Mobile learning for HIV/AIDS health care workers' training in resource-limited settings

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Abstract

This is a joint project from the Institute of Tropical Medicine in Antwerp, Belgium and the Institute of Tropical Medicine Alexander von Humboldt, Lima, Peru. We hereby present a mobile learning approach for health care workers' (HCWs) training using mobile phones as personal learning environments. Individual smartphones (Nokia N95 and iPhone) equipped with a portable solar charger were used by 20 physicians deployed in urban peripheral HIV/AIDS clinics in Peru, where almost 70% of the national HIV-patients in need, are on treatment. Learning activities based on learning theories and mobile functionality were embedded in the mobile project to enhance learning. Clinical modules were offered to the HCWs. A set of 3D learning scenarios simulating interactive clinical cases were developed and adapted to the smartphones for a continuing medical education program lasting 3 months. A mobile educational platform supporting learning events, could track participants' learning progresses over time. A discussion forum accessible via mobile could connect the participants to a group of HIV specialists available for the back-up of the medical information. Learning outcomes were verified through mobile quizzes using multiple choice questions at end of each module. In December 2009 a mid-term evaluation has been delivered looking at both technical feasibility and user's satisfaction, highlighting the technical challenges encountered using mobile devices for lifelong learning and the users' perception of the program. The challenges met during the project gave rise to discussions and future directions for research.

Keywords

mobile, HIV/AIDS, mobile learning, mLearning, health care workers, low resource settings.

1. INTRODUCTION

In order to enable HCWs involved in HIV/AIDS care in urban peripheral stations in Peru to access the state-of-the-art in HIV treatment and care, the Institute of Tropical Medicine Antwerp (ITMA) in Belgium and Institute of Tropical Medicine Alexander von Humboldt in Lima (ITMAvH) in Peru set up an educational mobile application in 2009, allowing knowledge sharing and data contribution through a mobile-based educational platform.

This paper gives an overview of the pedagogical approaches used in the project, as well as the technical methods and materials in an attempt to combine those two

2. PROBLEM

Health care workers (HCWs) have indicated the need for an autonomous mobile solution that would enable access to the latest medical information for continuing professional development using low cost devices and to exchange ideas about difficult clinical cases with peers through social media (Lindquist, Johansson, Petersson, Saveman & Nilsson, 2008 and Jham, Duraes, Strassler, & Sensi, 2008).

3. BACKGROUND

Looking at mobile learning in a wider context, we recognize that mobile, personal, and wireless devices are now radically transforming societal notions of discourse and knowledge, and are responsible for new forms of employment, language, commerce, as well as learning (Ally, 2009). The arrival of mobile and wireless technologies is also rapidly changing the access in low resource areas, where the mobile phone is set to play a major role in the stimulation of the information society in developing countries (Ford & Leinonen, 2006).

Mobile technologies fulfill the basic requirements needed to support contextual, life-long learning by virtue of its being highly portable, unobtrusive, and adaptable to the context of learning and the learners' evolving skills and knowledge (Sharples, 2000). Building on those two definitions Vavoula and Sharples (2002) suggested that there are three ways in which learning can be considered mobile: learning is mobile (1) in terms of space; (2) in different areas of life; and (3) with respect to time. These definitions suggest that mobile learning systems should be capable of delivering educational content to learners anytime and anywhere they need it. It is exactly this flexibility that fits the HCWs setting, for they need to be on the move most of the time, making both house calls and traveling to neighboring clinics.

4. PEDAGOGICAL APPROACH

While a more in-depth description of the used materials will be given later in the paper, an overall view of pedagogical approaches linked to the offered mobile content is given here.

3.1. Personal, authentic and contextualized content

Mayes and de Freitas (2007) noted that "underlying both the situated learning and constructivist perspectives is the assumption that learning must be personally meaningful, and that this has very little to do with the informational characteristics of a learning environment" (p. 18). By delivering mobile content that was of immediate relevance to the HCWs professional demands, the delivered materials motivated the HCWs to go through them.

The content of the different clinical modules for this mobile project was based on actual real life examples, adding to the authenticity of the learning material. Helen Beetham (2007) wrote clearly on the authenticity of the activity: "Apprenticeship and work-based learning depend on activities arising 'naturally' from a highly authentic context (situative learning)" (p. 27).

We wanted to build further on this by adding the possibility for the learners themselves to exchange cases through their mobile. By allowing content to be put forward by the learners via Facebook, skype or the discussion forums, it contextualized the case studies that were exchanged between all the learners. For as Sharpe and Oliver (2007) wrote "practitioners continue to favour interventions that are contextualized for them;… allow practitioners to work on their own real-life issues; and take account of the language, values, culture and priorities of their particular community" (p. 123). The fact that this case study gave the students the possibility to link the content to an environment that was relevant to them increased the chances of enhancing their learning process.

3.2. Problem based learning and peer-to-peer exchange

The cases put forward to the learners pushed them into solving real life examples that were relevant to their professional setting. Problem based learning is becoming increasingly important as it fits the constructivist learning theory model and enables a more thorough understanding of the content that is discussed. The problem based learning was learner-centered as the HCWs were asked to put their own cases up to be discussed with their peer learners by using the mix of mobile tools that were offered to them.

Peer-to-peer knowledge exchange is an extra asset to mLearning, which is promoted by the affordance of mobile devices, as one of their primary functions is communication. Communication through mobile phones has a low threshold for learners, which makes it an easy peer-to-peer exchange tool, but with smartphones an added communication channel could be added: social mobile media. Peer-to-peer knowledge exchange was one of the overall logic to obtain the learning objectives, as this enables the learners to build on their own experience and knowledge. This peer-to-peer dynamic was made possible by using different social media software's (Facebook, skype), but also the discussion forums inside the mobile Moodle learning platform.

The use of Facebook enabled a swift exchange of ideas. A Reach learner group was built inside Facebook. Skype was used to enhance peer-to-peer phone discussions and learner-tutor communication.

3.3. Attention to diversity in content imagery

Sharpe and Oliver (2007) pointed out that "Activity, motivation and learning are all related to a need for a positive sense of identity, shaped by social forces" (p. 18). Taking this into account the mobile animations and scripts offered in the course were screened to offer a more diverse imagery in the course. Mobile courses have grown in the past few years. Research has pointed out that context and identity are important motivational factors in mobile learning (Sharples, 2006). Gender and ethnicity are part of both context and identity of the learner.

The social cognitive perspective in teaching and learning emphasizes the importance that social interaction plays in contributing to motivational outcomes such as learner self-efficacy and self-regulation. According to Bandura (1997), attribute similarities between a social model and a learner, such as gender, ethnicity, and competency, often have predictive significance for the learner's efficacy beliefs and achievements (Bayler & Kim , 2004).

Interactive multimedia instructional design is anchored in culture through various world views, selective instructional design paradigms, and learning theories. As such, it is culturally contextualized (Henderson, 1996). Having proactive instructional design is particularly significant for learners who belong to cultures that are situated in an unequal relationship (Henderson, 1996). In order to be inclusive, a balanced presentation of diverse human groups is required, for example men and women, people with different ethnic and cultural backgrounds or religions, etc. (de Waard & Zolfo, 2008). The same argument is made with respect to digital educational materials. Analyses, however, show that such a balanced representation is not always provided (Heemskerk, Brink, Volman & ten Dam, 2005)

In the animations that were used for the clinical modules on the mobile devices, a balanced ethnic and cultural mix was taken into account, with the goal to address a more varied learner audience, that would as such feel that the content appeals to their identity.

The above paragraph shows how the learning activities that were put into the course had pedagogical relevance, as well as technological affordances. Now let's go into detail and look at all the specific parts of the course connected to the mobile devices that were used.

5. TECHNICAL MATERIALS & METHODS

Out of 24 Peruvian Department Capitals, 20 were already involved with the Institute Y in a distance learning project, which started in 2004 having as aim the scaling up access to antiretroviral treatment in the Peruvian peripheral regions. These 20 facilities were included in the mLearning pilot project. The health centres in the Department Capitals are run by medical doctors and staffed with 5-10 health care workers as social workers, counsellors, and data clerks. Individual Smartphone's (10 Nokia N95 and 10 iPhone) equipped with a portable solar charger were delivered to the 20 physicians based in the peripheral HIV centres.

A router connected to a DSL or cable modem, available in all stations, allowed wireless connection, facilitating the surfing and the download of the didactic material in any place of the clinic, guaranteeing at same time wire-free

interactions, without the need of participants to purchase a complete computer to connect and reducing the cost of communications, using Skype via mobiles (Figure 1).

Figure 1: Smartphones: Nokia N95 and iPhone

The training program was composed by a set of 'clinical modules' simulating interactive clinical cases which were adapted to mobile devices and sent to the physicians working in the 20 Peruvian HIV peripheral clinical stations. The whole case series involved 5 different topic areas, the most common being the use of new drugs for HIV/AIDS treatment, their safety and side effect profile; the mLearning program was delivered during the months November 2009-January 2010.

Figure 2: Example of 3D animation

The didactic material was developed with 3D animations using iClone and Moviestorm, reproducing specific scenarios (e.g., clinical consultation) (Figure 2) and each module revision was provided through multimedia files (developed with screenflow which enables starting from power points to add to the screen shots audio and video, publishing everything in a mobile accessible format).

Learning outcomes of the acquired knowledge were tested through mobile-based multiple choice questions issued at beginning and at end of each module (Figure 3).

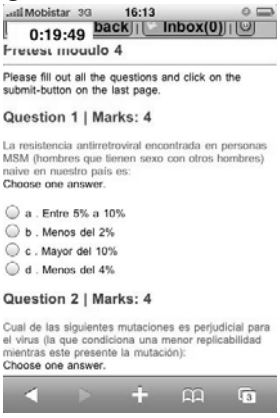

Figure 3: Example of a post-test

A functional mobile platform (MLE Moodle) was offered to support the learning events, tracking students' progresses over time. The platform also provided access to Facebook for peer-to-peer learning sharing on clinical cases discussion within a network of experts, which assured feedback content quality. The suggested readings were distributed along the timeframe of the 2-week clinical module discussion mainly as Pdf format, using Google docs (Figure 4).

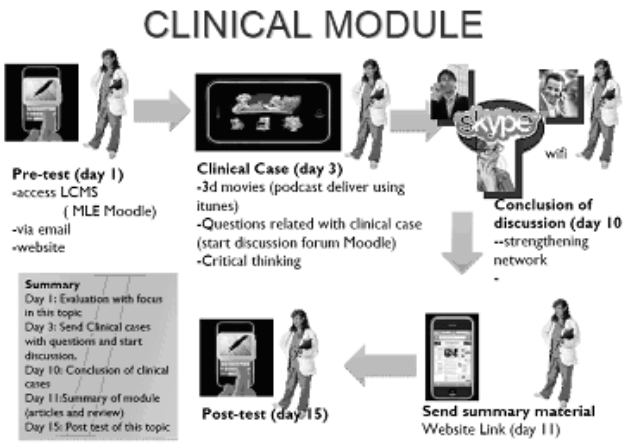

Figure 4: Clinical module: flow

6. LEARNER EXPERIENCE RESULTS

A mid-term users' satisfaction survey delivered through a standardized anonymous questionnaire, coupled by a focus group discussion, was performed in December 2009.

The users' satisfaction surveys sought to gain feedback on quality of the tutorials, usefulness of the information, applicability to the daily context of HIV treatment and care; the focus group discussion sought to identify general barriers to the program adherence; the help desk interview gave information about the technical difficulties encountered in implementing the program.

Out of 20 participants, 18 returned the standardized questionnaires (response rate of 90%); the participants' median age was 48,5 years (range, 34 - 55 years), with a median of 6 years experience in treating HIV patients. Most of the participants had no prior mobile learning experience and their social media literacy was also limited (Figure 5).

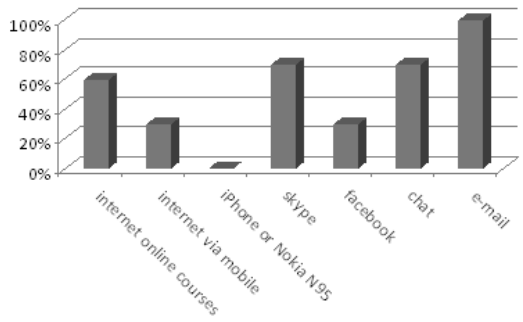

Figure 5: Participants' previous computer use

Over half of the iPhone users, 66,67%, indicated that Skype was easy to access compared to the 22,2% using

the Nokia N95; 88,9% of the iPhone respondents found easy to access Facebook via mobile compared to the 44,4% using Nokia N95. The results indicated similar usability of iPhone and Nokia N95 (88,9% and 87,5% respectively) for the download of podcasts and access to MLE Moodle for pre- and post-test.

The freedom of planning the educational activities according to the user' personal agenda was indicated as an added value by 86,6 % of the participants; the access to the educational content without needing a computer, by 94,4%. All respondents had positive opinions about the quality of the received information, the applicability of the content to the clinical practice and the appropriate relevance of the suggested readings.

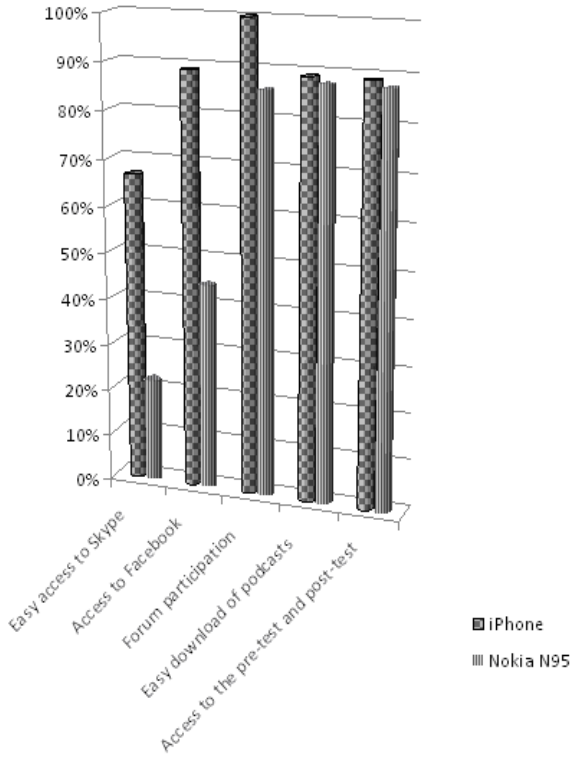

Figure 6: Use of applications according to mobile device

The main advantages indicated by the participants during the focus group discussion were the portability of the equipment and easy access to the educational content at own space and time. Some of the Nokia N95 users pointed as problematic the screen size of the equipment, the keyboard size and the quality of the images. The topics covered by the program have been graded as pertinent to the daily clinical practice and very well thought by the participants.

7. DISCUSSION AND FUTURE RESEARCH

7.1. Peer learning in access challenged regions

Many developing countries would move towards the use of distance learning programs avoiding peripheral health stations being left unmanned, because of HCWs moving out for short or long training programs (Lester & Karanja, 2008). As Peru is a developing country, there is limited access to information and teaching resources and a great need to enhance learning and teaching environments: mobile phones can create an inexpensive, reliable, learning environment between health care workers in a 'one-to-one personal learning' and between colleagues in a network. Some of the mobile devices are relatively low-cost, powerful, small and lightweight, and they can well perform in difficult environments because of very little power required for the internal battery, which can be recharged using inexpensive solar panels (Kneebone, Bello, Nestel, Mooney, Codling, Yadollahi, Tierney, Wilcockson, & Darzi, 2008).

However, by using smartphones (with solar panels) as a means to keep peers up-to-date on the latest medical education, there is a risk that less financially strong HCWs will not have access to this means of learning due to the cost of the hardware. This might result in an extra digital divide.

7.2 Time investment challenge

Although mLearning is applauded for its capacity to offer learning where no learning could take place before, the time investment necessary to allow the learners to truly dedicate themselves to the provided courses or materials is often overlooked. This was also the case in this project. The HCWs participating in this project were not given extra time to dedicate themselves to the training workload. The learning came on top of their work. Although learners were willing to go all the way with this project, one can doubt the long-term feasibility of mLearning that will always be on top of the workload. For it is not because mLearning can be done at anytime, anyplace and anywhere, that this implies that no extra time should be made available.

7.3. Enhancing mobile tech literacy

HCWs can learn how to use mobile devices, how to search for information, how to upload and download information in a relatively short time frame, i.e. one day of intense training and a helpdesk available if needed. The use of Smartphones enables users to upload and download information using the wireless capacity. The Smartphone can be very useful in distance learning giving to the users the opportunity to contact their mentor by phone, receiving immediately feedback and helping to establish a network (Krishna, Boren & Balas, 2009 and Prgomet, Georgiou & Westbrook, 2009).

The unique future of this project is that the skills the healthcare providers acquired with mobile technology are easily and effectively transferred to other areas of their lives (from acquired knowledge to computer literacy, with impact on digital divide) through the implementation of learning theories related and functional in a mobile learning environment.

Although the increased mobile literacy seems to be a good thing, the mobile literacy should be taught in such a way that it is generic no matter which future mobile devices will be used.

7.4. Age and digital literacy

An interesting fact of this project was that the average age of the participants was 48,5 years old. Looking back, it would have been interesting to see where the learners could be situated in Rogers' (1960) Technology curve to understand whether the success of the learning outcomes could (in part) be linked to a certain level of technological preference of the participants of this project. This can be

done taken into account research done by Bristow (2009) on technology innovations as specific domains of interest comparing the concept with the basic characteristics of digital natives and immigrants.

7.5. Ethics of mobile devices

While providing the learner group with expensive smartphones, some ethical considerations came to mind: can research promote a specific mobile device and push it onto a population that has considerable financial limitations? How sustainable are projects that rely on expensive equipment in low resource areas? How does sharing patient information through mobile devices (camera's, open discussions) comply with patient privacy issues? Especially when taken into account the data dispersal of social media software (e.g. Facebook data)? The ethical aspect of any social media based mobile project reaches beyond the local context, but has global implications. Although we did discuss patient privacy, user consent, and we assured sustainability and follow-up, we were not taken into account all the ethical implications of a mobile project (Facebook, sharing information issues). Ethics in mLearning projects should be researched more extensively in the future to create a generic ethical framework for technology in learning.

8. CONCLUSION

With mobile devices the learning environment is enhanced and ability to share knowledge through online discussion is strengthened through social media or directly on phone line. The sharing of experiences in a network facilitates the transformation of learning outcomes into permanent and valuable knowledge assets.

The results show that the delivery of up-to-date modules on comprehensive treatment and care of people can be contextualized and customized to mobile devices. Particular attention should be given to the adaptation of the educational material to the small screen size, time restraints, local technological reality, ethics, and to the performance of the program development in the different operating systems.

9. ACKNOWLEDGEMENTS

This project was the result of a collaborative work of the complete eLearning teams at ITMA and ITMAvH. This project is supported by REACH-Tibotec 2008 Educational Grant. This was a team work with major input from Carlos Kiyan, Maria Zolfo, Inge de Waard and Lut Lynen from ITM and Beto Castillo Llaque, Luis Fucay, David Iglesias, Victor Suarez, Juan Echevarria, Ellar Llacsahuanga from ITMAvH.

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