

Mobile Applications within Education

An Overview of Application Paradigms in Specific Categories

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Abstract—M-learning has the potential to take education out of classroom boundaries. Based on the device used, any student/learner can access a vast area of content. Varying from podcasts to videos, participate in virtual lessons or just ask a mentor over the net directly for answers to his problems. These new technological capabilities create demand for rethinking pedagogy and school system education. For that reason, our examples of mobile applications within education (formal/informal) been made in correlation with technology. Usability details for each app are being discussed through the ISO9241 part11 standard. While describing current trends by taking in consideration curriculum prescribed directions and differentiated instruction’s theoretical suggestions.

Key Words—m-learning, mobile pedagogy, education digital tools, learning design, personalized learning, augmented reality, virtual reality, standards based instruction, computer assisted instruction, intelligent tutoring systems

1 Introduction

There are only two ways to think about the use of technology in education. You can either consider it as an add-on to existing educational practices. Thus, technology can only support learning in average school-based environments where electronic whiteboards and standard personal computer classrooms unfold a classic paradigm. Or as an agent of transformation facilitating a maximum boost of lifelong learning and purpose wherever you want it, whenever you want it. In the second case, you have m-learning enabling authentic interactions between learners of the same or different culture, providing quick access to diverse data from the web and accommodating knowledge on the pace of each individual.

M-learning is a subcategory of e-learning which is a macro concept of education. With the use of technology well spread among young pupils and students across the globe, learning and particularly m-learning is already being redefined as "learning

across multiple contexts, through social and content interactions, using personal electronic devices" [[8]]. Most of the theory about m-learning is based on critical social-cognitive beliefs that learning is situated in the sum of interactions and conversations between people while the use of tools for learning is also an important and recognized factor of learning [[26]] [[39]].

The basic tools (hardware) available for m-learning are the W/H (wireless handheld devices) [[31]]. First the wireless phones and later on the PDAs (Personal Digital Assistant) with the use of WAP (Wireless Access Protocol) technologies in combination with WML (Wireless Markup Language) and automated SMS (Short Message Service). Despite the fact that in early 00s formal education had not a learner center orientation, the adaptation from universities and organizations of the new innovative technology gave the necessary jumpstart for m-learning projects to built-up. Mobile technology contains the mobile hardware and the software included, because their sum plus the interaction with the user/learner results the end product we call m-learning.

Mobile devices offer one of the easiest and fastest ways to access educational content. Besides World Wide Web, mobile devices have their own set-up application store where users can download unique apps. All these apps are designed with a specific purpose. Consider gaming apps that have an entertaining purpose. Still the possibilities are endless and many games are developed with an educational orientation. For mobile games used in classroom settings research shows increase in problem solving skills and collaboration skills [[32]], attract and maintain attention [[27]], active teamwork throughout gameplay and civic engagement [[10]]. Of course, there are many different types of applications and technologies utilized within education besides gaming apps.

Starting from the concept and the characteristics of the mobile application presented. We will try to recognize type of active learning that takes place along with various advantages and disadvantages in each case. Ending summarizing results.

2 Theoretical Framework

Analyzing mobile applications within education is a complicated task. Our goal is to check possible outcomes of learning parameters and propose strategies to use based on individual needs and literature findings.

In ISO9241 part11 are stated the basic principles of human machine interaction. Specific ISO9241 defines software usability including mobile applications as: software is usable when it allows the user to execute his task effectively, efficiently and with satisfaction in the specified context of use [[1]].

For m-learning the context within education is obviously a classroom. Because of the capability of mobile devices to go wherever the user carries them we have to count the possibilities of using an app to learn at home or even somewhere outside like a park or a coffee shop. The context might be occasionally different and influence the usability, as a result the overall learning procedure.

The term effectiveness refers to how well the users achieve their goals using the system. A mathematics application targets the issue of high school students to learn algebra. The way this task is accomplished describes the effectiveness. Statistically is measured as tasks accomplished in a unit of time. Efficiency refers to the resources needed in order to achieve goals. It is measured on repetitions made to achieve a task, also time consumed on errors. Satisfaction is how the users feel about their use of the system. Rating scales are made to measure user's satisfaction. An easy way is to count the percentage of favorable or unfavorable user's comments.

Based on these characteristics, the problem how a mobile application can be of use within education should be tackled upon three factors: users, tasks and possible environments – contexts of use.

This overview also questions:

- Can technology assist student learning?
- How can an app be of use within education?

The pedagogy theory we follow is Tomlinson's differentiated instruction [[35]][[36]]. Her ideas match with the innovative type and style of education that m-learning can offer.

Most of the times there are certain things to teach and specific skills to be acquired in the end of the courses. Plus, the examinations and the assessment that has to be done. All these derive from the curriculum. Every curriculum sets specific goals to be achieved for the students with the guidance of teachers. However, there's always the risk that all above could turn out to be more of a race for test scores rather than actual learning. Differentiated instruction suggests ways in which we can make that curriculum work best for varied learners. That should include technology driven ways and learning modes provided from mobile devices and m-learning applications.

3 Overview

WELCOME:

Wireless E-learning and COMMunication Environment is an application that combines push and pull technology through browser and WAP tech to supplement the student's device with info about event alerts and campus services. This is content delivery in the simplest possible format [[31]].

MOOsburg:

Developed with Java software, MOOsburg is an application for W/H devices where students can discuss their findings about environment and ecology at the spot [[31]].

The most known and widely used m-learning applications are the social media networking applications.

Facebook:

Basic characteristics are easy access, quite simple GUI and the free and open use for all. The average millennial student has already a profile in Facebook and friended his peers. In some cases, groups of students come together to organize events. Com-

ments posted on each other's walls, creating opinion threads and course related material exchange, which also helps to check the accuracy of the information. All these digital interactions from the instructors point of view might seem impersonal since these trends developed the last decade and don't belong to the core values of past generations. If an instructor wants to call himself a pro must be able to utilize these technologies. Initiate discussions about class sessions, provide feedback where needed, assign tasks in order to improve his students learning through repetition and generally blend in [[15]] [[40]].

Twitter:

On the other hand, Twitter is a light application for quick short message exchange. These short messages are called tweets. Some instructors allow the use of tweeter during a course session in order to develop an in-classroom community and increased interaction. Chances are that it may end up more of a distraction rather than an instructional or educational tool [[15]] [[40]].

Advanced users that are more content aware and usually professionals prefer applications like:

YouTube:

YouTube's most viewed videos are the Tutorials which are clearly for educational purpose and DIY videos, also famous are the Vlogs users upload from their travels to present their findings and everyday life experiences from native or foreign places [[40]].

Very popular are the Web 2.0 tools. Wikis, Podcasts and Blogs.

Wikipedia:

Wikipedia is a multilingual, web-based, free-content encyclopedia project. That consists of a vast collection of info webpages with open access for everyone to create and edit. Crosslinks between internal pages is a useful feature. Students can collaborate to create a wiki page, exercise their creative skills and when finished use their critical thinking and reflect upon the results. Reports show more than 75,000 active contributors and 9,000,000 entries for Wikipedia in more than 250 languages [[2]] [[34]].

Podcasts are self-contained broadcasts that immediately engage the learners with outcomes of a given lecture [[13]].

Actually, podcasts are excellent for revising, which is a substitutional use, especially for learners who miss lectures constantly. They can be used as additional material to broaden and deepen students understanding, this is a supplementary use. Last, they make a very good creative use for extra active students and learners as user generated podcasts [[22]][[28]]. To gain access to podcasts you need a podcatching application. All Apple's iTunes store, Google's Play store and Microsoft's Marketplace offer their own exclusive podcatching applications alongside extra third party developed apps. This alone is a proof how much attention podcasts gained after their first entry to the market. Today just in Apple's iTunes alone you can find over 8 million free podcast episodes in over 100 languages [[22]].

Overcast:

Overcast is a podcatching application which also offers sync and backup between your devices so you never lose your work and always continue from where you last stopped even in different devices.

GoogleListen:

GoogleListen is a fine option for android costumers. Once you have found something worth listening to, you can either choose to stream it immediately or add it to your list for later use. Important feature is the auto-remove capability for the podcasts you have finished.

Zune:

Zune is the equivalent podcatching application for Microsoft's marketplace. It combines all the above options only it has to be installed first to your desktop personal computer and then synchronized to your windows smartphone.

Blogging is an easy way to publish information and opinions. Most bloggers form their blog like a personal diary where they keep track of their thoughts about everyday life and situations.

Blogger:

With Blogger, you can create a personal blog webpage publishing your own UGC stuff and ideas. It is a ready to use platform so simple that even users with no programming skills can handle. It provides instant publishing of text or graphics. The option of comments is available under each post. Archive of past blogs and hyperlinks to other blogs are also important for community bloggers around the blogosphere. An instructor might choose to start blogging to share content with colleagues or students. PowerPoint slides, lecture notes and videos for learners are the usual. Informal learners can access this content if it's public and not locked for subscribers only. This is a much-differentiated way to handle the progress of the course, session by session. Low pace students will also benefit as extra information keeps uploaded and stays saved there for them to comprehend. Most blogs make use of RSS feeds which allow subscribers to take notice about updates in the content of the blog without actually having to go and visit the blog. Instead a synopsis along with the blog's name is collected within a feed and sent to the subscribed users in a process known as syndication. [[21]] [[2]]

Language learning applications create a very big category specialized for various types of students and learners with specific purpose and content [[17]]. Mobile learners prefer personalized programs like MALL -mobile assisted language learning-applications to help them advance quickly in their studies. [[19]]

EduCall:

EduCall application offers a quick and simple way to learn a foreign language. In app, you can find standard day to day phrases for basic conversations. Videos and quiz tests are available. Learners can also chat with each other and improve their language use skills. [[7]]

M-learning:

M-learning is an EU funded program which delivers learning content to young adults who no longer participate in formal education or training. The idea is that through the use of a mobile phone one may be more likely to engage young learners in a time and a place more conducive to their learning preferences. The m-learning

infrastructure is quite sophisticated, incorporating its own learning management system and speech/text tools. Interactive puzzles for teaching languages and activities designed to develop aspects of literacy and numeracy are some of the tools that are available. [[16]]

Another category is the course specified content applications.

Graph2Go:

Graph2go is a mathematics application. Innovative graphs, mathematic functions and geometrical constructs used to improve arithmetic skills and make the course more enjoyable and interactive. [[9]] [[12]]

MobileMath:

MobileMath is a mathematics game application. Designed for K12 students. Helps them experience mathematical concepts in the physical world. The in-app learning environment is based on geography, maps and location technology. Users can also play in teams, gain points by creating virtually constructed mathematical shapes. The construction process is done by physically walking and pin pointing locations. Users can recognize constructs like squares, rectangles and parallelograms. A device with GPS capabilities is required [[12]] [[41]] [[4]].

The augmented reality applications are considered to be the most innovative category for m-learning. Very familiar to technology enthusiasts, augmented reality concerns any technology that blends real and virtual information in a meaningful way. Broadly could be defined as “a situation in which a real-world context is dynamically overlaid with coherent location or context sensitive virtual information” [[42]]. Specific in-between reality and virtuality exists the mixed reality. On the side border of mixed reality, augmented reality takes shape. Augmented reality is the personal perception one does, created by any fusion of digital information with physical world settings. Such applications considered of being able to augment immediate surroundings with electronic data or information, in a variety of formats including visual/graphic media, text, audio, video and haptic overlays [[14]].

MARS:

Moblie Augmented Reality System is a Columbia University’s mobile app that combines a mobile computer and headset with a compass, inclinometer and GPS, allowing users to see representations of historic buildings at their original locations. [[14]] [[20]]

Savannah:

Savannah by futurelab is an AR application where students get in the life of a lion for a day. Groups of five carry out a series of missions in which they need to think and act as lions as they inhabit a virtual savannah. The virtual savannah is overlaid on an open area of approximately 100 by 40 meters that contains no physical obstacles. Each student explores this virtual savannah using a handheld computer which is equipped with headphones, a GPS receiver to track their physical position and Wi-Fi networking to communicate with a central game server. Users need to act collaboratively to carry out these lion missions (such as marking their territory, hiding their cubs and hunting). A stated aim of this app is to encourage users to understand the behavior of lions through personal experience. [[4]] [[5]]

Zapp:

Zapp is a learning project for small groups or individuals that gets them to interpret geological features of rural landscapes through situated inquiries and collaboration. Augmented reality applications by design enable a connection between formal and informal learning. Education turns out to be more motivating and full of stimuli in augmented learning environments along with vast potential implications that foster student creativity and skill acquisition. [[14]] [[29]]

Along with augmented reality goes virtual reality. As mentioned above augmented reality and virtual reality are the cross-side borders of mixed reality. We can say that augmented reality is something that happens outdoors while virtual reality and virtuality exist indoors. Virtual reality is recognized as an impressive learning tool. That leads learners to new discoveries, motivate, encourage and excite. Despite the disadvantages related to cost, the necessary time to learn how to use the hardware and software, possible health and safety scenarios, leave alone the difficulty for the instructors to integrate new technology into a course or curriculum. In virtual reality environments simulations make it possible to explore new domains, make predictions, design experiments and interpret results.

mCLEV-R:

mobileCollaborative Learning Environment with Virtual Reality. This virtual reality environment is modeled after a traditional university. It consists of a lecture theatre, classrooms, a library, number of meeting rooms and a series of social areas. The lecture room is for PowerPoint presentations. Also, there is available audio communication and a video board which only the teacher can use. The meeting rooms allow students to work together on projects and other group tasks. Text chat and audio chat is available. The library is where you can download lecture notes. There is actually a virtual bookcase and a number of desks to sit before you can browse the catalogue of lecture notes. Any course can be run through this interface once the appropriate notes are provided. The tools that are available offer the prospect of collaboration with other users who might connect from a desktop pc or log in on another mobile device. The application provides text-chat, voice communication, web-cam and file sharing. The unique feature that is available through virtual reality is that every student during the registration selects its own character known as avatar. The avatars are human like (they walk, raise their hand and nod their head). Details like this make the experience more immersive and authentic [[30]].

Artificial Intelligence (AI) applications make a category of very useful apps especially for education. The development of such apps requires the combination and expertise in many different fields that the educators most of the time don't have. For this reason, many efforts been made for the development of authoring tools that have ready all the background components (student model, expert model-system, instructional procedures and strategies, interface capable of natural language dialogue) [[38]]. Examples of AI applications are mainly software apps with intellectual capacity (virtual avatars who can interact with the user) and in the form of device like robots [[11]]. For education, this type of application usually is referred to as ICAI (Intelligent Computer Assisted Instruction) or ITS (Intelligent Tutoring Systems). The data that are used for each application depend on the knowledge domain to be taught with extra tests and homework. The difference is there's no interference of a human tutor.

The system keeps track of the student's progress and gives direct feedback when needed. This way is facilitated a student-initiated learning with integrated diagnosis - in the case of special educational needs- and assessment.

SCHOLAR:

SCHOLAR is an ICAI system that was designed to teach facts about South American geography. Both the system and the student can initiate a dialogue by asking questions. All questions, answers and decisions are precoded [[23]].

SOPHIE:

SOPHisticated Instructional Environment is another ICAI system about electronic troubleshooting that provides a learning environment in which the user can acquire problem solving skills by trying out ideas. [[6]]

Mobile Author:

Mobile Author is an authoring tool that helps you create your own ITS system. Students can access the platform either from computer or mobile phone. As an ITS system, it can assess the student's performance, inform the databases that record the student's progress and provide advice based to the needs of each individual student [[38]].

Last the games category. There are many types of games; however, it is easy to separate them. There are games that are made for entertainment, the ones that have a more educational theme and the hybrids that combine both. Educational games focus on pedagogy; they have well defined learning objectives and can be played either inside or outside school.

Weatherlings:

Weatherlings is a collectible card battle game in which players pit their decks of weather-dependent cards against other player's decks. This game is created on the Ubiquitous Games platform under development at MIT's Scheller Teacher Education Program (STEP) lab. It is an online card game aimed at middle-school aged students who are learning about weather and climate. Game play consists of short battles set in real cities, for which the game builders have collected a record of actual weather conditions. In each battle, a player plays his or her own cards and tries to defeat an opponent's cards. The twist that differentiates Weatherlings from other card games is that card's attacks and defenses depend on weather conditions at the time and place where the battle is happening. In Weatherlings, these short battles are designed to be played casually after school or between classes on portable devices.

After logging in to the game, and before starting to battle, a player builds one or more decks of cards customized for particular weather conditions. Based on the strengths of the decks they have built, and their knowledge and interpretation of climate graphs for potential arenas, players choose the location of the battle from three possible sites. After the arena is chosen, students choose the best deck for the arena they have settled on and begin the battle. In that battle, students are prompted to predict the weather in a given climate for each battle round to gain in-game bonuses [[27]].

Pox:

This game was designed by the team at Tiltfactor Laboratory at Dartmouth College. The game is played on a grid of 81 (9x9) spaces, with each space representing

one person in a community in which a communicable disease is beginning to spread. At the start of the game, two people are infected with disease; they are represented by two red spaces near the center of the board. Game play proceeds as players alternate drawing cards from the POX deck. Each card provides two pieces of information. The first tells players how the disease will spread during the current turn; the second describes the public health resources that are available to be deployed. As the game progresses, players must effectively allocate public health resources to obstruct, and ultimately halt, the disease's progress. In this way, the game models fundamental public health decisions and dynamics around which players must collaboratively attempt to form a winning strategy to stem the spread of the disease. The mechanics of POX aim to illustrate how quickly disease can spread, especially if players opt not to prioritize vaccinating the uninfected over the alternative of curing the infected, when given the choice. Players win the game if they are successfully able to surround infected people on the board with vaccinated people, so that the disease can no longer spread in any direction, before a pre-determined number of characters die. This game aims to promote a growth in player's systems thinking ability, strategy and decision making by learn how to prioritize actions and their impact [[24]].

4 Summary Discussion

All mobile applications overviewed comply with the ISO9241 part11 standard. That means all interactions made between users and machine through these applications are effective, efficient and satisfactory. In a measurable way that is beyond the scope of this overview.

The differentiated instruction perspective we used helped us distinguish at least three curricular elements: a) content – input, b) process and c) product – output [[36]]. Content meaning what students learn with a specific mobile application. Process or more simply how students learn and finally Product meaning how they demonstrate what they learned.

M-learning applications contribute to all three key curriculum elements. Mobile devices are a technology that can be of use within education. Acting as a medium to enhance learning and teaching. Even more important is that the world beyond school is not a "pen and paper" world but it is becoming more and more digitalized [[25]]. An effective education should focus to real world requirements [[33]]. That answers only our first question: if technology can assist student learning.

To answer our second question, we analyzed more the in-classroom context and the details of the interactions between teacher and students. Learning is a complex procedure that is built upon by the interactions between students and teacher [[26]] [[39]]. To give meaning to these interactions and make them fruitful an instructor-teacher should bear in mind that each student processes and absorbs new information in a different way [[3]]. Making identifying student's learning style a very important aspect. Bottom line, being familiar with learning styles and teaching accordingly, research shows, can increase student academic achievement and improve attitudes toward learning. [[18]] [[37]].

In our overview, we highlighted eight different mobile techs and relevant applications examples. From these technologies, we recognized four types of teaching strategies (situated learning, collaborative learning, cooperative learning, problem based learning) which can be hooked up with different types of learning styles. Modelled from simple input information (visual, acoustical, kinesthetic) to a more specific learning profile (assimilator, converger, diverger, accommodator) [[37]].

5 Conclusions

The social networking apps although they create environments full of interaction and stimuli, necessary for education, they lack organized and instructed knowledge. An ITS allowing interaction between learners with a complete organized knowledge database activity is best suitable for learning. An ICAI system can help an individual learner to choose the content and the pace of his personal learning, making these apps more suitable for homeschooling and students with difficulties.

In each case, mobile devices can deliver content that can be processed by learners in a digital package of an end product called mobile application. There is enough proof that m-learning applications if they combine pedagogy can be very useful for education. Even transform the educational system. The major advantage that make m-learning so popular today is firstly that it encourages an anywhere – anytime learning habit. It improves social interactions through social networks and enables a more personalized learning experience. Also, has made tremendous impact closing the gap between the so-called learning divide. On the other side, there are some negative aspects considering the difficulty to access an available network, the use of technology and the limitation of physical communication.

This outlook of mobile use and m-learning are quite promising. Taking advantage of just now and just for you specialized content every user/learner can easily access critical data that would take otherwise hours of search and major resources. From across the globe m-learning application developers are delivering innovative programs making informal learning a big challenge and rising the question if the informal learning can take on or even replace formal learning environments.

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