USER-CENTERED DESIGN IN MOODLE REDESIGN FOR MOBILE USE

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Abstract

This article addresses the issue of improving user experience while redesigning Moodle for mobile use. We propose to use UCD for redesign along with usability guidelines, visual design and mobile web best practices. Students were asked to participate in a questionnaire aimed to gather their experience as a Moodle user. Questionnaire results allows us to validate the relevance of Moodle redesign for mobile devices. We conducted a usability test. Usability testing revealed that desktop version of Moodle present several problems related to visual design, accessibility, information architecture, navigation, simplicity and consistency. We propose to document the concrete design criteria, navigation map, and specifications for the mobile version of Moodle. These documents allowed the programmer to implement Moodle for mobile use. Our finding is that using UCD

along with usability guidelines, visual design and mobile web practices we can improve user experience.

Palabra(s) Clave(s): Mobile application, Moodle, User-centered design.

1. Introduction

User-centered design (UCD) is a software design methodology where designers and users collaborate actively throughout the software development process. Users drive the design and are the key to determine the usability of a product (e.g. application or web site). User-centered design methodology is divided into four phases that operate iteratively: analysis, design, construction and evaluation. Analysis is the initial phase where the users context is studied. Design is where user requirements are transformed into design proposals. Construction phase involves the building of the application that meets users requirements. Evaluation phase has as a primary function to ensure that the system developed meets user needs [1].

UCD has been used to design user-friendly Web systems. According to Nielsen [2] usability "addresses the Web and determine the success or failure of a site". A usable web site means that it is useful, easy to use, easy to understand, easy to learn and easy to appreciate.

Accessibility, information architecture, navigation, simplicity and consistency are **usability guidelines** that support the construction of usable Web sites. Accessibility refers to the possibility for users to easily find and access information. Accessibility is also related to the downloading time, so in the design is important to take into account Internet connection speeds from which users connect. Information architecture is the organization of Web site content, so the user can get the information he wants with the fewest steps. Lynch and Horton [3] suggest to organize the site in such a form that will not be more than three steps to reach information and that menus do not include more than seven links to the different sections of the site. Navigation allows the user to move from one page to another within a website. A clear and consistent navigation helps to maintain user orientation within the site and reduces search times (Lynch and Horton [3], p. 30).

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Simplicity and consistency involves the use of clear graphics, simple and well related to the action to be performed, so that the user can easily interact with the site. In addition, consistency in design also involves maintaining visual consistency and organizational throughout the entire site, which helps the user to become familiar with the site, to feel comfortable and confident that he will find what he wants.

Moreover, **visual design elements** such as grid, color, typography and graphics are the basic building blocks of visual composition; therefore, they support the construction of usable Web sites [2]. A grid is not visible element in the web design that helps to align text and page images to give visual balance and order. The consistency of a design generated from a grid facilitates navigation and understanding of the information presented. Grids helps to give visual order and hierarchy to the information displayed on the screen [3].

In addition to the basic elements of visual design, the W3C group has proposed **general recommendations for building web sites or web applications** to display properly on mobile devices [4].

UCD has mainly been applied for the design of new products. However, UCD has successfully been employed to improve the redesign of an existing product [5]. This work is about the redesign of Moodle for mobile use. Moodle, an acronym from Modular Object-Oriented Dynamic Learning Environment, is one of the most used learning platforms worldwide. Moodle has different modules to manage a course, e.g. calendar, participants, forums, blogs, wikis, chat and tasks [6]. In this redesign we apply UCD along with usability guidelines, visual composition and mobile web best practices.

We have found several projects that propose a mobile version of a learning management system. Those projects can be classified into open-source and proprietary. Some open-source systems are: Mobile Learning Engine Moodle (MLE Moodle) [7], ATutor [8] with a mobile theme, and Moodle Mobile [9]. Some proprietary systems are: BSCW [10] and Blackboard [11]. We have not found information that would allow us to know if they have applied UCD for their proposals; but we performed an analysis of their interfaces.

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ATutor, Moodle Mobile, BSCW and Blackboard employ one-column and two-column pages; however, MLE Moodle only uses one-column pages, making navigation and organization difficult. BSCW, Blackboard, and Moodle Mobile display a back button to return to previous page; but there is not a navigation bar to allow the user to know where he is located. Finally, only MLE Moodle and BSCW display a home button to easy access other sections.

2. Development (method)

Participants

We conducted a UCD study with students at the Universidad Autónoma Metropolitana, Azcapotzalco campus. 137 students enrolled in Moodle courses took part in the study. These students were selected randomly from 1404 Moodle students. Participants are smartphones users.

Materials

Students were asked to participate in a questionnaire aimed to gather their experience as a Moodle user. In particular, the aspects we collect from the survey were aimed at understanding students' perception about Moodle, if Moodle is a convenient tool to support courses, if Moodle is easy to use, if its design is attractive, student working environment, file formats commonly used, information consulted in their courses, activities most frequently performed in their courses, and their disposition to use a mobile device to access Moodle.

In order to find out usability problems in the desktop version of Moodle, we access to the "Taller de diseño" course from a smartphone.

Procedure

When participants accepted the invitation to take part in this study, they were given a URL to answer the questionnaire. They completed the questionnaire in their own time and working environment.

Questionnaires allows us to gather user context. To complete the analysis, we performed a usability test to the desktop version of Moodle. Usability testing seek

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to find out problems related to visual design, accessibility, information architecture, navigation, simplicity and consistency.

In the design phase, we proposed a set of concrete design criteria, navigation map, and specifications for the mobile version of Moodle. This proposal took into account usability guidelines, visual design as well as mobile web best practices.

In the construction phase, a programmer implemented the mobile version of Moodle according to the documents constructed in the design phase. The programming language was PHP and was implemented as an extension of the desktop version.

Finally, in the evaluation phase, the programmer runs performance tests.

3. Results

Analysis phase

Users context

Questionnaire results indicate that 69% of students accessed Moodle from school, 86% agree that Moodle supports classroom education, 91% would like to access Moodle from a mobile device and 63% use their mobile device to access Moodle daily or 2 or 3 times a week (table 1).

Table 1 Moodle usage.

Rate	Observed variable
69 %	Access Moodle from school
86 %	Consider that Moodle supports classroom education
82 %	Consider that Moodle provides information of interest
73 %	Can easily contact classmates in Moodle
74 %	Like to use Moodle
91 %	Consult assessments and exercises in Moodle
76 %	Look up learning resources in Moodle

The questionnaire allows us to validate that Moodle redesign for mobile devices is relevant since most of the students believe that Moodle is an application that supports classroom education and would like to access from a mobile device.

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Usability testing

Usability testing revealed that desktop version of Moodle present several problems related to visual design, accessibility, information architecture, navigation, simplicity and consistency as it is shown in figure 1, when accessing the home page.

Figure 1 Desktop version of Moodle, using a smartphone.

We can observe in figure 1 that there are very few elements that can be seen, forcing the user to use the vertical and horizontal scroll bars. We highlighted that UAM logo, visitor status and navigation breadcrumbs were always present on the pages. Moreover, wine and gray colors predominate as they are part of the institutional colors. Table 2 summarizes Moodle usability test.

Table 2 Moodle usability test.

Guideline	Analysis
Accessibility	**Difficulty to find information.**
Information architecture	**Just a part of the content is seen, user is forced to use vertical and horizontal bars**
Navigation	**Logo, visitor status and navigation breadcrumbs are always present on the pages**
Simplicity and consistency	*Color*: **institutional colors are used consistently.** *Typography*: **Font type Verdana and Arial are used for readability on screen.** *Graphics*: **Not all graphic elements are linked to the action to be performed.**

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Design phase

In this part, we present the concrete design criteria, navigation map, and specifications for the mobile version of Moodle. This proposal considered usability guidelines, visual design as well as mobile web best practices.

Concrete design criteria

To solve usability problems revealed in usability testing, we proposed a set of concrete design criteria for the mobile version of Moodle (table 3).

Table 3 Design criteria for the mobile version of Moodle.

Guideline	Design criteria
Accessibility	Concise text with three screens maximum.
Information architecture	Three levels to reach a Moodle element.
Navigation	Breadcrumbs at the top of each screen and a secondary navigation bar, icon based.
Simplicity and consistency	Grids with one, two or three columns and a variable number of rows. Different colors to distinguish each category and item. Graphics up 20 kb

Navigation map

We proposed a navigation map (figure 2). Note that no more than three steps are used to reach a course element. Navigation starts at AULA VIRTUAL home page, where access is permitted to users. First level corresponds to the academic divisions (CBI, CSH, CyAD and Posgrado CyAD). Second level corresponds to the course (TEMAS SELECTOS 5, SEMINARIO DE DISEÑO, and TALLER DE DISEÑO). Third level corresponds to activities or resources (e.g. assignments, participants, calendar).

Specifications

We proposed a set of specifications about layout, graphics size, typography and color for each page type for the mobile version of Moodle. figure 3 shows the specifications for the home page (named "Aula Virtual" in navigation map), figure 4 shows the specifications for the course page, figure 5 shows the specifications for

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the one-column pages, and finally figure 6 shows the specifications for the two-columns pages.
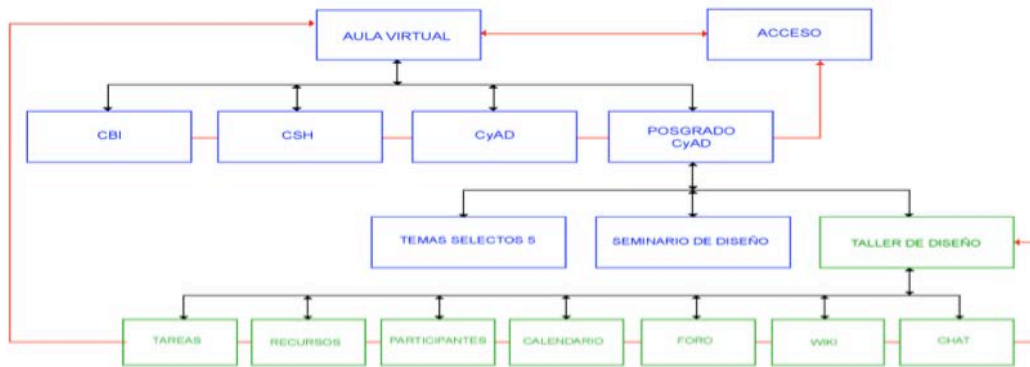

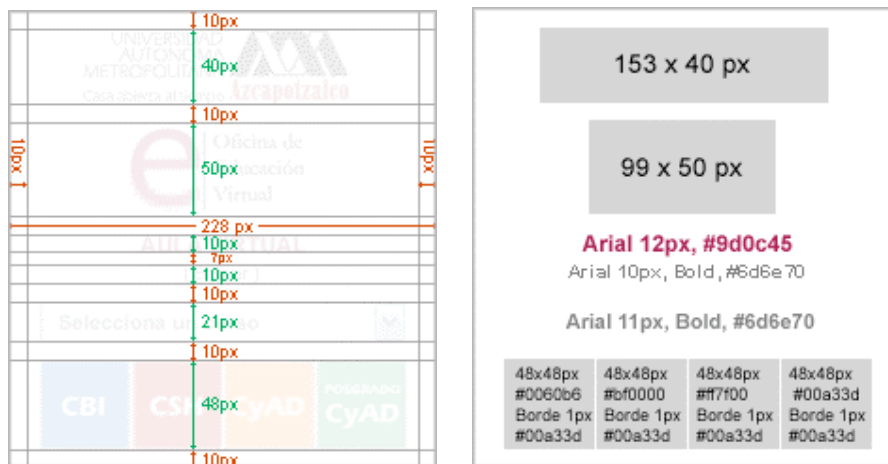Figure 2 Navigation map for the mobile version of Moodle.

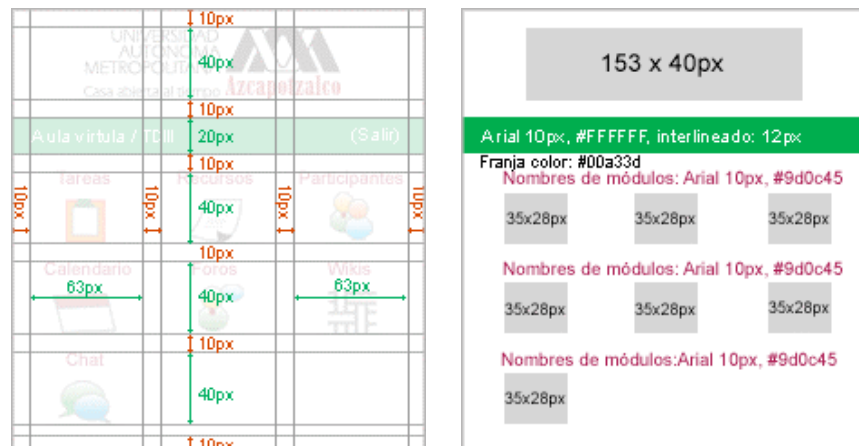Figure 3 Specifications for the login page of the mobile version of Moodle.

Figure 4 Specifications for the course page of the mobile version of Moodle.

Figure 5 Specifications for the one-column page of the mobile version of Moodle.

Figure 6 Specifications for the two-columns page of the mobile version of Moodle.

Construction and evaluation phases

In this part, we present the mobile version of Moodle as seen from a smartphone. figure 7a presents the home page. Figure 7b shows an example of the course page. Figure 8a presents an example of a one-column page. Finally, figure 8b shows an example of a two-column page.

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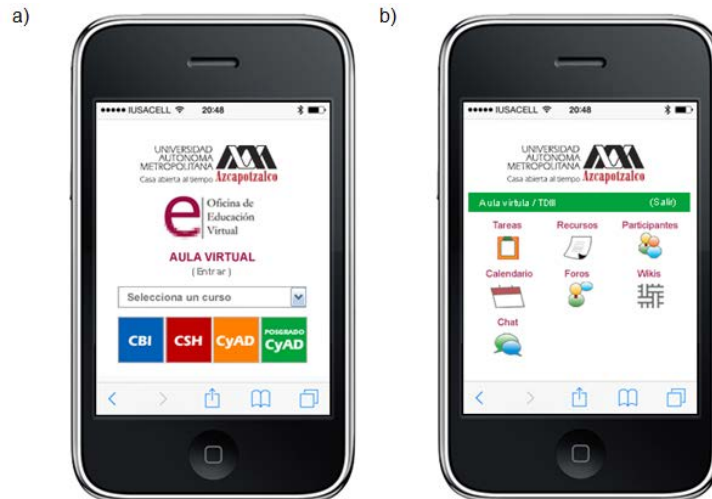
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Figure 7 a) Login page and b) A course page of the mobile version of Moodle.

Figure 8 a) One-column and b) two-columns page example (mobile version of Moodle).

We can observe in figure 7a that each academic division is assigned a color. Figure 7b, 8a and 8b have a text-based navigation bar based on the so-called breadcrumbs, which help the user to be location-aware and to navigate through the course-tree. The color of the navigation bar depends on the division in which the user is located. Figure 8a and 8b have an icon-based navigation bar for each of the active modules to easily change between activities and resources.

In the evaluation phase we run performance tests of the electronic prototype of the mobile version of Moodle.

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4. Discussion

Usability guidelines, visual design and mobile web application web practices has already been used to design a web page. More specifically, Nielsen [2] provides usability guidelines for accessibility, information architecture, navigation, simplicity and consistency that support the construction of usable web sites. Visual design elements such as grid, color, typography has been considered by Lynch and Horton [3] to support the construction of usable web sites. Moreover, there exist a W3C recommendation for mobile web best practices [4].

However, UCD has been applied essentially for design of new products. We have applied a UCD for Moodle redesign for mobile use taking into account visual design, usability guidelines and mobile web best practices.

In the analysis phase we conducted a questionnaire for Moodle users. The results of the questionnaire allowed us to validate the relevance of Moodle redesign for mobile devices. Moreover, we performed a usability test that revealed that desktop version of Moodle presents several problems related to visual design, accessibility, information architecture, navigation, simplicity and consistency.

In the design phase, we proposed concrete design criteria, navigation map, and specifications for the mobile version of Moodle. This proposal considered visual design, usability guidelines, and mobile web best practices.

In the construction phase, an electronic prototype was developed according to the documents constructed in the design phase. Finally, in the evaluation phase, we run performance tests of the electronic prototype of the mobile version of Moodle.

5. Conclusions

In this paper we have applied UCD for Moodle redesign for mobile use taking into account usability guidelines, visual design, and mobile web best practices to foster usability.

As the case study was successful, we recommend that the method proposed in this paper guides new web application redesigns for mobile use.

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