially formatted websites on a small screen. WAP was slow to catch on because it was slow and very limited graphically. For these reasons only some Web sites are available in WAP format. New PDAs, smartphones and the iPhone probably spell the end of WAP.

WCDMA: Wideband Code Division Multiple Access (Wideband CDMA), also known as UMTS in Europe, is 3G standard for GSM in Europe, Japan and the United States.

Web App: A web app is an application that uses technologies such as JavaScript, CSS and HTML5 and is executed in a web browser. The application can be run directly from a website, or it can be downloaded and installed locally in some cases, for offline use.

Wi-Fi: Wireless Fidelity, more commonly referred to as Wi-Fi, is used to describe a set of standards for devices that connect to a local area network using wireless technology.

Widget: A widget is a small, portable application embedded within a web page that adds dynamic content. Also known as modules, snippets, and plug-ins. Widgets are used to add entertainment and functionality to a web site.

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About

This complete version of the ADL Mobile Learning Handbook at http://mlhandbook.adlnet.gov is under continual development by ADL. There is also a mobile version for demonstration purposes only and to showcase cross-platform interoperability using mobile web standards.

The purpose of the Mobile Learning Handbook is to provide a universal mobile resource on all topics pertinent to mobile learning. ADL will be adding additional content using various mobile authoring tools and welcomes the opportunity to work with all mobile vendors. ADL cannot endorse specific tools, but would like to work with all who are interested in enhancing this mobile resource. Please contact ADL about collaborating or to provide feedback or ask questions at adlmobile@adlnet.gov.

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ADL Vision

To provide access to the highest quality education and training that can be tailored to individual needs and delivered cost effectively, anywhere and anytime.

ADL Overview

The Advanced Distributed Learning (ADL) Initiative is a collaborative effort to harness the power of information technologies to deliver high quality, easily accessible, adaptable, and cost-effective education and training. ADL uses structured and collaborative methods to convene multi-national groups from industry, academia, and government who help to define the specifications and standards for the learning industry and then develop tools and content to those standards.

ADL is sponsored by the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD P&R). This is an official app of the U.S. Government Advanced Distributed Learning (ADL) Initiative.

> **Note**: *ADL does not endorse any products mentioned in this handbook. Specific devices and applications are provided for informational purposes only to help introduce the concepts related to mobile development for learning or human performance support.*

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