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7 Accessibility in Language MOOCs

Abstract: ELearning environments are rapidly evolving towards more a revolutionary computer and mobile-based scenario along with social technologies that will lead to the emergence of new kinds of learning applications that enhance communication and collaboration processes. The flexibility of the learning service provided by MOOCs allows students to learn at their own time, place and pace, enhancing continuous communication and interaction between all participants in knowledge and community building. This learning system especially benefits people with disabilities and can improve their social inclusion. However, access to the MOOC platform can also add extra difficulties such as the need to develop specific digital or even social skills. In this paper a set of specific strategies regarding the achievement of accessibility in all aspects of the overall MOOC system (from content to user preferences) along with references to the applicable standards.

Keywords: MOOC, usability, accessibility, standards, social inclusion

7.1 Introduction

It is a proven fact that new technologies, specifically Information and Communications Technologies (ICT), contribute dimensions which have, to date, been inaccessible to people with disabilities by providing them with the resources they lack and strengthening their capacities. (Dobransky & Hargittai, 2006; Seymour, 2005). This gives them greater autonomy and independence by breaking down their isolation and lack of communication and promoting their family and social integration. All of this leads to an improvement in their state of mind and personal self-affirmation; in short, their quality of life.

As regards the possibilities that ICT offer people with visual, auditory and mobility disabilities; in order to improve their well-being, promote their training and therefore their potential for entering the workforce (i Díaz & Bonjoch, 2007; Vila et al, 2007), there are numerous studies looking in depth into both the ease of and difficulties in accessing and using the different types of technology that they come up against, thus giving rise to significant limitations when using ICT (Koon & De la Vega, 2000) and the appearance of the digital divide (Cullen, 2001). The difficulties centre especially on the use of computers and the Internet, rather than the user's devices.

This is also the case for eLearning, where teachers and students access their virtual courses on learning platforms using the web browser for their main tasks (Avgeriou, 2003). Furthermore, eLearning environments will continue to evolve

towards a more revolutionary computer and mobile-based scenario along with social technologies that will lead to the emergence of new kinds of learning applications (Kop & Bouchard, 2011; de Waard et al., 2011) that enable communication and collaboration (Kukulska-Hulme & Jones, 2011). These applications will take advantage of the unique conditions of mobility and the ubiquity of Internet access, exploring successful actions for education and social inclusion.

In this context, whilst LCMS environments are most commonly deployed within universities, schools and other academic institutions, Massive Open Online Courses (MOOCs) have made open education available to the public domain by offering a free window to their courseware that students might experience in university and colleges. Higher Education institutions are shifting from closed educational platforms to new open learning environments by demonstrating that the evolution of open education on the Internet is enabling thousands of people around the world to follow different educational initiatives (Haggard, 2013; Gaebler, 2014).

The flexibility of the learning service provided by MOOCs allows students to learn at their own time, place and pace, enhancing continuous communication and interaction between all participants in community building and learning. Nevertheless, access to the MOOC platform can also add extra difficulties such as the need to develop specific digital skills. As an example, the amount of audiovisual content and interactive elements (test, self-assessments, etc.) present in these types of courses, active connections with social networks, etc., may add new difficulties to the accessibility requirements, thus broadening the digital divide, and not just for people with disabilities. The pedagogical and visual design of the MOOCs, their information architecture, usability and visual and interaction design could be having a negative impact on student engagement, retention and completion rates as has been analysed previously in adult learning (Tyler-Smith, 2006). As MOOCs become more mainstream participants become less tolerant of poor usability and expect an intuitive learning platform which is enjoyable to use.

Thus, an analysis of the critical factors necessary for building a specification of requirements for an accessible MOOC system is provided here, presenting an outline of language learning MOOCs' requirements for access. The requirements for academic eLearning delivery, user profiling, adaptable and multimodal interfaces, well-known applicable standards, together with the needs of students participating in this type of education, are taken into account in order to achieve this purpose. Accessibility issues are addressed, as regards user abilities and needs, the service domain and associated technological infrastructures.

The paper is organized as follows. Firstly, some considerations on accessible learning are presented, along with their benefits for the social inclusion of vulnerable learners such as people with disabilities. Secondly, several standard-based definitions and properties of usability and accessibility are presented, discussing their application in MOOC learning, where contexts of use need to be taken into account. Thirdly, different issues as regards accessibility and combined strategies are presented to

formalize the usability and accessibility requirements needed in MOOCs. Finally, the main conclusions are expounded.

7.2 ICT Access and its Use by People with Disabilities

According to the “Access and use of ICT by people with disability” report drawn up and recently published by the *Fundación Vodafone-España*, it must be noted that 91.8% of people with a disability use a mobile telephone, 42.8% of them a computer and 32.5% the Internet. These figures are somewhat lower than those on average within the overall Spanish population (95.5%, 72.7% and 75.1%, respectively for each technology) even though the use of the mobile telephone among people with visual, auditory and mobility disability is practically universal.

Likewise, the use of the Internet has a very significant potential yet a low percentage of use (32.9% on average) as there is a serious problem of accessibility to the Internet for the visually-impaired. The use of the Internet for these individuals is low (18.5%), far less than the average (72.7%) as there are many people who would need an adapted computer which is not available (33.0%) and others who have tried to use it but have found it not to be user-friendly (24.4%). The same is true for the use of the Internet from mobile devices, even though new intelligent telephones have very advanced configuration options as regards accessibility, especially with the iOS and Android operating systems.

The collective of hearing-impaired individuals, on the other hand, tends to use ICT, making the computer (47.5%) and Internet (61.8%) the most used technologies. Furthermore, people with this kind of disability who are Internet users are those that participate in social networks the most (56.1%) and use the services of Web pages of organisations dedicated to disability support to participate in forums (36.6%). Because of the limitations caused by this type of disability, however, this population is the one which faces the greatest problems of accessibility to mobile telephones (56.3%).

In the case of people with a physical disability, the use ICT is often conditioned by limited mobility. Nevertheless, in general terms, it is this group that has a greater perception of the use of the mobile telephone as a facilitator of communication and for enabling personal autonomy. Those people with a physical disability use the computer less (32.6%), and 32.5% use the Internet, mainly indicating that its use seems very advanced and complex to them (34.1%).

Although a large number of these people would like to have devices adapted to or suitable for mobile telephones, Internet and computers, many of them are unable to afford them as this collective of people is especially vulnerable due to the current financial crisis, especially in specific aspects related to their disability, and their household incomes, which for the majority do not exceed €2,000 net monthly (98.3%). In any case, the price of the suitable devices seems to be a barrier but, fortunately, the

advance in technology and the envisaged reduction in the acquisition costs will be a solution to this problem.

An educational solution like MOOCs, benefitting from the use of Technology Enhanced Learning is an opportunity to mitigate the isolation of these vulnerable learner groups.

7.2.1 MOOCs Opportunity for Social Inclusion

One of the factors that has been revealed as a determinant for people with visual, auditory and physical disabilities in their potential for entering the workforce is their low level of education. Thus, 81.0% of them overall have secondary studies or less. The level of education is reduced especially among the collective of people with disability who are more than 45 years old (93.8% with secondary studies or less) and among the people who have a disability related to mobility (84.9%). On the other hand, the difficulties in finding employment are added to the fact that the greatest part of the collective of people with disability work in low qualified positions (53.1%).

However, the process of access and integration to people with functional diversity in the education system is positive and irreversible in our country and the rest of our environment. In Spain, the number of students with a disability who use support products and/or require adaptations to be able to enjoy the resources offered in higher education is increasing every year. There is a growing number of these students (in Spain it is close to 50%) who have an officially recognised disability and who have chosen distance-learning universities for their education. However, the majority of the applications made by these students are within the paradigm of “Permanent Learning” or Life Long Learning (LLL), so that their education, work and personal life can be integrated into a continuous process in which all citizens would be able to access knowledge and personal satisfaction through work.

Permanent Learning has enjoyed very significant institutional support since the European Parliament adopted the ambitious proposal of the Commission to develop an action program unique in the area of education and training whose aim is to cover learning opportunities from infancy to adulthood under the PL paradigm with a specific sub-program centred on tackling learning and teaching needs in higher education (eInclusion, 2012). In this type of education delivery, students can attend high quality institutions, receiving accredited and recognized qualifications without leaving their own home. For learners with disabilities, this is of special importance, as travelling to learn may be very difficult for many of them and their home and work environments usually are highly adjusted to their specific needs, particularly in terms of physical access, transport and assistive technologies.

To the increase in the use of information technologies, such as the Internet, can be added the rapid introduction of new elements such as audiovisual content. Initially, the content of the Web was mainly textual with the later incorporation of

images, and little by little a large quantity of multimedia content. It is not common these days to find Internet sites that do not have audio, video, presentations, animation, etc. integrated into them. In this sense, a driving force has been precisely the beneficial application of this type of content in the area of education to favour active learning or the tendency towards the Web 2.0, in which the majority of places are based on collections of shared visual and audiovisual resources (such as Flickr or YouTube), just as in MOOCs (see Figure 7.1).

Figure 7.1: MOOC visual interface at UNED COMA ([http:// unedcoma.es/](http://unedcoma.es/))

However, the introduction of audiovisual content into eLearning platforms adds a new difficulty to the accessibility requirements, since they include new elements which widen the digital divide, and not only for people with a disability. It is becoming increasingly common to be unable to access video through not having a certain program or codec to interpret each new format.

The recent addition to this new open and online learning called MOOC, the creation of new educational forms (both from the instructional and technological point of view) can be used to rethink education, also renewing inclusive education that can reach all citizens. Reaching social inclusion can only be obtained by embedding inclusive strategies. For instance, with the rise of MOOCs, a format that allows massive participation and global audiences to become more important as potential learners. Thus, the importance of targeting and including vulnerable groups in MOOCs, such as people with disabilities is emphasized. In reality, they only need to have previous access to digital technologies and new offerings such as those brought about directly by international language learning opportunities.

The use of Open Educational Resources (OERs) allow more potential use and reuse of the content in the MOOC context due to their availability, including the ubiquity of the technology being used by the learners. McGill (2010) noticed that materials

should be available on alternative technologies in order to make OERs and courses fully open and accessible. Although early MOOC emphasized open access features, such as open licensing of content, open structure and learning goals to promote the reuse and remixing of resources, some MOOC use restricted licenses for their course materials, while maintaining free access for students.

The system obstacles to enter and be successful in MOOCs must be traced in order to solve them and ensure access for all. Low participation rates have implications for social development in vulnerable groups. Especially poor completion rates in education put these people into a downward spiral that can lead to social exclusion. Therefore, academic success would enable vulnerable groups, such as students with disabilities, to actively take up MOOC learning outcomes (De Waard et al., 2014).

For students with special needs who might have issues with educational attainment, ability to travel or socio-economic restrictions, MOOCs offer an opportunity for self-development from within a physical space that is already adjusted to their needs.

7.3 Demands of Usability and Accessibility in MOOCs Services

In practice, eLearning services are rendered mainly by means of web technologies. For this reason, eLearning represents a domain in which the paradigm for web accessibility is of immense application. In this sense, the Web Accessibility Initiative (WAI) from W3C promotes accessibility by means of guidelines related to the content (WCAG), the authoring tools (ATAG), and the user agents (UAAG).

The multimedia formats that are very popular in MOOC platforms are based on creative audiovisual content with a high technical quality of sound and image as well as the interactive services that make the participation and communication of their students possible by facilitating accessibility for people with reduced physical disabilities and convert them to active users of the learning.

Therefore, in order to achieve the degree of minimum accessibility required in the multimedia digital resources three significant aspects have to be taken into account:

1. Manufacture the content accessible in itself: in this sense, locutions are added, alternative content in the form of subtitles, audio-description, etc. by always trying to satisfy basic graphic and visual usability aspects, and respecting the types and sizes of the most accessible fonts, optimum levels of contrast, etc.
2. Making it possible to access and guarantee the content: the resources are accessible from the Internet eLearning platforms, and that those based on video can be downloaded by means of streaming
3. Intuitive interaction in user access: the educational resources are available, organised in similar collections (Delgado & Rodrigo, 2010), with information on the level of interactivity, type and duration of the content, etc.

The term ‘usability’ derives from the term ‘user-friendly’, defined as “an expression used to describe computer systems which are designed to be simple to use by untrained users, by means of self-explanatory or self-evident interaction between user and computer” (Chandor et al., 1985). Gradually, the term user-friendly came to be criticized as having “acquired a host of undesirably vague and subjective connotations” (Bevan et al., 1991).

Some authors tend to define usability in overly brief and ambiguous terms, attempting to describe its application rather informally, and without direct reference to the hardware of the device. Furthermore, there is a tendency to overlook the characteristics of the context in which a product is to be used. This usually entails jeopardizing the usability of a product in its operational environment. In addition, usability tends to be evaluated in an ad hoc manner, which makes it very difficult for experts to come to an agreement on the actual usability of the gadget or the device being evaluated (Pareja-Lora et al., 2013).

A more comprehensive and precise definition of usability and of its basic attributes and indicators is required. This is particularly true when dealing more specifically with the different ICT devices used in education, where it is not possible to characterize the whole range of user experiences that comprises many different technologies, contexts of use, study modes and learning objectives. Thus, the usability of a product is not an inherent property; in fact, it depends on the context of its use, that is, on a set of different usability attributes, whose relevance and/or relative importance is determined by different types of user, tasks, environments, etc. Accordingly, it is essential to take into account the context of use when evaluating the usability of a product or service.

Figure 7.2: Forum exchange on the UNED COMA platform

The field of eLearning has seen a significant body of literature develop over the last decade in terms of eLearning accessibility, with a key focus on both LCMS (Learning

Content Management Systems) tools and the learning content contained. MOOCs are developed for the Internet community, focusing on student self-learning and interaction with other learners in a peer-to-peer modality (see Figure 7.2), with engagement coming in the form of frequent assessment items. In many ways, the MOOC model can be simply seen as mass eLearning with a heavier reliance on peer-to-peer learning exchange rather than instructor lead assessment. Hence, producing MOOC content and activities, which being somewhat different from those found in other standard online courses, does not require the development of new skills. In this context the issue of accessibility in these platforms becomes important if the MOOCs are to meet their goals of inclusivity on a large scale.

Whilst the modality of the MOOCs approach may remove physical and economic barriers, it can also highlight the same accessibility barriers that appear in any complex web-based systems. Students using support technologies may have problems while navigating in the MOOC environment, accessing the platform (registration process) and even using the learning content contained in the platform. More issues appear while doing largely automated assessments and the process of engaging with fellow students through forum posts or collaborative group work.

A MOOC interface design is often determined by the platform since some of the features – learning and testing tools – cannot be edited or customized by the academic assistants. Its materials and its mode of delivery might adhere to a set of accessibility standards.

7.3.1 Accessible Interfaces

MOOC platforms are the web based eLearning engines that provide mechanisms for scheduling academic curriculum, delivering various modes of assessment and allow for synchronous and asynchronous communication between instructors and students. In terms of the interface elements, such as logging in, logging out, navigating in courses and content and communicating with all stakeholders, MOOC environments have—like other LCMS—multi-layered structures across which users with disabilities must be able to navigate. Most modern LCMS environments claim to vary levels of accessibility compliance, even though new software apps have come to help develop intrinsic MOOC platforms that are still not so well described (mooc.org, Google Course Builder, Open MOOC, etc.). MOOC LCMS has not been designed and developed with accessibility in mind and some accessibility issues have been already reported (Iniesto et al., 2014). Moreover, this accessibility, if it exists, is aimed largely at the student, rather than the instructor or administrative roles. There seems to be a gap in the scientific analysis of how instructors using assistive technologies can use these systems as learning creators.

Managing content can include some easy tasks such as editing the names of items, deleting items or setting the sequence of items, but not all of the approaches

are necessarily intuitive or quick to use. Furthermore, module and content sequencing is usually managed through drag and drop operations, although keyboard alternatives are often possible. However, how usable these non-mouse alternatives are for large amounts of course management, or where complex content arrangement is required, remains unclear. Old versions of LCMS management functionalities were more “accessible” in their intrinsic conception: simple drop-down lists or numbered field values being attached to each module or content item within a module and so on. Nowadays LCMS tools have evolved to more media rich, graphically interactive web applications that greatly increase the interface complexity.

7.3.2 Learning Resources Accessibility

Elearning materials are often used with a specific technology, or configuration, which can make them less available to people who have limited access capabilities or who are using non-standard computer equipment. Learners with disabilities using assistive technologies can benefit greatly from eLearning and MOOCs, not just because it allows distance and flexible learning activities, but also because it helps students with disabilities to access resources which would otherwise present significant barriers to them. These barriers can include the interface elements of the Learning platform in which materials and objects reside, and the manner in which users interact with these objects. ELearning environments typically contain a variety of components which do not always share a consistency of interface logic or interactive elements, ranging from posting in a forum, making up elements in tests or timed quizzes, to playing embedded videos or downloading a variety of document formats.

The image displays a video player interface. On the left, a sidebar provides video details: 'Datos del video' (11-11-2011 12:00, 30m, Spanish), 'Visitas: 85', and 'UNED, Evento Plataforma AVP | Plataforma AVP, streaming, videoconferencia. | info@inteca.uned.es'. It also lists authors (INTECCA UNED), publication status, and related documents like 'Tema 2. Los alcanos y sus sustitutos. d'exp.' and 'Tema 2. Los alcanos y sus sustitutos. ppt.'. The main video area shows a slide titled '2.4. Análisis conformacional de alcanos'. The slide content includes a bullet point about intramolecular forces in ethane, a diagram of ethane rotation, and a bullet point about the 3 kcal/mol energy barrier. A video player control bar at the bottom indicates the video is by 'Carla Isabel Nieto - Química Orgánica I del Grado en Química'.

Figure 7.3: Example of an accessible videolecture from the UNED repository Cadena Campus (<http://inteca.uned.es>)

7.3.2.1 Accessible Videlectures

Videlectures are key elements in the MOOC model, and the hurdles of interacting with the platform or contents should be minimized. But alternative accessible formats, subtitles, and/or sign language interpreters for audiovisual materials, audio-description recordings are not easily available (see Figure 7.3). While some ideas are emerging from the field of social accessibility, building communities of volunteers that make transcriptions, etc. (Rodrigo, 2014) and some aspects regarding their labelling have also been identified that will improve the usability of MOOCs videolecturers (Sánchez, 2013):

- Display the unique and consistent numbering of videlectures (e.g. week number and video reference): providing a unique numeric code for each videolecture based on week number and the video reference within a week would allow students to identify and position each videolecture easily within the course.
- Use titles to describe the content of each videolecture: a descriptive title on the content of the videolecture would help students that are only interested in certain topics and those that want to rewatch a videolecture to review one topic or concept.
- Indicate of the length of each videolecture: indicating the length of the videolecture within the video title would allow students to assess the time they will need to watch the video easily, and decide whether they want to start it or not or even pick a shorter one instead.
- Mark watched and downloaded videlectures: when a student watches a videolecture the system automatically displays a check icon to show that he/her has already watched or downloaded a videolecture. This is really useful to remember where was the last time the video was watched and what to continue with. Icons for “completely watched”, “partially watched” and “downloaded” videolecture, could be very useful markers.
- Offer shortcuts for repeated actions: to support productivity, and avoid monotonous and repetitive work, enterprise applications often include the possibility to perform some tasks jointly for more than one item. In MOOCs, for instance, offering the users not only the option to download each videolecture individually, but also to download all videolectures of the week/course at the same time.

7.3.2.2 Accessible PDF Document Considerations

The versatility of the PDF format has given rise to its rapid extension on the Web and it is the most used format to present document on Web pages. However, its wide-ranging use has given rise to worries about accessibility, especially for the users of screen readers. The information contained in PDFs prior to the launch of Acrobat 5 in 2001 is now considered practically inaccessible, in spite of there being a plug-in for Acrobat 4 which offers access to the documents.

PDF is not recognised as a standard format by W3C; however, there are WCAG models and guidelines that regulate its use to favour its accessibility:

“To provide an equivalent text for all non-textual elements. This includes images, graphic representations of the text, etc.” Guideline 1.1 WCAG 1.0

“To guarantee that the pages are accessible even when the new technologies are not compatible or are disabled.” Guideline 6 WCAG 1.0

With the launch of Acrobat 5 in 2001, Adobe allowed accessible PDF documents to be produced. A significant characteristic was the support it offered to screen readers that allowed the content of the documents to be labelled in a similar way to HTML. It also included the possibility for users to navigate the PDF document by means of a keyboard as well as filling in and sending PDF forms online.

The PDF labels are used to define the structure of the document. It can be used to guarantee the order of reading the content of the page and include the paragraph attributes necessary to redistribute the text correctly in accordance with the size of the screen and the devices. The labels also provide standardisation so as to describe text characters independently of the font, in such a way that the screen readers are able to read all of the characters and words correctly.

To improve accessibility in 2003 Adobe launched Acrobat 6, which allowed, together with Reader 6, voice to text content in PDF documents to be converted by means of synthesisers contained in the Windows and Mac OS X operating systems. Windows also integrated a wide range of support technologies such as Braille, JAWS and Window-Eyes devices. This version also allowed the PDF content to be saved as a text file or in RTF, XML, HTML and Doc format. The advances allowed authors to create complex accessible documents. However, to do so, the author has to create the documents with care and take into account the improvement in accessibility.

In order for a document to be considered accessible, it must have the following characteristics:

- It must contain text in which a search may be made. It must not be a scanned image.
- If it contains forms that the user must fill in, it must be accessible, providing tabulated navigation and descriptions of each field.
- It must contain labels in order to define the structure of the document.
- A clear and easy-to-follow order of reading.
- A description for images, links and forms.
- A facility for navigating the document.
- Establish the language of the document.
- Use fonts that allow the characters to be extracted as text.
- The security options of the document must not interfere with screen readers.

7.3.2.3 Accessible Flash Multimedia Restrictions

The Flash format is frequently used to create multimedia elements. Its content is independent of the navigator and to be able to see it, the corresponding plug-in must be installed. Before version 6 of the Flash Player, the content generated was practically inaccessible to disabled users since it was not possible to add equivalent texts for either visual or auditory content. Although for users with physical disabilities this format was not a barrier. For users with cognitive or learning difficulties it was a tool that improved accessibility. As a concept, it is much easier to understand when it is presented in an animated form rather than in words.

With the launch in 2002 of the Flash Player 6, Macromedia provided a media player compatible with MSAA which served as a link between deliberately created multimedia material and the support technologies that the users use. Thus, applications such as Window-Eyes and JAWS can have access to the aforementioned material. However, Flash is not independent of the device as is demanded by the WCAG guidelines.

Flash has also designed a Macromedia Flash MX tool to facilitate the task of the developers of creating accessible content, allowing alternative text or descriptions to be added to the graphic elements and hide the elements that do not have content for the screen readers. Finally, another important advance towards accessibility is the existence of tools such as MAGpie (Media Access Generator), which allow the creation of subtitles and audio-descriptions in XML files. Flash parses the file and shows the information stored in it.

In conclusion, the use of Flash elements can affect what is used to a greater or lesser degree according to its aim. For example, if Flash is used in navigable menus it will give rise to significant errors of accessibility due to the lack of Flash support from the support technologies. The alternative to this problem of accessing information is to provide a standard version of the content of the course, for example, in HTML format. There is also the standard SVG technology as an alternative in the field of vectorised graphics, also recommended for W3C, in spite of the need for a plug-in in order to use it and that multimedia elements cannot be included directly, unlike the Flash format.

7.4 Strategies for Improving Usability and Accessibility in MOOC Services

With all of the above considerations, some strategies can be applied to improve the usability and accessibility level of MOOC systems: platforms and services as a whole. Some of them are related to adding accessibility to MOOC content repositories of learning materials (content and assessment) via specific metadata schema, defining the user profile and preferences, enabling user adaptable interfaces, using multimodal

adaptive interfaces and including some user's models such as User eXperience and User Centered Design Model.

7.4.1 Learning Resources Metadata to Improve Accessibility

But at the time of using the Internet as a means of communication to publish multimedia content in audiovisual format, it is necessary to take different aspects into account:

- Technological: such as, for example, the user agents that must make it possible to access the information, the technology to develop and edit the resources (accessible software applications), authoring tools to facilitate the production of accessible materials or the adaptation of those already produced.
- Adapted Devices: when a user accesses a resource available on the Internet, it can be accessed directly or a device would have to be used (hardware or software) specifically: screen reader, specialised mouse, virtual keyboard, magnifying glass, etc.
- Existing Inclusive Methodologies and Educational Standards: in this sense the XML markup languages have to be mentioned, together with the use of metadata that provides the adaptability of the content according to the user profiles, formal specifications for the integration of synchronised multimedia, etc.

In order to improve the accessibility of eLearning content, the Access-For-All Metadata (ACCMD) specification was developed by IMS in 2004. It describes learning content by identifying which types of resource are available in a Learning Object, which can be used to present the same content to a given learner, but by means of different media. Metadata can then be used to describe the types and the relationships between an original resource and its available adapted formats. Interpreting user profiles for choosing the appropriate content, ACCMD metadata can be exploited to describe textual alternatives that are available for images, audio descriptions for videos, transcripts or captioning for audio tracks, visual alternatives for text, and a variety of other potential alternative formats matching user's preferences. Based on ACCMD, these appropriate alternative media resources can be retrieved and presented to the user. A visually-impaired learner, for instance, viewing a video that had entered an ACCLIP profile previously, will automatically receive that video with audio descriptions, while a hearing-impaired learner will receive the same video but with captioning included in the presentation.

Furthermore, the third part of the ISO/IEC 24751:2008 accessibility standards [19] (Information technology—Individualized adaptability and accessibility in eLearning, education and training—Part 3: “Access-for-all” digital resource description) is devoted to describing the resources which make up an eLearning content (ISO DRD), with an approach which is similar to the IMS ACCMD, both standards having the same

aim: providing information on alternatives to original resources. Then, any resource presented in an e learning content can be identified as having an original form and one or more adapted forms, depending on its media type.

A limitation to these standards arise whenever eLearning content authors want to provide alternatives both to the whole original content and to each single part that makes up the entire resource (images included in a document, formatted texts, etc.). According to these standards, it is neither possible to declare those pieces of formatted text as original resources—if they are not in separated files, nor can a subset of adapted resources be declared as an alternative to a single resource. For example, a sequence of audio files cannot be identified as a single auditory resource, a video with sign language cannot be defined as an alternative to it, and a sequence of images cannot be declared as an alternative to a video.

The IMS Access for All (AFA) Digital Resource Description (DRD) 3.0—draft released in 2012—aims to solve these problems by radically changing the point of view: now it is possible to declare one or more access modes for each resource, define existing accessible adaptations and whether they come from the specific original resource.

7.4.2 Assessment Accessibility

Another interesting and recent IMS specification is the Accessible Portable Item Protocol (APIP), which is related to the accessibility of eLearning assessment. It provides assessment programs and questions item developers with a data model for standardizing the interchange file format for digital test items. The APIP standard is based on the IMS Question and Test Interoperability (QTI) v2.1 specification and expands the QTI model into a complete framework, allowing the definition of accessible tests and adopts the IMS Access For All Personal Needs & Preferences (AFA PNP) v2.0 specification as the basis for supplying the user preferences to customize the presentation of the question items to fit the accessibility needs of the user.

7.4.3 Enabling User Adaptable Interfaces

An effective eLearning environment should take into account each learner's abilities, together with learning goals, where learning takes place, and which specific devices the learner uses. In this context, it is strategic to describe learner's preferences and needs by means of a profile. How this profile interacts with the eLearning platform interface and the objects it contains can impact upon the learning experience of users with different capabilities.

Given an approach that improves usability by making the user interface or content adaptable to (or by) the user, Jäppinen et al. (2005) have written about the pros and cons of adaptability in the context of mobile learning. In essence, they conclude that

a system that could model the user and automatically regulate and organize its functioning to him/her would be very appealing, even though, at the same time, this property can make the system less controllable and predictable for the user, which could cause confusion.

7.4.4 Multimodal Adaptive Interfaces

One solution to the challenge of computer systems becoming more and more complex and with more interaction consists of making computer systems easier to use and learn. One way of doing this is through research into and the development of more intelligent interfaces that are adapted to the user in a natural and progressive way, trying to detect their characteristics so that the system can adapt to their level and preferences. The premise must be that the interfaces adapt to the person, not vice versa.

An adaptive interface has the capacity to adapt to the user automatically, based on suppositions. It must not be confused with adaptable interfaces, which are those that simply allow the user to modify the parameters of the system to adapt to the user's behaviour. Adaptable interfaces are more suitable in critical or very complex environments in which it is preferable to leave the decision making on how to configure the interface in the hands of the user (Miller, 2005). The key concept of this type of interface is the "user model", aiming to synthesise the characteristics and skills of a group of people to facilitate and improve their interaction with the system.

Its adaptability is achieved by interpreting the actions of the users, according to their options and the dialogue records with the system and generating responding at both the logical and physical level. The process is not simple: the "average user" does not exist, the knowledge of the user is not static and is not possible to create precise models.

There are currently several approximations relative to the design of adaptive user interfaces. An example is that adopted by the Spanish INREDIS project¹⁴ which proposes the creation of adaptive accessible models for people with a disability by modelling the different aspects of the domain with which the user interacts by means of ontologies that model respectively the skills and characteristics of the user (User Ontology), the characteristics of the services (Ontology Target) and the information relative to the devices that the users use to interact with the system (User Device Ontology).

The need for adaptive systems derives from the first instance of the heterogeneity of the user population. In the face of achieving a sufficient dynamism and facilitating the total integration of people with disabilities, a suitable technological infrastructure

14 <http://www.inredis.es>

is necessary that monitors and sustains the different tasks that the disabled user has to tackle in the context of the use of computer environments.

7.4.5 Accessibility Standards for Learner Profiling

Some standards have been defined to profile learner preferences and needs that will help the user to personalise devices and services for students with disabilities. Groups that have been really active in this work are:

- IMS Global Learning Consortium developing the IMS Learner Information Profile (IMS LIP) and IMS Learner Information Package Accessibility for LIP (ACCLIP)
- ISO developing the ISO/IEC 24751:2008 accessibility standards

With all these standards, learners can specify which kind of adapted and/or alternative resource they prefer or need. For instance, text may be preferred over visual resources or audio might be preferred over text or images, etc.

The IMS Global Learning Consortium has developed a specification that attempts to address learner profiling, the IMS Learner Information Profile (IMS LIP), devoted to describing general learner characteristics, by defining a set of packages that can be used to import data into and extract data from an IMS compliant Learner Information server. The IMS Learner Information Package Accessibility for LIP (ACCLIP) is that subset of IMS LIP which lets learners specify accessibility preferences and accommodations in terms of visual, aural or device. This profile provides a means of describing how learners interact with an eLearning environment, by focusing on accessibility requirements, therefore the user's set of preferences can be exploited according to the different contexts of use of the eLearning environment, customizing the visualization of the learning contents, selecting the preferred input or output device, etc. In 2009, a new version of ACCLIP was released, called "Access-For-All Personal Needs and Preferences for Digital Delivery".

Accessibility user preferences in the IMS standards can be grouped as follows:

- Display information: this set describes the user preferences to have information displayed or presented. For example, it is possible to define preferences related to text (fonts and colors), video (resolution), mouse (pointer, motion), etc.
- Control information: this set defines the user preferences to control the device: keyboard (virtual), zoom preferences, voice recognition.
- Content information: this set defines the user preferences to visualize learning content.
- Privacy and data protection information: each ACCLIP element has meta-data sub-elements related to this information. The privacy and the data integrity is considered very important, since the exchanged information can be closely related to the user's disabilities.

While the IMS standard is focused on defining content characteristics, ISO specifies the senses through which content is accessed. The second part of the ISO/IEC 24751:2008 accessibility standards (Information technology—Individualized adaptability and accessibility in eLearning, education and training—Part 2: “Access for all” personal needs and preferences for digital delivery) is devoted to describing the learners’ Personal Needs and Preferences (ISO PNP).

But according to the standards, learners can explicitly declare only one alternative access mode for each form of learning resource and it does not allow a change: for example, a blind user might prefer audio description but if such alternatives are absent, he/she cannot choose a text description instead. Therefore a new standard IMS Access for All (AfA) Personal Needs and Preferences (PNP) 3.0 has recently been developed, aiming to solve this type of problems and letting the learner specify multiple adaptation requests for each existing AccessMode. But still, IMS AfA PNP has some restrictions while choosing the size or quality of video and audio resources. For instance, it is not possible to request a lower version of a videoclip or audio file to be adapted to the user’s device. Therefore, a specific quality profile for learning resources would be desirable as well as clarification rules to better describe the list of alternative choices (e.g. ordered list of desirable content formats).

7.4.6 User Experience and User-Centred Design Model

Early adopters of innovative products and services are usually so excited with the new products that they will probably manage to use them despite their User eXperience issues. The problem starts when these innovative products succeed and want to move from early adopters to mainstream users, which are less permissive with respect to poor usability. At this point, having a product that is useful and meaningful is suddenly not enough. It has to be intuitive and enjoyable to use in order to be successful. Regardless of possible platform User eXperience improvements, though, universities, professors and instructional designers will always have the last word on shaping the user experience of their courses. How they organize the content, how they label the menu sections or how they structure the different pages is absolutely crucial. And for these decisions, one should consider human-computer interaction guidelines, usability best practices or recommendations for writing usable online texts.

The User Centered Design Model (UCDM) (Kinzie, 2002) means not only planning learning goals and actions, but also specifying different contexts of use and the requirements of different ‘actors’, which might include teachers, students, etc. In MOOC contexts, user centered design and user-centered evaluation have been driven by the concept of ‘task’. The student needs to be able to perform tasks such as studying course materials, taking notes, watching videos, writing assignments, accessing forum or chats, communicating with a curator, etc.

However, the process of learning is not always easily broken down into sequential activities and something like ‘studying course materials’ can be a very complex task depending how the materials might be studied. Therefore, conventional approaches to usability tend to be limited to metrics pertaining to the time taken to complete a task, effort required, output, flexibility, and the user’s attitude.

In contrast, some authors have attempted to overcome this by combining technical usability criteria (such as accessibility, consistency or reliability) with pedagogical usability components such as learner control, learner activity, motivation and feedback. Kukulska-Hulme and Shield (2004) have also argued that usability needs to be understood differently when it is being evaluated in the context of teaching and learning, and that the concept of pedagogical usability can be helpful as a means of focusing on the close relationship between usability and pedagogical design.

7.5 Conclusion

Attending learning institutions in terms of travel, accommodation, physical access and availability of assistive technologies are all barriers to the acquisition of traditional learning for some people with disabilities. Overcoming the physical location and access issues gives rise to a solution for fully inclusive education options for disabled learners. How eLearning systems are designed, how their interfaces function, how communication is handled, how assessments take place and what form the learning content takes all impact on the accessibility of these system by students with disabilities.

For web citizens with special needs, the ability to enrol in freely available MOOC courseware could be a viable first entry into tertiary level education or training. The challenge for the MOOC concept, then, is one of accessibility in terms of the community with whom it wishes to engage, ensuring that processes such as enrolling in a course, navigating the system, accessing learning materials and interacting with their peers is achievable through the use of assistive technologies.

However, the problem still remains that the successful development of MOOCs-based learning is highly dependent on human interaction and their digital skills in the use of the platform, the multimedia content and social technologies. The majority of learning activities undertaken continues to take place using some hardware/software that was not designed for its specific use with educational applications and, hence, usability issues often arise. Moreover, there are technical problems or incompatibility, when it is not possible to have the required technology, or it is not possible to obtain materials in alternative formats.

In MOOCs, learning activities are used that had been originally designed neither for specific MOOC platforms nor for a specific learning scenario. Therefore, educational resources that are being delivered present some problems for certain target groups, such as people with complex communication needs or disabled users. As a

result, the level of usability and/or accessibility of these resources is often lower than desired. This is a clear setback if they are to be used at a greater scale for inclusive learning.

Therefore some proposed accessible features for MOOC platforms are listed below:

- Different themes should be available so as to invite users to choose the interface layouts which best meets their needs.
- The MOOC platform should be compliant with accessibility standards, not only related to the Web interface (i.e. the IMS/ISO AccessForAll, so as to support learners in configuring the environment and the learning content according to their needs and preferences).
- The MOOC platform should also address the accessibility from an instructor's point of view, not only from student's. It should let people with disabilities perform academic profiles in MOOCs such as digital facilitators and content curators.

Although the usual accessibility barriers may exist in MOOC platforms, perhaps the model of large scale participation and social accessibility (Takagi et al., 2008) could be used to support special needs users by providing peer assistance in terms of study skills, content adaption and remote assistance. If enough interaction between users exists, students within the system can learn from their fellow students and make a contribution by assisting their peers. In the end, resources can be media-enriched, achieving a greater level of quality: transcriptions for mind mapping, audio recordings for podcasting, etc. All resources grouped together into learning resource collections that will benefit the all of the students in the MOOCs and the variety of the ubiquitous process.

Bibliography and Webliography

- Acceso y uso de las TIC por las personas con discapacidad* (2013). Fundación Vodafone España
Retrieved November 29, 2013, from <http://fundacion.vodafone.es/fundacion/es/conocenos/difusion/publicaciones/publicaciones/>
- Avgeriou, P., Papasalouros, A., Retalis, S., & Skordalakis, M. (2003). Towards a pattern language for learning management systems. *Educational Technology & Society*, 6(2), 11-24.
- Bentley, P., Crump, H., Cuffe, P., Gniadek, I., Jamieson, B., MacNeill, S. & Mor, Y. (2014). Signals of Success and Self-directed Learning. *Proceedings of the eMOOCs 2014 Conference*. Edited by P.A.U. Education (Laussane, Switzerland), 18-25.
- Bevan, N., Kirakowski, J., & Maisel, J. (1991). What is usability?. *Proceedings of the 4th International Conference on HCI*, 651-655.
- Chandor, A., Graham, J., & Williamson, R. (1985). *The Penguin Dictionary Of Computers* (3rd ed.). London: Penguin.
- Cullen, R. (2001). Addressing the digital divide. *Online information review*, 25(5), 311-320.
- Delgado J. L. & Rodrigo C. (2010). Perfiles de aplicación multimedia basado en estándares: un caso concreto para la UNED. *Revista Iberoamericana de Inteligencia Artificial (AEPIA)* Vol. 14, Nº. 47, 1-25.

- De Waard, I., Abajian, S., Gallagher, M. S., Hogue, R., Keskin, N., Koutropoulos, A., & Rodriguez, O. C. (2011). Using mLearning and MOOCs to understand chaos, emergence, and complexity in education. *The International Review of Research in Open and Distance Learning*, 12(7), 94-115.
- De Waard I., Gallagher M.S., Zelezny-Green R., Czerniewicz L., Downes S., Kukulska-Hulme A. & Willems J.; (2014) Challenges for conceptualising EU MOOC for vulnerable learner groups. *Proceedings of the eMOOCs 2014 Conference*. Edited by P.A.U. Education (Laussane, Switzerland), 33-42.
- Dobransky, K., & Hargittai, E. (2006). The disability divide in Internet access and use. *Information, Communication & Society*, 9(3), 313-334.
- eInclusion Europe: Retrieved March 24, 2014, from European Commission Web site on Accessibility and Inclusion: http://ec.europa.eu/information_society/activities/einclusion/index_en.htm
- Gaebler, M. (2014). MOOCs Massive open online courses. EUA paper. Retrieved March 10, 2014, from European University Association Web site: http://www.eua.be/Libraries/Publication/MOOCs_Update_January_2014.sflb.ashx, 2014.
- Haggard, S. (2013). Massive open online courses and online distance learning: review. GOV. UK Research and analysis. Retrieved March 10, 2014, from Web site: <https://www.gov.uk/government/publications/massive-open-online-courses-and-online-distance-learning-review>
- Í Díaz, M. P., & Bonjoch, M. R. (2007). ¿Y después del trabajo, qué?: más allá de la integración laboral de las personas con discapacidad. *Revista de Educación*, (342), 329-348.
- Iniesto, F., Rodrigo, C. & Moreira, A. (2014). Accessibility analysis in MOOC platforms. A study case: UNED COMA and UAb iMooc. 2014 International Workshop MOOC2014 (accepted for publication)
- Jäppinen, A., Ahonen, M., Vainio, T., & Tanhua-Piironen, E. (2005). Adaptive Mobile Learning Systems: The essential issues from the design perspective. In J. Attewell & C. Savill-Smith (Eds.) *Mobile Learning Anytime Everywhere – a book of papers from MLEARN 2004* (pp. 109-111). London: LSDA. 109-111
- Kinzie, M., Cohn, W., Julian, M., Knaus & W. (2002). A User-centered Model for Web Site Design. Needs Assessment, User Interface Design, and Rapid Prototyping. *J Am Med Inform Assoc*; 9:320-330.
- Koon, R., & De la Vega, M. E. (2000). El impacto tecnológico en las personas con discapacidad. In *II Congreso Iberoamericano de Informática Educativa Especial*, Córdoba.
- Kop, R., & Bouchard, P. (2011). The role of adult educators in the age of social media. *Digital education: Opportunities for social collaboration*, 61-80.
- Kukulska-Hulme, A., & Shield, L. (2004). Usability and Pedagogical Design: Are language learning websites special? Paper presented at *ED-MEDIA 2004 World Conference on Educational Multimedia, Hypermedia and Telecommunications*. June 22-26. Lugano, Switzerland. Retrieved February 14, 2007 from Web site: <http://www.aace.org/DL/index.cfm?fuseaction=ViewPaper&id=16072>.
- Kukulska-Hulme, A. & Jones, C. (2011). The next generation: design and the infrastructure for learning in a mobile and networked world. In: Olofsson, A. D. and Lindberg, J. Ola (Eds.). *Informed Design of Educational Technologies in Higher Education: Enhanced Learning and Teaching*. Hershey, PA: Information Science Reference (an Imprint of IGI Global), 57–78.
- Miller, C., Funk, H., Goldman, R., Meisner, J., & Wu, P. (2005). Implications of Adaptive vs. Adaptable UIs on Decision Making: Why “Automated Adaptiveness” is Not Always the Right Answer. In *Proceedings of the 1st International Conference on Augmented Cognition*, Las Vegas, NV; 22-27.
- McGill, L. (2010). Open Educational Resources kit. Retrieved from Web site: <https://openeducational-resources.pbworks.com/w/page/25168957/Overcoming%20barriers%20and%20finding%20enablersOECD>

- Pareja-Lora A., Rodrigo, C. & Jordano, M. (2013). An ontology to design accessible language learning mobile applications. *International Conference on Using New Technologies for Inclusive Learning Enable 2013*, M.A. Hersh (ed.) Glasgow, UK.
- Rodrigo, C., García, C., Sevillano, E., Sama, V., Vázquez, M. & Vázquez, N. (2014). Red Social de Estudiantes Voluntarios para Crear Recursos Multimedia Accesibles. In *V Congreso Internacional sobre Calidad y Accesibilidad de la Formación Virtual* (Guatemala)
- Sánchez, E. (2013). Usability guidelines for labeling MOOC videolectures Web site: <http://uxthoughtsabout.wordpress.com/2013/06/11/small-details-matter-videolectures-page/>
- Seymour, W. (2005). ICTs and disability: Exploring the human dimensions of technological engagement. *Technology and disability*, 17(4), 195-204.
- Takagi, H., Kawanaka, S., Kobayashi, M., Itoh, T., & Asakawa, C. (2008). Social accessibility: achieving accessibility through collaborative metadata authoring. In *Proceedings of the 10th international ACM SIGACCESS conference on Computers and accessibility* (pp. 193-200). ACM, 193-200.
- Tyler-Smith, K. (2006). Early attrition among first time eLearners: A review of factors that contribute to drop-out, withdrawal and non-completion rates of adult learners undertaking eLearning programmes. *Journal of Online learning and Teaching*, 2(2), 73-85.
- Vila, M.; Pallisera, M. & Fullan J. (2007). Work integration of people with disabilities in the regular labour market: What can we do to improve these processes. *Journal of Intellectual & Developmental Disability*, Volume 32, Issue 1, 10-18.