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Methods of adapting digital content for the learning process via mobile devices

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Abstract

This article analyses different methods of adapting digital content for its delivery via mobile devices taking into account two aspects which are a fundamental part of the learning process; on the one hand, functionality of the contents, and on the other, the actual controlled navigation requirements that the learner needs in order to acquire high level knowledge.

Currently the existing development processes consist of adapting content ad-hoc considering the device's special technical features and the programming language which has been used.

Designers and programmers pay special attention to the increasing need of implementing and going about the creation process in a systematic way. This obviously leads to a growing need to establish reference marks that will allow us to compare these different methods of creation.

The development and adaptation of digital content and navigability and the impact on the user is a point of departure for future research. Its function would be to determine effectively whether this learning process is viable or not.

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1. Introduction

Currently the fast development of the information and communication technology, and especially the new technological devices have permitted new ways of e-learning. One example is the m-learning, which unifies communication and mobility. The skilful use that students make of this type of technology has increased the interest of the educative community with regard to the development of oriented content. The objective would be to take advantage of all the possibilities offered by this new way of communication.

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The methods of creation, adaptation and implementation for the delivery of educative, informative or divulging online content via mobile devices are immersed in a continuous phase of development and evolution. But we could affirm that among the different current mobile devices, we cannot find a validated process which would permit us to have an adequate reference mark. The existing reference marks are normally a result of the adaptation of the desktop web content, with the intention of obtaining formats which respect certain aesthetic criteria that are compatible with the technology used for mobile devices. The main point is the source code adjustment, almost ignoring the adaptation of content.

With regard to the level of administration of formative content, the most frequent use by university students consists of the reception of data. The information can be complex when processed through the small screens of the mobile devices.

The reduced size of the screen of this kind of devices makes some people doubt about their efficacy for the purposes of high level formation, which are parallel to the e-learning methods. Avgeriou (Avgeriou, 2003) highlighted the students' ability to introduce long texts in this kind of devices. They are able to take notes and respond to essay questions despite the existing inconvenient, as revealed by the study titled "Mobile Technologies and its impact – an analysis in higher education context", which deals with the analysis of the m-learning students' perception (Seibu Mary Jacob y Biju Isaac, 2008). Learning via mobile devices is widely accepted by the student community. Students are interested in using all the available m-learning resources through portable computers, palms, mobile phones, and PDAs in order to get access to information anytime and anywhere. They also recognize that the access to information via PDA or mobile phones is more complicated due to the small size of the screens, as Avgeriou mentioned (Avgeriou, 2003). This is the main inconvenient of this type of devices, but they also present some advantages in relation to mobility and size which are very characteristic of the mobile technology (admitting that the fast technologic evolution would result into new devices which would overcome them soon). These limitations do not affect the general interest in using both the e-learning and m-learning methods in a parallel way, taking advantage of their mutual positive contribution.

That is why it is necessary to overcome possible technical problems and recycle the existing educative material for its adaptation for mobile devices, which would permit the exchange among platforms.

2. Advantages of using mobile devices for learning.

Seibu (Seibu Mary Jacob 2008) establishes the following classification of advantages focused on higher education:

- Easy access: free available knowledge with updated information. Immediate access to learning materials anywhere.
- Self-study options: The m-learning flexibility permits to study anytime and change the level of learning intensity in each particular case (even more freedom of action than using a desktop PC).
- Evaluation and feedback: the m-learning devices can include some evaluative tools in order to control the student' s progress, even create detailed reports. That permits to know what students have learnt during the course, how the course is developing and how the student improves. We obtain information about the benefits for the learning process.
- Access to diverse online materials: An m-learning system permits a continuous interaction between teachers and students. Students have access to the course material and to digital online libraries which are useful to face their tasks and exams. It is a clearly beneficial aspect for learning.

Seibu Mary describes several advantages of the m-learning methods, adding some connotations which are valued positively by the student community, a point which permits to obtain better final results, as it was affirmed by García Laborda and Bejarano (García Laborda y Bejarano 2005).

Currently it is difficult to find a student without a mobile phone, PDA or any other multimedia device. The mobile technology has widely spread and devices which permit the execution of complex operations are offered at all prices. This fact has increased the demand of new specific services. But, how can we develop new applications focused on learning via mobile devices? Which are our tools to develop these learning applications ?.

3. Applications for mobile devices

Currently, apart from Windows Mobile (Microsoft Corporation, 2008), the development of applications for mobile devices is controlled by three principal platforms: C++, J2ME, and Flash Lite. Obviously, each of them shows some advantages and disadvantages.

C++ is seen as probably the most powerful, but also as the most complex by any programmer. Very specialised programmers are required and the language does not permit the development of fast applications. The projects which are developed through C++ are usually expensive.

Java ME (J2ME) is probably the most common platform for the development of mobile devices today. But, it is almost impossible to offer a program through J2ME guaranteeing its perfect working without having previously downloaded a profile. The profile consists of a series of courses, libraries and APIs which complete the device configuration. Some of these added functionalities can be communications, the graphic interface or the permanent data storage.

Flash Lite: the development process is much simpler and faster if compared with any other application. This permits the quick creation of easy applications with some of the best possible results. We do not need to pay attention to profiles or configurations. What is developed can be used by all the Flash Lite devices (we have to bear in mind that there can be different screen sizes).

The commercial achievements of Flash Lite and the advantages that it offers has made Sony Ericsson work in the Capuchin project. This is an open source project, which means that it will not be a Sony Ericsson's exclusive, permitting its use by other models or makers. The project consists of creating a bridge between Flash Lite and J2ME, which would permit an asynchronous communication and additional capacities for J2ME terminals or the possibility for J2ME applications to have a user Flash Lite interface, as it is based on a bi-directional communication between both applications. Andy Patricio reports about the presentation of this innovation in June 2009 in JavaOne .

One of the principal objectives when designing applications should be the consecution of intuitive and easy to use interfaces. In the case of mobile devices, this is a very important goal. The usability of this kind of devices is a key issue for its commercial success. Jacob Nielsen (2006) affirms: "Usability is a quality attribute relating to how easy something is to use. More specifically, it refers to how quickly people can learn to use something, how efficient they are while using it, how memorable it is, how error-prone it is, and how much more users like using it. If people can't or won't use a feature, it might as well not exist."

The design of qualitative user interfaces is very complicated. If we had to summarize all the difficulties and express only one, we could say that we, people, are a problem. We can mention some of our limitations: we get distracted easily, our sight sense is not very sharp, the degree of eye/hand coordination can vary enormously depending on the user, etc.

"Context" is another important concept when designing interfaces for mobile devices. The context of use of an application and how we interact with it are key issues. A good design would imply a previous analysis of these concepts. When these context notions are explored, we see how different the design of the interface can be in the case of a mobile device or its desktop equivalent.

4. Creation of optimized content for mobile phones

It is fundamental to know which the basic methods of adapting content from e-learning to m-learning are before using textual or audiovisual content in a test or exercise which has been adapted for the students' m-learning environment (Cameron Moll, 2008). These methods are mainly focused on the aesthetical aspect, but there are others which value aspects which are inherent to mobility, as it is the context, the content and the user' concrete needs when using these mobile devices. Moll proposes four basic methods of adapting content. We will notice the advantages and disadvantages of using it in an educative context.

4.1 Doing nothing special

In this way, the content of our web can be shown via mobile devices. It may seem bizarre, but it is a likely solution, though not the most recommendable one. This view is viable if we pay attention to the following reasons.

On the first hand, if the structural code of the page consists of a language of labels which are meaningful and based on standards, some of the best navigators used for mobile platforms are prepared to redesign the sites while working in order to adapt them to the requirements of the small mobile screens simultaneously.

It is not recommendable to present a web site by just reducing its size. We would need an organized distribution and an optimization of images in order to present content more effectively. It shows the spatial adaptation of content carried out by the navigator.

Secondly, devices such as the iPhone, whose navigators are able to zoom and expand the content size (capacity to see a web page by expanding or reducing the view) include a site map which permits the visualization of a whole web site as it would be seen in a PC screen.

The non-modification of the content for its delivery via mobile devices is only accepted if it can be visualized correctly through adapted navigators. The objective would be make the users feel no-difference if they compare with its delivery via computer desktops.

4.2 Modification of the design style and optimization of the images

Most of the available devices are able to work with HTML and also with WML. These languages are based on an implicit hierarchy of marks so that navigators can interpret the content. Adapting the design for mobile devices implies synthesizing the design and reducing the images in order to adapt the file. The superfluous data can be deleted in order to reduce the file total size and the content style to the minimum.

There are several available resources which permit the user to eliminate all these style marks automatically. The most recent resource for the final user is Mowser (<http://mowser.com>), developed by Yahoo Mobile Russell Beattie. The user just types the web address and Mowser shows the site with the pages adapted, formatted and structured for its delivery via mobile devices, with the correspondent suppression of useless marks. Skweezer.net (<http://www.skweezer.net>) is another pioneering web service for mobile phones which was developed by Greenlight Wireless Corporation and works from the year 2001. Thought this may seem an attractive method due to its easy application, it would not fit our context conditions. Besides, the file size can be excessive because of the size of the content itself. The large size of the file usually results into a page with a very long scroll bar. To be honest, it is not logical to spend resources for the development of this method so as users can reduce the images and the design style through its mobile navigator automatically.

4.3 The use of style sheets

The use of style sheets (CSS) has always been seen as the most useful way to adapt content for its delivery via mobile Web. CSS are inherent to the mobile Web. Following this method, it is just necessary to add an extra style sheet and introduce several code lines for its application. Just one web address is required.: `<link href="moviles.css" rel="stylesheet" type="text/css" media="handheld" />`

Those who know how XHTML and CSS work, know about the flexibility and control when using these style sheets. As we mentioned before, we could get the content of the site adapted for mobile devices by using just one CSS style sheet and adding a couple of line marks. But we must also take into account several problematic issues. Not all the available mobile devices work with this type of attributes, and this sometimes makes them be ignored. Even in the case of those devices which are able to work with them, the user's data can be excessive because of the content which cannot be visualized despite of being also downloaded.

The most important issue is that style sheets are mainly focused on the aesthetical aspect and not on the context. It pays little attention to the content, a crucial aspect in the mobile navigation field.

4.4 The creation of optimized content for mobile phones

As we have seen before, all the previous methods are focused on the aesthetical aspect, paying little attention to the inherent aspects of mobility, context, content, and the users' specific needs when working with these mobile devices. This last method deals with the adaptation process by considering two main issues: first, how we accede to content and second, the priority of content over aesthetics, of function over form. This method pays attention to the inner features of mobile devices and not so much to the characteristics of the desktop web. We get optimized pages

which are faster and save a great part of the useless data. The final result and experience are very pleasant and enriching. But this method is also criticized because it is necessary to create an alternative web with a different address. That means extra work for those who would be responsible for the maintenance of two different sites. This conflict is also mentioned in an article by Jo Rabin, considering two different options: the unified web defended by W3C and the mobile web.

5. Conclusion

The development of content for m-learning platforms is seen as an evident advantage for the student community. Despite some possible restrictions, it permits a personalized learning process for each student, having access to it anytime and anywhere. The methods for the creation, adaptation and implementation of educative or informative materials is always evolving. Currently the lack of a totally validated process does not permit to have reference marks in relation to mobile devices.

The available technologies for the development of m-learning platforms are J2ME and Flash Lite. J2ME has permitted the programmers a quick adaptation to these new possibilities. Flash Lite is able to develop simple applications in a brief period of time and its final graphic results are not easily achieved by its competitors. Sony Ericsson is developing the Capuchin project as an attempt to unify the best aspects of J2ME and Flash Lite.

When adapting the existing content from e-learning to m-learning, the problem arises when trying to find a way for the adaptation of this content to the demands of this new technology. The adaptation of these new formats usually consists of a basic transcription of the source code, not paying attention to the adaptation of the content relative to the context.

We defend the creation of optimized content, paying special attention to the adaptation of content, but also taking care of the aesthetic aspects. An intuitive and easy to use interface would be the best option if we think of the human-system interaction. Usability is seen as a key factor in order to succeed when learning via mobile devices.

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