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Accessibility assessment of MOOC platforms in Spanish: UNED COMA, COLMENIA and Miriada X

Francisco Iniesto and Covadonga Rodrigo
Department of Computer Languages and Systems
Universidad Nacional de Educación a Distancia (UNED)
Madrid, Spain
finiesto@gmail.com, covadonga@lsi.uned.es

Abstract—This article develops a methodology for the assessment of MOOC courses, focusing on the degree of accessibility of three Spanish MOOC platforms: UNED COMA, COLMENIA and Miriada X. Four different criteria have been used in this context: automatic tools, disability simulators, testing tools and educational content.

Keywords— *Accessibility, MOOC, automatic tools, disability simulators, testing tools, educational resources.*

I. INTRODUCTION

The shift from closed educational platforms to open learning environments, such as MOOCs (Massive Online Open Courses), is a result of the development of online education, which has enabled thousands of people worldwide to follow different kinds of educational initiatives [1] [2]. However, quality education is not guaranteed through the use of new technologies alone. Any kind of online education implies upgrading technological knowledge and skills for all parties involved.

In Spain, the number of students with disabilities who use assistive technology devices and/or adaptations in order to take advantage of the resources offered within third-level education increases every year. Moreover, an increasing proportion of those students have a legally recognised disability, and choose distant education universities to carry out their studies (i.e. eight thousand students with disabilities enrolled in UNED during the academic year 2012/2013, which approximately represents 50% of the total number of university students with disabilities enrolled nationwide).

Despite being highly open platforms by nature, the actual Access to MOOCs and their platforms could imply an additional difficulty for students with disabilities, as they will have to develop new and ever-changing skills. The introduction of audiovisual and interactive elements in these courses (i.e. tests, self-assessments, etc.), adds a new challenge for accessibility requirements, as the new elements increase the digital gap for all users, never mind people with disabilities.

The objective of this study is to carry out an accessibility assessment of some of the MOOC platforms available in Spanish. This article describes first the platforms being assessed, then the assessment criteria that were applied, as well as the selected tools, to conclude with its main findings.

II. MOOC PLATFORMS: UNED COMA, COLMENIA AND MIRIADA X

The above mentioned platforms were chosen because they have been very prolific in the development of MOOC courses in Spanish [3], [4], contributing greatly to the availability of almost one hundred MOOC courses by October 2013:

- UNED COMA was one of the first free MOOC platforms in Spanish. It enables the creation and management of massive courses in an autonomous, simple and intuitive manner, and it has its own quality system [5], [6].
- COLMENIA is a community that gathers together a number of learning communities, such as UnX (the first Ibero-American digital community for entrepreneurs), and Weprendo (a mobile digital entrepreneurship community). They both use educational systems based on MOOC courses.
- Miriada X is a MOOC platform that was established in early 2013. It is being promoted by Telefónica Learning Services and Universia, the latter constituting the largest network of Spanish and Portuguese-speaking universities.

III. ACCESSIBILITY ASSESSMENT METHODOLOGY

The accessibility assessment presented in this study is based on studies and guides already published [7], [8], [9] and [10]. A representative sample of webpages and educational resources has been selected:

- Platform's Start Page.
- Form Page.
- Course Page.
- Course's Forum Page.
- A course's educational resource.
- Video-pills.

The following courses have been selected for this study: "España+Francia+Cerca I" from UNED COMA; "Emprendimiento y Desarrollo de Aplicaciones de Realidad Aumentada" (Entrepreneurship and Development of Augmented Reality Applications) from COLMENIA, and "Estrategias de Marketing Online. Community Manager" (Online Marketing Strategies. Community Manager) from Miriada X.

The assessment methodology is based on four criteria "Fig. 1":

- Assessment using automatic tools.
- Assessment using disability simulators.
- Assessment using testing tools.
- Assessment using educational contents.

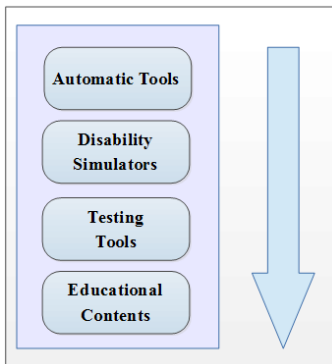


Fig. 1. Assessment methodology criteria .

The methodology used is based on an automatic approach. Therefore, results show findings particularly related to visual disabilities. The WCAG 2.0 Guidelines for Web Content Accessibility are the regulations being applied in this context [11].

A. Assessment Using Automatic Tools

The WCAG 2.0 Guidelines are organised according to four main principles for web content accessibility: perceivable, operable, understandable and robust. These principles are important to carry out an automatic validation in accordance with the WCAG 2.0 Guidelines. To this end, the online test eXaminator has been applied to all webpages under study. eXaminator assigns a score between 1 and 10 as a quick indicator of webpage accessibility while, at the same time, it incorporates assessments according to their impact on a number of user profiles. Individual assessments are used to obtain a score for each of the user profiles, and the webpage overall score can be obtained by finding the average score of the five partial assessment values, which correspond to the degree of limitations caused by total or severe sight loss, reduced mobility of the upper limbs, limitations to understand and age.

This tool provides different criteria for the overall set of tests carried out ("excellent" or "very good"), in the case of those points which have been applied in a correct and "regular" manner; "badly" and "very badly" in the case of those which present accessibility problems according to the guidelines. At the end of its analysis, this tool provides a score, which is calculated as weighted scale. The results are shown in "Table I".

Validation obtained through eXaminator concludes that the three platforms under study have many very bad or basic errors, which means that they obtain a mediocre score. In some cases, it is actually the platform's or course's homepage that shows basic accessibility problems in the first place. Homepages are compulsory for all students and should (in theory) the first ones to be accessible.

TABLE I RESULTS OBTAINED THROUGH AUTOMATIC VALIDATION.

UNED COMA	Excellent, very good and good	Regular	Bad	Very bad	Score
Start	7	1	4	1	6.6
Form	7	1	2	3	5.8
Course	7	1	4	3	5.9
Forum	6	2	4	1	6.2
Average Score					6.1
COLMENIA					
Start	5	2	7	6	4.5
Form	5	3	8	4	4.7
Course	7	2	7	1	5.4
Forum	6	1	5	5	6.2
Average Score					5.2
Miriada X					
Start	4	1	4	7	4.2
Form	6	3	8	4	4.5
Course	4	3	5	6	4.1
Forum	6	3	8	4	4.5
Average Score					4.3

When examining the positive results obtained, it must be pointed out that the three platforms share some common features, such as the fact that they do not use attributes to control visual displays, and that webpages have a *title element*.

UNED COMA and COLMENIA share an absence of link elements for navigation and the use of headings.

UNED COMA's platform has a positive feature whereby the main page language is easily identifiable and forms have a send button.

The assessment results obtained for each platform when using eXaminator are shown in "Table II", where each profile is specified. It is evident that for UNED COMA the lowest scores relate to the limitation to understand. For COLMENIA and Miriada X, the lowest values relate to the limitation to see and for the upper limbs.

Unfortunately, the three platforms share an important number of problems, as absolute values are used for font size; there are links with the same text that bring the user to different destinations; the first link on the page does not bring the user to its main contents; there are *iframe* elements without *title*, and there are images without text alternatives.

UNED COMA and COLMENIA use justified text for their CSS. In COLMENIA and Miriada X, the reasons why sight limitations and the limitations of the upper limbs take place, as events are associated with non-interactive elements; there are forms without send buttons; there are no links that enable the user to jump to the next content block, and the language code for the *lang* attribute is missing. With regard to the course from Miriada X, some of the most important errors are, for instance, that there are links whose content is only images with no text alternative; in some cases, absolute measures are used to indicate the width of an object; there are tables without heading cells, and there are tables which contain one or more nested tables.

TABLE II. RESULTS DIFFERENTIATED BY TYPE OF LIMITATION.

UNED COMA	Total Sight Lmt.	Severe Sight Lmt.	Limbs	Cognitive ability	Age
Start	7.2	6.4	6.9	5.7	6.5
Form	6	6.4	5	5.4	6.2
Course	6.5	5.7	5.8	5.3	6
Forum	6	6.5	6.6	5.8	6.1
Average Score	6.4	6.2	6.1	5.5	6.2
COLMENIA					
Start	4.5	4.7	4.2	5.2	5.2
Form	4.2	5	4.2	5.2	5.5
Course	4.5	5.7	4.9	6	6.2
Forum	5.3	6.7	5.7	7.1	7.1
Average Score	4.6	4.4	4.7	5.9	6
Miriada X					
Start	4	4.3	3.6	4.3	4.6
Form	4.3	4.7	4.2	4.6	4.8
Course	3.6	4.5	3.5	4.3	4.8
Forum	4.3	4.7	4.2	4.6	4.8
Average Score	3.3	4.5	3.9	4.4	4.7

B. Assessment using a visual disability simulator.

In order to carry out our assessment using simulated visual disabilities, aDesigner has been used in this case. This disability simulator helps designers to ensure that content and applications are accessible and usable by people with visual disabilities. Simulations are performed for the different pages, and there are two different simulation options: simulating a blind person and simulating a person with a visual disability.

When the tests for the blind person simulator are carried out, this tool identifies that most pages can fulfill the accessibility guidelines with minor modifications, and that the page structure is suitable to be used by blind people. In relation to the problems encountered, the automatic tool eXaminator has already identified some of them and these have been described in the previous section, such as the appearance of images without the attribute *alt*; that the page has several *html elements*; the use of relative measures for font size, and the use of redundant textual information.

However, some problems have actually been identified by using this particular tool in the case of the tests carried out with the simulator of people with visual disabilities. The simulator itself identifies that there are problems when distinguishing colours. Environments coincide in the identified errors, mainly the combination of background and text colours is difficult to distinguish, and font size is fixed and too small.

Taking all this into account, some recommendations that could be easily complied with could be made in order to improve the accessibility of all environments, such as improving colour combinations; avoiding the use of fixed font sizes, avoiding the redundant presence of textual information and the use of links with the same textual reference that bring the user to different destinations.

C. Assessment using testing tools.

The testing tool SortSite has been used for this section. This tool not only validates the accessibility of a particular webpage. It also checks other additional and necessary aspects, such as the degree of SEO usability (Search Engine Optimization); the compatibility among the different browsers; code errors, and privacy and validation of standards. This additional information enables an assessment that includes all other assessments and which is applicable to all necessary fields which are relevant for a person with a disability. The accessibility assessment performed by this tool has not been taken into account, as it does not provide new data and addresses some aspects which are not related to accessibility.

Taking into account the results obtained in each case, some general errors have been observed, such as the presence of broken links in all platforms; the incorrect use of *cookies* due to the absence of privacy policies in all platforms, as well as the lack of compliance with W3C HTML/XHTML [12].

D. Assessment using educational contents.

In this case, the accessibility assessment has been based on a number of criteria proposed by Sánchez Caballero [13]. Regarding UNED COMA and the course "España+Francia+Cerca", the resources provided to the user are mainly PDF documents, some of which are scanned as images, completely preventing screen reader users from being able to access it. The types of resources provided by UNED COMA are as follow: PDF versions of scanned documents (produced internally and externally), audio materials in mp3 format, as well as links to external videos and pages.

Due to the technical nature of the course entitled "Emprendimiento y Desarrollo de Aplicaciones de Realidad Aumentada", aid materials are provided in CIF format, or in that of the application being used throughout the course. It also provides users with its own help guides in PDF format. The course entitled "Estrategias de Marketing Online. Community Manager" from Miriada X provides its own materials in PDF format. "Table III" shows the results of the document assessment.

TABLE III. ANALYSIS OF EDUCATIONAL RESOURCES.

	UNED COMA	COLMENIA	Miriada X
Sans-serif Style	No, Times New Roman	Yes, Calibri	Yes, Calibri
Visual hierarchy	Correct	Correct	Correct
Contrast	Correct	Correct	Correct, misuse of colours
Underline	Correct	Correct	NA
Allow sound volumen adjustment	Correct	NA	NA
Text, symbols or images for audio materials	Not Provided	NA	NA
Images must have high resolution	Low resolution	Low resolution	Medium resolution
Graphs and tables with titles and summaries	Not provided	Not provided	Not provided

In the case of video-pills or educational audiovisuals, none of them provide alternative text contents. These findings are reflected on "Table IV".

TABLE IV. ASSESSMENT OF VIDEO-PILLS OR EDUCATIONAL AUDIOVISUALS.

	UNED COMA	COLMENIA	Miriada X
Includes subtitles	No	No	No
Sign language interpretation.	No	No	No
Includes alternative text for audio content	No, only French videos	No	No

IV. FINDINGS AND CONCLUSIONS

MOOC courses are important in so far as they can provide and facilitate free and open education opportunities for global groups of people while, at the same time, offering quality training within a learning environment heavily based on the use of ICTs. Unfortunately, the preliminary results contained in this study show that huge problems have been identified when enabling people with disabilities to access these new educational platforms. Looking at the last column in "Table I", we can see that all platforms analysed in this study have obtained scores between 4 and 6, something that should be highly improved.

Moreover, it is interesting to consider the degree of compliance with the WCAG 2.0 Accessibility Guidelines, which has been calculated according to the scores obtained ("excellent" and "very good") and in relation to the number of tests carried out. The different platforms have obtained different average scores, but none of them reaches an average score that could be said to be reasonable (over 60%). In this context, UNED COMA gets 50%, COLMENIA gets 31.5 %, and Miriada X gets 25.7%. The lowest results under the criteria of limitations for UNED COMA are a result of the problems encountered during the tests to understand texts and documents, as well as navigation in general. In relation to COLMENIA and Miriada X, the lowest scores are obtained when talking about limitations to see and for the upper limbs. UNED COMA seems to be better suited for students with visual disabilities.

The three platforms under study present common errors, such as the presence of broken links, the use of *cookies* policies, and the lack of compliance with W3C standards.

With regard to educational contents, one must be aware that there are no standards within the platforms themselves to create uniform and accessible contents. These standards would be useful for the contents to be reused and to obtain accessible results [14]. It must be pointed out that different universities develop and produce the contents in several of these portals. It is of particular significance the lack of accessibility in the case of audiovisual resources.

In order to overcome these barriers then, it is necessary to continue promoting digital literacy among people with

disabilities, and do a follow-up regarding their access to the scope of the MOOCs.

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