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Challenges of Inclusive Design for E-learning IT Courses: fostered by the Covid-19 pandemic

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ABSTRACT: *The Covid-19 pandemic has posed new challenges for both students and teachers, having to move from face-to-face to online teaching in a short time. The threats brought new opportunities, allowing students away from schools due to limitations, to use on-line classes for developing their careers and academic skills. Designing an inclusive course for students with disabilities is a great challenge. This article presents some effective practices and techniques to increase inclusion and avoid accessibility issues that can arise in an online course, such as a MOOC for IT e-learning having in mind the difficulties of students with special needs.*

KEYWORDS: *Inclusive Design, MOOC, Accessibility Guidelines, E-learning, students with disabilities.*

I. INTRODUCTION

The year of 2020 will be remembered for the emergence of the Covid-19 pandemic caused by the coronavirus SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) [1-4]. Of all areas of society where it had a strong impact, education is one of the most affected [2]. Learning will never be the same after this crisis. All around the world, students and teachers were forced to stay at home. Nevertheless, education has continued fostered by the massive use of all distance learning tools available. Educators had to learn how to use videoconference, chat, course management systems, all of this on the fly, from night to day. And learners had to adapt themselves for a completely new way of getting their lessons and study at home.

The vocabulary and acronym set were enriched with many new terms either referring to technologies, methodologies or learning platforms, such as Zoom, Teams, Meet, Moodle, synchronous and asynchronous classes. E-learning, distant learning, blended learning, are now among the main discussions between educators, staff and parents. Meanwhile, teachers and other professionals started using MOOCs, Massive Open Online Courses, another acronym that is nowadays a common term amid educators and students. Enrollments at MOOCs such as those by Coursera or Udemy, skyrocketed having an increase of several times compared to the same period of the previous year [3]. MOOCs are supported by online platforms such as Moodle, known as Learning Management Systems (LMS) or Virtual

Learning Environment (VLE), providing the grounds for E-learning [4].

At the present date, when this paper is written, there is no vaccine approved or a treatment effective to fight against the diseased caused by SARS-CoV-2. As the start of the 2020/21 academic year approaches, the need for mitigation measures to provide safety education while using the same resources (both premises and teachers) as before are needed. The safety measures imposed legally by authorities around the globe, although those may vary according to each country or region, normally include a huge reduction of the simultaneous number of students present at the classroom. Unless there is a magic way of doubling or even tripling the size of most schools, and since the typical school day is limited to a certain number of hours, students will need to have some or all classes elsewhere, namely, at home.

Society had to give a quick response to the pandemic threat. This crisis brought a large-scale behavior changes with psychological burdens on individuals, a huge impact on stress, relationships and families [4].

As always, threats and challenges bring new opportunities. Students with certain disabilities either physical or others, that were previously not able to attend school, have now an extraordinary opportunity to enroll in classes that were very difficult or even out-of-reach for them. For instance, a person with severe mobility limitations, such as depending on a wheelchair, or even worse, confined to a bed, has now this incredible opportunity of "somewhat" equality as they do not need to move from home to attend class. Classrooms may enter their homes directly through the laptop, with extra addons and functionalities, such as the possibility of attending class at their convenient time and pace. They can go back and forward in the subject matter, reviewing as many times as needed, until they fully comprehend the subjects. All the while using social media and other tools to engage and interact with other colleagues and the teachers.

This paper briefly presents and discusses this reality and how e-learning can be an aid for students with certain disabilities. After this introduction, the next section presents some of the disabilities that might constraint students, particularly for college students of Information Technologies (IT) courses and what are the technological means to convey these limitations. The third section presents some inclusive design techniques to be used on e-learning courses, enabling people with disabilities to be allowed to participate and be fully integrated into the learning system. At last, and before the conclusions are drawn, tips on how to create an accessible MOOC are explained, using a step by step guide and providing resources to develop this issue further.

II. STUDENTS WITH DISABILITIES

Technological evolution has made education accessible to people with some sort of disabilities. There are many different types of disabilities, from physical limitations to cognitive incapacities [6]. Nevertheless, in a world promoting equality among peers, it is an important step forward to promote equality and it is imperative to all human beings to access education at all levels.

Information Technologies (IT) courses make extensive use of digital apparatus, most of them already prepared to overcome accessibility issues [7]. These might include visual or hearing impairments. People with limitations with the use of keyboard or mouse might find it hard, if not impossible, to select and click text, images or to draw, using a computer. Color-blind persons may have extreme difficulty on reading if contrast between text and background is not suitable to them. Or if the pallet of colors makes it hard to read all or part of the text. Sometimes graphs are presented with lines using colors not distinguishable for these persons.

Other disabilities might include people with temporary or permanent movement limitations, and thus not able to commute to the school or college. They might be confined to a wheelchair or even worse, to a bed [6]. Although limited, these persons have their cognitive abilities available and the time needed to enroll a college course.

Another set of impairments is related with cognitive ones. Some have limitations in understanding complex concepts. Others suffer some sort of dyslexia. These persons need extra time to fully understand concepts, and to listen several times, over and over again, to the lesson [6,10].

For each one of these impairments there is a technological solution that can easily be embedded into existing learning platforms and digital educational resources [14,15].

There are a few questions that need to be answered. How well do the e-learning courses meet the needs of students with different disabilities? How are these e-learning technologies and platforms suited to interact with adaptive hardware and software that some students with disabilities require? How accessible is the growing array of available e-learning? These are important questions for the students with disabilities. In addition it should be mentioned that our education system needs to be prepared to deal with the e-learning needs and concerns of students with disabilities [6].

Next section will address some of these concerns and provide a few inclusive design techniques to be used in e-learning courses.

III. INCLUSIVE DESIGN TECHNIQUES FOR E-LEARNING

Some of the universal design values are diversity, equity and inclusion. All populations should have the same opportunity to participate in courses in an equitable way. As such, by using inclusive design people with certain disabilities are not segregated from the rest of the class [6]. However, it is paramount that in no way should this lower the standards in a course.

Accessibility of electronic material varies on the contents and the impact that each might have in a specific disability. For instance, blind students typically use screen readers like NVDA [7,8]. PDF and other files, such as Microsoft Word documents, PowerPoint presentations, or web pages, must use alternative text for images. For every non-text element such as images, charts or graphs, a concise (100 characters or less) description of the information conveyed must be provided. Images with no specific information, used

for decorative purposes, should be labeled as “decorative image”, that simple. Making complex images such as math graphs, diagrams, charts and flowcharts accessible for everyone can be challenging. It involves understanding the purpose, the content itself, and the technology to create and access alternative formats. To describe in a short phrase or sentence complex images requires a lot of thinking and might take some time. Learners may not understand the images without a long description, but if it is too complex it might become hard if not impossible, to fully understand what is conveyed by that image. Fortunately, there are ways to overcome this.

Supada Amornchat, during her master’s degree at Western Illinois University, developed a guide to make visual content accessible [9]. This document provides a step-by-step guide with examples on how to describe complex images. It includes examples of pie charts, bar charts, line graphs, flowcharts, diagram charts, and maps, using text descriptions, lists, data tables and even tactile graphics. This document provides, at the end, a list of valuable internet resources.

Word documents can be made accessible by using the following tips:

- Avoid capitalizing all letters (i.e. “All Caps”);
- Break long blocks of text into smaller segments;
- Use styles to format text for screen readers;
- Use built-in formats for bulleted lists, columns, and tables;
- Avoid floating text boxes;
- Include alternative text for images;
- Use links with short but descriptive text followed by the full URL inside parenthesis.

PowerPoint documents should obey the following rules:

- Use built-in slide layouts;
- Make extensive use of Outline view to check the continuity of the presentation
- Add alternative text for images.

Microsoft Office has an Accessibility Checker, a free tool available in Word, Excel, Outlook, OneNote, and PowerPoint on Windows, Office Online, or Mac, and Visio on Windows. It finds most accessibility issues and explains why each might be a potential problem for someone with a disability. It also offers suggestions on how to resolve each issue. Although the Accessibility Checker catches most types of accessibility issues, there are some issues it is not able to detect. Thus, it is important to always review work visually to find the issues hiding from the Accessibility Checker.

Accessibility of electronic material varies a lot depending on the file format. For example, image-only PDF files are inaccessible since screen readers cannot access the file content.

Another example consists on accessible materials put into inaccessible platforms become inaccessible (e.g., Google Books). Videos in order to be accessible should be provided with closed captions. Sound must be carefully synced with captions. And a transcript file should be provided to facilitate translation to other languages and to the screen readers for blind users. Transcripts and captioning not only assist individuals who are deaf or have hearing impairments but also helps individuals having to learn in a different language. Studies have shown that captioning

increases user engagement for viewers overall. For videos in the public domain (e.g. YouTube), captions increase search engine findability.

Webpages pose many accessibility issues due to the wide variety of web designs, different platforms, web browsers and visualization devices [10]. The World Wide Web Consortium (W3C), an international community that develops open standards to ensure the long-term growth of the Web, gave rise to the Web Accessibility Initiative (WAI) that brings together people from industry, disability organizations, government, and research labs from around the world to develop guidelines and resources to help make the Web accessible to people with auditory, cognitive, neurological, physical, speech, and visual disabilities [11]. To meet the Web Content Accessibility Guidelines (WCAG) 2 requirements (success criteria) and techniques, a customizable quick reference guide was put up and made available [12].

This section pointed some of the most used digital documents and what should be done to address accessibility issues [13].

IV. CREATING ACCESSIBLE MOOC

When planning and designing a course for e-learning, accessibility should be one of the priorities. After choosing the platform VLE or LMS, educators and planners must take into account which devices and frameworks are available for providing inclusive resources.

Universities all over the world have been adapting their online contents and websites to be accessible to all students including the ones with disabilities.

The best practices should be studied and followed by educators and MOOC content designers. There are several examples of accessibility guidelines such as the Portland Community College, available online [14]. Another accessibility guideline checklist for online courses is provided by the University of Colorado Boulder [15].

In short, MOOCs or any online course, should comply with every item in the following list:

- Syllabus must include a statement related with accessibility;
- Clear and consistent navigation through the course website;
- Follow WCAG requirements;
- Confirm that all actions with mouse are also keyboard accessible;
- Provide adequate color contrast;
- Provide transcripts for audio-only media;
- Caption videos;
- Avoid image-only PDFs.

At last, when having your online course ready to be up and running, perform a set of checkers and tools to ensure that all accessibility issues were properly addressed.

V. CONCLUSION

The Covid-19 pandemic has created many problems, particularly in the education sector. However, it opened an opportunity for inclusion of students with disabilities, by promoting the use of teaching tools, namely e-learning. If designed properly, following properly validated accessibility guidelines and inclusive design, distance

learning tools turn out to be inclusive and promoting of equality among students. This article addresses some of these shortcomings, what are the techniques used to overcome them and how distance learning, through the use of MOOCs, can be inclusive rather than creating more inequality, creating an opportunity out of a threat.

Currently, the technological evolution has made it possible to make accessible a set of technological devices and applications for students with disabilities. The easy access to digital cameras, smartphones, computers, mobile Internet, among other devices, as well as editing tools and the Web 2.0, which are increasingly user friendly, accelerates the development of educational resources thus opening up an enormous potential for the use of distance learning in education. Teachers, even those with less ability to use modern information technologies, now have access to a wide range of resources, which can and should, target the learning process. At a time when the old teaching models are out of step with the students' reality, MOOCs, e-learning and distance learning allows for updating these models, meeting the skills that students need to acquire or improve skills. New technologies in teaching students, and educators should endeavor to find various ways to integrate it into their classroom. More specifically, these digital platforms can effectively leverage academic skills and motivation in students with disabilities. E-learning empowers students that were excluded from the academy thus proving new opportunities to participate in the society given them new skills and education, essential tools for thriving in the modern competitive world where 21st-century literacy skills are essential and reach deeper understanding in different curriculum areas. This pandemic situation, although bringing social and economic crisis, might be an opportunity for some that are normally left behind, namely the students with certain disabilities.

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