The basic pla t orm

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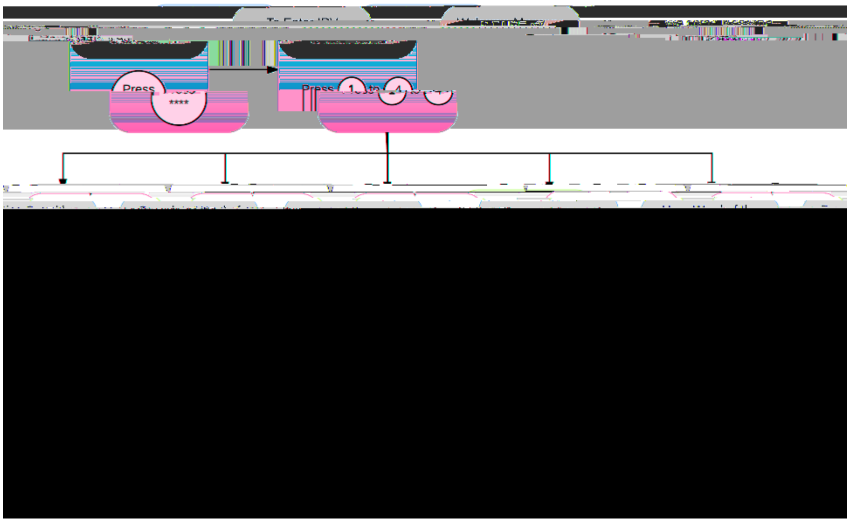

inherent capabilities of the cell phone coupled with other learning technology that creates a powerful learning platform. In addition, the IVR provides visually impaired learners with an opportunity to engage in mobile learning. There is also the ability to use this approach to reach nomadic populations that are illiterate—being able to hear instructions provides a starting point for their learning.

Text messaging

Short Message Service (SMS), often referred to as *ŭŜĚŭ YŜăăl·ƎʎyƎ* or just *YŜăăl·ƎʎyƎ*, was designed to allow brief messages to be sent over the cellular network using the phone number of the recipient as the destination identifier. SMS is limited to 160[5] characters though some popular services such as Twitter limit the message length to 140 characters. There is also the Multimedia Messaging Service (MMS) that allows text messages of unlimited length as well as rich media attachments. MMS can be used to share images, video, audio and other multimedia with other cell phone users. Text messaging has become a ubiquitous form of communications found on even the most basic cell phones.

Text messaging can be enabled on a Learning Management System (LMS). The learner, via SMS, can respond to the LMS initiated text message. Returning to the IVR example from the previous section on voice calls, the learner with the help of text messages, could enrol in a class simply by sending a text message. The learner could receive the word of the day along with the definition via text message, and then practice using the word of the day in a sentence by sending and receiving text messages. Text messages could also be used for learning assessment via true/false, mul tple choice, or short answer quizzes. The SEMA project, men toned elsewhere, used all these formats as well as crea tng groups for message-based discussion, calendar alerts, administra tve reminders and study guide support.

The simplicity of text messaging makes it an a trac tve op ton for mobile learning. Text messaging as a learning pla torm is also simpler and less expensive to implement than an IVR system. The constraint of text messaging is that there are s tll cellular service providers that charge for each text message. There are also cellular service providers that charge for text messages that exceed a monthly quota. Refer to the discussion in the Tari fs sec ton below for more informa ton on monthly charges. Variable charges based on monthly usage can result in hidden costs for the learner that they may be unable to pay.

Consider the cost of text messaging to learners when looking to implement a text messaging based mobile learning applica ton.

A powerful example of using text messaging is found in Edmonton, Canada's Centre to End All Sexual Exploita ton (CEASE) that build a program to use mobile text messaging as an outreach strategy (Box 4.1).

Text-to-speech/speech-to-text

With the introduc ton of Siri[6] and Google's Speech Recogni ton for Android devices it is now possible to give voice commands to a smartphone. It may be as simple as the smartphone reminding its owner about a scheduled mee tng, se t ng an appointment for next Tuesday at 2PM, or conver tng an incoming text message or email to speech and reading it aloud. This ability to convert natural speech into text for a message

[illegible]

Recognizing the ability to send a text message that had su f cient informa ton to be ac tonable by the recipient, Edmonton's Centre to End All Sexual Exploita ton (CEASE) decided to send text messages to a mobile phone list culled from an adult adver tsing site about the services o fered by CEASE. The phone numbers were entered into FrontlineSMS, a free SMS management tool, and CEASE cra fed the text message. FrontlineSMS sent the text message to the mobile phones informing the recipient that he or she could contact CEASE for counselling, training, income support, vic tm advocate, and peer coaching. The goal was to augment the work CEASE does in person as many sex workers are no longer working on the streets and a new way to access sex workers was needed.

CEASE found that the work to gather the numbers using automated tools and to import the phone list into FrontlineSMS was about an hour. This gave them the poten tal to access hundreds of poten tally exploited persons with ease. Though this was a pilot program the number of recipients that responded posi tvely was encouraging. They did have a few individuals respond asking to be removed from further no t fca tons. The posi tve responses either thanked them for the good work, or asked for more informa ton.

FrontlineSMS required a laptop running their so fware, and a GSM modem plugged into the laptop to send and receive SMS messages. The cost for sending the SMS messages was considered negligible, as it was part of the monthly service plan. FrontlineSMS is free.

This case study shows that text messaging can be used to communicate with a group of at risk men and women that could not be reached easily any other way.

Source: Gow, G., Quinn, K. and Barlo t, T. (2014). *[illegible]*. Front-line SMS Case Study. Available at: h t p://sta t c1.squarespace.com/sta t c/56e1a99907eaa0941d037b0a/56e1aa9e06dcb7bbf42a70ce/56e1aaf306dcb7bbf42a7a35/1457629939677/frontlinesms_casestudy_Sexual-Exploita t on-Outreach-with-Text-Messaging.pdf?format=original. Accessed 6 Nov. 2016.

or email, or to issue voice commands by speaking to the smartphone are powerful tools when developing training for visually impaired learners. While powerful, the technology is not perfect and users may find it difficult to be understood by the smartphone. This can be mitigated somewhat when the smartphone can be trained to understand the owner. There may also be higher monthly costs due to increased data consumption.

eMail

Many mobile devices provide access to email. While this may not be thought of as a learning solution, sending email messages to an automated system can engage the learner in educational activities. By responding to an email message and performing the task as directed a new email can be sent furthering the exploration of the subject being studied. Email should not be discounted as a learning tool. Email can be used for performance support, sharing or exchanging resources, and keeping in touch with a community of practice. However, email will require the learner to have a data plan on their mobile device so that they can manage the monthly cost. Designing an interactive learning environment without consideration of the potential to increase the monthly cost is disingenuous to the learner.

Internet

Internet over a cellular device provides the learner with access to the vast information on the World Wide Web. This also means that a Universal Resource Locator, or URL, can be used to direct the learner to specific resources. By tagging specific resources with a URL the learning system can send a message to the learner and include the URL to a resource to further the learner's knowledge. URLs are the backbone of the Internet and they are used to link to audio files, video files, documents, graphics, HTML pages, and websites. It is the URLs that provide the connection to the plethora of social media sites and the Internet based tools.

Leveraging the Internet for learning requires a change of focus from content author to content curator. Rather than spending time developing content from scratch for use in courses, the focus becomes that of locating high quality content on the Internet that can be repurposed to further the learner's knowledge. It is also important to ensure that selected content remains available as websites can disappear without warning or the URL of a selected site changes due to a website redesign.

Apps

Apps allow developers to create applications that run on mobile devices and access the hardware subject to the device manufacturer's security policies (see Hardware section below). In June 2016, Apple had 2 million applications and Google had over 2.2 million applications available for download in their online stores[7]. With this volume of Apps there is a high probability that there is an App for just about anything a mobile device user wishes to do. There are even Apps that extend the functionality found in learning management systems to mobile devices.

With the introduction of HTML5, it is becoming possible to develop applications that are browser based. HTML5 implementation improves video, audio, and offline capabilities for browser based applications. HTML5 is growing in popularity; however, the implementation of HTML5 is still inconsistent and not all mobile devices implement all the HTML5 features. Therefore, cross platform testing is still required for HTML5 based applications. HTML5 should not be confused with the Apps being described here however. Apps in this article refer to software development where the App's source code is compiled to run natively on the targeted smartphone. As the power of mobile devices grow and network speeds improve, this distinction may become irrelevant.

The benefit of Apps is how they enable the extensibility of mobile devices. If a need can be identified an application can be written. The challenge of Apps is that they are device specific. An App that is written for an iPhone will not run on an Android device and Apps written for iPhone or Android will not run on the Microsoft mobile devices. This lack of portability means that Apps need to be developed for each platform that will be supported. There are tools emerging that allow developers to write code that is portable—but device specific refinement is still required. Over time the portability of Apps will increase, but for now it requires additional effort to support multiple smartphone operating systems.

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This sec t on will discuss the hardware that is included on mobile devices and use with mobile learning. Not every mobile device will have everything described in this sec t on. It is di f cult to talk about hardware and not men t on so f ware—as so f ware is what allows the mobile device's hardware to be u t lized by applica t ons. For the sake of simplicity, only the hardware is discussed below. The modern mobile device can be thought of as a handheld computer—complete with internal storage for data, programs, temporary storage, and an opera t ng system that controls the basic func t ons. Of course basic func t ons of a mobile device are extensive—as they do much more than make and receive phone calls.

Accelerometer

The accelerometer is a sensor that lets the mobile device know up from down. An example of this is when the accelerometer provides the device orienta t on so that the screen can rotate as the device is rotated. The accelerometer can detect small changes in the orienta t on of the mobile device—an example is the game Temple Run that allows the player to navigate a maze just by t pping the mobile device side-to-side or up and down. The accelerometer provides data on the learner's movements allowing an applica t on to respond accordingly. Simula t ons that require hand-eye coordina t on are more realis t c when the accelerometer is used to track learner ac t ons. The accelerometer is shared by other applica t ons as well as the mobile device itself—and cri t cal movements could be lost due to other applica t ons accessing the sensor.

Ba t ery

It is important to remember that a mobile device relies on its ba t ery and can only operate while the ba t ery contains su f cient power. Individuals that do not have direct access to power to recharge their mobile devices must seek alterna t ve ways to recharge their mobile device. With an es t mated 1.6 billion people (Box 4.2) that do not have easy access to electrical power, individuals having to travel to recharge their devices should be taken into considera t on.

When developing mobile learning strategies, considera t on needs to be given to learners that

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GSMA published a report on the high cost of charging mobile devices in loca t ons that are o f the power-grid (o f -grid) in July 2011. It es t mates that 1.6 billion people do not have access to electricity. Yet the number of individuals who live o f -grid and own mobile devices is increasing each year. These individuals need to use alterna t ve ways to charge mobile devices such as solar-chargers, car ba t eries, hand-crank chargers, or f nding a small power generator. However, these all require purchasing addi t onal equipment that may break, become inopera t ve, or be costly to access. For example, the cost for charging a mobile device in Kenya is around the same price they pay per minute of air t me (USD 0.18 – USD 0.25)[a].

GSMA noted that many of the cellular base sta t ons in these remote areas operate o f the power grid. In such loca t ons the cellular providers have developed methods of genera t ng power onsite either from a generator or from renewable "green" sources. Many of the cellular base sta t ons generate more power than they need. This excess power could be made available to the local people. An example of this is Safaricom that had developed a mobile handset charging dock that is a f xed near their cellular base sta t on.

Note: [a] GSMA. (n.d.). *DŊŜŜyˊtƻǿŜǌ Ŧƻǌ aƻōʎſŜʏ /KI·ŊƎʎyƎ /KƻʎŎŜǎ*. [pdf] Available at: h t p://www.globaltelecomsbusiness.com/pdf/charging_choices.pdf Accessed 6 Nov. 2016.

Source: GSMA. (2011). */ƻϒϒdzyΆǘè tƻǿŜǌ ŦǊƻϒ aƻōʎſŜπ/KI·ŊƎʎyƎ {ŜǊØʎŎŜǎ*. [pdf] Available at: h t p://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/07/charging_services.pdf Accessed 6 Nov. 2016.

do not have easy access to electrical power. Deploying mobile devices to learners when the learners will not have ready means for charging the devices will lead to a failed program. In rural areas, learners may only access a generator, and network coverage at a weekly market.

Bluetooth

Bluetooth is a low-power personal network that is designed to allow electronic devices to communicate over short distances, normally around 10 meters (30 feet). The most common use of Bluetooth is pairing an earpiece to a person's smartphone so that they can use the smartphone without having to hold the smartphone to their ear. There is no reason why other uses of this capability cannot be developed. The auto industry has been adding Bluetooth capability to automobiles for several years to allow the vehicle owner's smartphone to connect with the automobile. Recently the sports industry has begun to make wearable devices, such as the Nike Fuelband, to monitor heart rate, steps taken, and calories burned and share the data with applications running on a smartphone.

Bluetooth provides a means for classroom equipment to communicate with the learner or the teacher. Bluetooth capability can be built into field equipment allowing learners to connect once they are within range of the equipment and complete pairing (gaining access). Once paired with a Bluetooth equipped piece of equipment the learner would be able to send commands and receive data for later analysis. Bluetooth also allows learners to share data amongst themselves—creating a collaborative micro-network.

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applications. There are also Apps that let you enter the GPS coordinates of a location and then use the built-in GPS on the smartphone to aid the learner in navigating to the target location. By using a GPS recorder a person can engage in geocaching or other forms of exploration of his or her environment and capture the exact location of observations or phenomena.

Microphone

A microphone is required for voice conversations on a cell phone. There is an additional advantage with smartphones—being able to record voice or ambient sounds. The only limit to the recording length is the available memory for storing the recording.

The ability for learners to record themselves, to record others, or to record specific sounds enables the learner to add another dimension to their mobile learning. The ability to create an audio diary, interview a subject matter expert, or record the amazing sounds of the Australian Superb Lyrebird while researching in the field are all powerful ways that the built-in recording feature could be used to extend learning. Incidentally, some apps can exploit the microphone for measuring wind speed.

Near Field Communications

Near Field Communications (NFC) differs from the other forms of communication, as NFC does not rely on active radio transmission as the other co ľc'Ω

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