Understanding existing state of mobile learning from e-Learning perspectives:

Three cases

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Introduction:

Mobile technologies are increasing in not only number and variety (Al Saleh & Bhat, 2015), but also in capabilities. Most applications now go beyond basic communication functions and include high graphic cameras, sensors, GPS systems, as well as the numerous functions to enhance a user's activities (Chen, Seihamer, Bennett, & Bauer, 2015). But how do mobile technologies fit into the educational landscape? Although many educators see mobile devices as a distraction to students and a disruption to educational traditions; other instructors, as well as students and educational researchers see mobile technologies as effective tools for education (Oller, 2012). Mobile devices offer anytime and anywhere connection capabilities providing access to educational content. Mobile learning makes use of the many features of various mobile devices to extend education beyond the confines of a classroom in order to enhance or often to go beyond traditional educational content.

Background

There are varying definitions for mobile learning. Generally it can be defined as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (Crompton, 2013A, p. 83). Mobile devices are very popular, for example 86% of college students own a smart phone, but mobile learning is less prevalent (Chen et al., 2015). This is slowly beginning to change, as 52% of post-secondary faculty feel that mobile learning could benefit their courses (Dahlstrom & Bichsel, 2014); however, only 30% of instructors are incorporating mobile learning into their courses (Chen et al., 2015). For more a more widespread adoption of mobile

learning, continued improvements to infrastructure, as well as improved pedagogical support and policies are required (Chen et al., 2015).

The main benefit of mobile learning is the flexibility in terms of both time and space. Ninety percent of the world is now able to access mobile networks (Oller, 2012), allowing easier connections between learners and instructors and has the potential to revitalize and personalize educational interactions (Motiwalla, 2007). Learning can move beyond traditional spaces to create new learning opportunities for students across various locations to explore, find and share information. (Oller, 2012). Mobile devices also allow for a variety of interactions between learners and instructors, with many students finding it convenient to complete educational interactions during otherwise unproductive time such a time spent commuting. (Motiwalla, 2007). Additionally instructors may develop/create their own mobile learning experiences, or utilize the mobile components of established learning systems to complement current systems (Oller, 2012). Independent developers have increasing been addressing the educational area and creating applications for mobile devices. In 2011 for instance, 15 000 new applications were produced each week (Norris & Soloway, 2013).

Educational Theories and Mobile Learning

Mobile learning has achieved excellent results in improving communication and learning, helping learners to more fully connect with the learning process and involving them both intellectually and emotionally in their learning goals (Al Saleh & Bhat, 2015). Students are taking more responsibility for their learning goals by personalizing their mobile devices with alerts and communication tools (Motiwalla, 2007). Mobile devices can also promote seamless learning, by enabling the curious learner to access

information whenever and wherever they may be, allowing any location to become a learning space (Milrad et al., 2013). The mobility aspect allows learners to connect with different and changing environments (Crompton, 2013A).

Mobile learning works with many of the student centered learning theories that are becoming increasingly popular, including social constructivist theory, conversation theory, inquiry based learning, discovery method, connectivism, and activity theory, among others.

Social constructivist theory is based on Vygotsky's theories involving the zone of proximal development, which is the amount of understanding a student can gain under the guidance of a mentor. Mobile learning is extending the zone of proximal development in many directions, as it connects learners with mentors at the precise time that they are needed, as well as providing spaces for learners to become more autonomous (Hamm, Saltsman, Baldridge, & Perkins, 2013).

Much learning occurs through conversation, and conversation theory focuses on the two way conversations that occur between the learner and the instructor, as well as conversations between learners (Motiwalla, 2007). A mobile device increases the amount of conversations that can occur as it allows both synchronous and asynchronous forms of communication by giving students ownership of their learning by choosing how they wish to access these conversations (Crompton, 2013B).

Inquiry based learning works through exploration, with learners developing skills while gaining knowledge. By using mobile devices, learners can explore and work in a variety of different environments while communicating with peers and instructors.

Working in different environments allows learners to make connections between a variety of learning outcomes and investigative skills (Ahmed, 2014).

Similar to inquiry based learning, the discovery method encourages students to interact with situations and information to create their own understanding of the material (Ahmed, 2014). Mobile learning can provide the opportunity to experience new situations and provides easy access to information, using new technologies such as GPS networks and augmented reality applications which can enhance and change a learner's perception of the world (Lytridis & Tsinakos, 2014).

A more recent learning theory is connectivism, which examines how technology works with learning. The theory emphasises the non-linear process of knowledge acquisition and focuses on the linking of information and people. It is an important theory for mobile learning because it encourages students to learn how to navigate to and filter relevant information in order to obtain the appropriate information (Stoerger, 2013).

Finally, activity theory is focused on the actions of the learner. It has been split into two sections to reflect the influence of technology. There is the semiotic layer that examines the cultural tools needed for learning, as well as a technological layer examining how it works as an active part of the learning process (Crompton, 2013B). Mobile learning is an important technology to examine as part of this theory as it is both a technological and cultural tool.

There are a number of different frameworks that researchers are using to examine mobile learning and mobile technologies; however, there is no standard format for this analysis. One of the problems with defining a theory for mobile learning is the blurred

line between a mobile device as a learning tool and a mobile device for personal and social use; however, this ambiguity can also be used to capture the attention of learners by capturing their curiosity and interest (Crompton, 2013B). Overall, mobile learning operates where technology and pedagogy connect. In terms of technology, the mobile application should allow for the development of personalized learning experiences and support for learning. An application that enhances learning should be organized with a focus on learning goals. The learning experiences should be presented as a relevant problem or a challenge that can be solved through collaboration and based on the context of the information (Moura & Carvalho, 2013).

Being able to engage students and motivate their learning is one of the largest benefits of mobile learning. Activities can be individualized for each learner and can as well allow learners to personalize standard materials. The portable nature also increases context and enhances communication abilities (Moura & Carvalho, 2013). These benefits make mobile learning an exciting new educational tool.

Mobile Learning Applications

Three different mobile applications, in three different subject areas, are identified and examined according to how the technological and pedagogical domains operate and intersect.

iNaturalist

iNaturalist is a mobile application and website that lets every person contribute to a database of global biodiversity. It targets both professional biologists as well as amateurs interested in nature. Users create an account and upload photos with location

data to create a record of plants, animals, and even bacterium. So far, over 2,000,000 observations have been made worldwide covering over 80,000 different species. It was originally created as a collaborative master's project of a number of students in order to create a crowd sharing database for scientists to study biodiversity. iNaturalist uses creative commons and open source programs and initiatives (iNaturalist Network, 2015).

The iNaturalist application allows for personalization in a few ways. Firstly, a user can create projects or join projects and upload their individual observations. It allows users to search for species in a variety of ways. Users can search a list for specific species to learn more about them, or they can perform a location-based search either through a map or a list of observations that have been taken in that area. It makes use of a number of the technological developments including GPS location based services, high resolution cameras, and satellite imagery, as well as the all-important mobile factor.

This application works to create a community of learners by connecting people with a common interest in the natural environment around the world. Learners may submit questions to the iNaturalist community, which would function as a community of practice wishing to develop and share their knowledge of the natural world. There is an opportunity to collaborate on projects with other people, both in the virtual and real world. While it does not have any learning goals, such as you would find in a classroom based application, it does have a clearly stated purpose and has created a community of life-long learners to fulfill that purpose.

iNaturalist makes use of location based technologies to enhance peoples' experience of nature while also contributing to a global community. It presents an opportunity for

people to exercise their curiosity and learn about nature in non-traditional education spaces. Although this application does not work on developing any specific skills, it marshals the portability of a mobile device with an engaging activity and hence stimulating users to explore an area of interest beyond the traditional confines of an educational environment. The collaboration element allows people having similar interests to connect and share information from around the world.

StudyBlue

StudyBlue is a digital data base of content created by students and shared to help other students. Students can create their own study flashcards or use a series of cards created by others. There are currently 7 million people in the StudyBlue ecosystem who have created and shared over 250 million pieces of content. It is both a mobile application and a website. The program also connects to the popular note-taking website Evernote, allowing students to import Evernote content into flashcards and in turn export their flashcard sets back into Evernote. There are two levels of StudyBlue. A free level and a subscription level, which has no ads and unlimited borrowing from the library (StudyBlue, 2015).

StudyBlue allows users to find a series of flashcards in two ways, they can search by topic or though school and classes. They also can use a variety of tools and functionality to create their own series of flashcards, including video and audio. There are also three different ways the students can review the material, providing a multiplicity of choices for students to use the application. This increases the level of personalization for this piece of technology. The variety of available platforms allows students to access their study content from anywhere and at any time.

This designers of this application have worked to create an informal learning community of shared resources, although beyond sharing digital content it is not possible to connect with other users to ask questions or provide expertise. StudyBlue itself does not have any particular educational outcomes or learning goals but instead presents itself as a tool to be used by students in their pursuit of other more formal learning. While offering a variety of functionalities, StudyBlue does not provide any information on study techniques. Students may practice the study skills they already have but it is unlikely they will develop new study skills.

The main benefit of StudyBlue is its portability. Students have access to their study notes from their mobile device and can use traditional "dead time", such as travelling, to study or review material. They can obtain several classes worth of flashcards and keep them organized just by using their digital device. The mobile aspect and the functionality of the application works well in the technological domain of a mobile learning program; however, it does not fit well in the pedagogical domain. It does not provide any problem or challenge, the opportunity to gain new skills, or the creation of a community of learning. This application is a useful tool for learners to complement other learning endeavors.

Toronto in Time

Toronto in Time is an application that allows users explore the city of Toronto throughout time. The goal is to enable residents and visitors to learn more about the city. It is the second in the series created by James Marsh, editor in chief of The Canadian Encyclopedia, working in partnership with Historica, the Department of Canadian Heritage as well as many other similar organizations on a provincial and

municipal level. The application shares the history of Toronto by connecting locations and historical documents. Currently there are more than 150 sites around the city of Toronto that have content linked to this website and application (Toronto in Time, 2015).

This application allows users to explore the historical content of the city as well as harnessing the power of mobile devices to extend the user's understanding of their physical environment. A learner can look for information by theme or location, or follow a guided trail through a particular theme. This allows for a good degree of personalization by enabling a user at home or on the move to follow their curiosity and discover more about the city of Toronto. However, there is no direct opportunity for an individual to contribute to the information on the application, to do so the user would need to contact the creators directly to find out if they could contribute.

Within the application, each location contains details of the historical significance, including images with some image groups showing the difference between the past and the present. There are no specific objectives for a user to work towards, nor a problem or challenge for learners to solve, and there is no way for users to connect to each other in any form of community building. Toronto in Time is an individual experience which is not easily shared.

Toronto in Time uses the technology of mobile devices to allow users to understand more about the historical significance of their location and other historically relevant locations around the city. It is an excellent tool for people who are interested in learning about Canadian history because it goes beyond the traditional textbook or guide and presents information connecting with the present. However, it is only useful for exploration purposes as it does not present any form of learning goal or challenge, nor

does it allow interaction and collaboration between users. This application contains a lot of quality information, but despite its mobile component, the construction of knowledge is static.

Discussion

The three applications featured in the previous section illustrate some of the different types of mobile learning that is readily available to anyone with a mobile device. They all make use of anytime, anywhere learning, but each in a different way. iNaturalist connects people interested in observing the natural world in order to record their observations, StudyBlue lets learners make their school work more portable, and Toronto in Time gives users a link to the past from their location. Additionally, they all contain some element of personalization. Overall, all of these applications have done a good job of using of mobile technology to enhance their content.

In the pedagogical domain the applications fared less well as these applications are independent from any specific learning organization and therefore are simply resources for learners to use. While none of the applications gave learners a problem or challenge to be solved, iNaturalist does have its own organizational goals that each user contributes towards. Only iNaturalist has created an interactive community where users can interact and learn from each other through comments posted on observation posts. StudyBlue is easily linked to traditional education as it can be used independently by students wishing to organize their study materials digitally. While StudyBlue allows shared content between learners it does not provide any method for interactions between users. Similarly, Toronto in Time learners are isolated from each other and have no method of contact. The target user for Toronto in Time and

iNaturalist are people that are already interested in the subject and wish to explore the topic while enhancing their environment.

These three applications illustrate the benefits and challenges of designing educational mobile applications. While mobile devices make the technological features relativity easy to achieve, creating an application which is pedagogically sound and includes many best practices is more challenging. However, mobile learning does allow people the opportunity to augment their environment and explore their curiosity through anytime, anywhere accessibility. Applications can be personalized through different organizational paths allowing for an individualized experience.

Conclusion

Mobile devices are altering education, both within and beyond traditional classroom spaces. The location based services can enhance a student's environment, while connecting with informational content. Applications provide different organizational paths for personalization of learning materials. Good educational quality applications will also create a community of learning practice, where users can engage and collaborate with others on a similar learning journey. Mobile learning has the potential to change the educational landscape by taking education out of the classroom and into the real world.

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