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How Solidarity Technologies Could Change and Improve e-Learning Courses and Get Inclusive and Responsive Answers for All?

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Abstract: *The practical application of Solidarity Technologies concept adopted in my PHD thesis, with its roots in inclusion promotion, interfaces simplification and universal access, more specifically in issues related to Information and Communication Technologies (ICT) and their availability for all, is one of the goals of this paper. Discuss how Solidarity Technologies could be applied at empirical research in specific formal of eLearning and Blended Learning in a specific case of graduate or post graduate ICT and Multimedia courses as well as lifelong learning situations for physical impairments and disabilities students in virtual or real academic environments, could improve inclusive and responsive answer for all.*

Keywords: *Solidarity Technologies, Accessibility, Usability, Connectivity, Networks.*

1.Introduction

Solidarity Technologies was the proposal presented in my PhD Thesis (Mourato, 2011) as the result of a case study, developed in the period from September 2006 to March 2008, between ICT Resource Center in Lisbon region (CRTIC - Special Education Reference Unit) and three undergraduate schools located in three pediatric wards of Portuguese Institute of Oncology Francisco Gentil of Lisbon, Garcia d'Orta Hospital and Alcoitão Rehabilitation Medicine Center. Low cost technological solutions were created with student's customization (body switches, solar bio sensors and home automation devices) which allowed students the easiest frequency of eLearning distance classes, fostering their autonomy in real, technological and augmentative communication terms. Solidarity Technologies enabling the formal fulfillment of school curriculum adapted to each one as well as collaboration and interactivity with students from origin schools, mediated with a Learning Management System (LMS) MOODLE based, called SaberSimples.Net, which allowed each student and teachers involved, develop their own Virtual Learning Environment (VLE) and connect to a practice community, using asynchronous and synchronous open source applications and tools, such as blogs, chats, forums, among others solutions. At the same time, several teachers enroll a training course about the subject that was developed using day by day inclusion experiences and problems resolution. The research (Mourato, 2011) took place in hospital schools through CRTIC, in three phases: exploratory, explanatory and experimental which enabled a Solidarity Technologies survey that gave suitable information's for a more effective implementation of students' referencing disabilities. The elaboration of a personalized curriculum for each student, using hardware and devices adaptation interactions, develop digital resources for accessibility specific design that approach communication and collaboration with home schools' students and the community of practice growing in continuous in MOODLE and social networks.

Solidarity Technologies (Mourato, 2011) refer initially to the exploration of concepts such as accessibility, usability, connectivity, collaboration and universality of access. Using a step by step guide that could observe and describe scenarios for students' disabilities may

establish and provide tools for inclusion. People with physical, neurological or psychomotor disabilities need the same accessible contents and assistive technologies then the others. The possibility of going online, create their own business or simply work on Internet or in social networks could increase and expand their freedom, autonomy and creativity.

Solidarity Technologies is a comprehensive notion that also includes technical support aids, assistive and adapted technologies, which guarantee autonomous and global participation of citizens in Knowledge Society. People with visual impairments could research information, change personal id, pay taxes, shopping and solve several issues online by using a screen reader or intelligent assistant from Google, Microsoft or Apple Macintosh.

After describing the guiding principles of Solidarity Technologies, for a very concrete case study about undergraduate hospital schools (Mourato, 2011) it is important (and urgent?) experiment and integrate the concept in higher education for eLearning graduate and postgraduate courses, in this particular proposal, in the area of ICT, Multimedia and Informatic Engineering, whose essential framework, methodology and guidelines have already been used in some ICT and Multimedia disciplines taught by me, since 2019.

Solidarity Technologies can function as a basic guiding interoperability principle in projects, software, games and websites appreciation or training and prepare teachers and future professionals.

In this paper, Solidarity Technologies application into e-Learning practice is a specific goal (providing step by step guidelines for students and teachers, who want to assemble custom-made hardware and use adapted accessible devices, free open source software, changing the source code or having a comprehensive view on which tools and applications are most suitable for creating accessible websites on Web 2.0 and 3.0).

Others objectives of Solidarity Technologies in distance modality is using Problem Based Learning Methodology (PBL) materializing learning scenarios creation, with free educational resources. The idea is keep content recyclable, reusable and remixed, based in Virtual Learning Environments (VLE), Cloud based or in LCMS like Google universe, but all the times available.

Why using now Solidarity Technologies implementation proposal?

Solidarity Technologies promote digital inclusion millennium principles from UNESCO, European Union and W3C Initiative, privileging positive discrimination in all areas of life, education, health, society and politics. More than giving hope and a normal academic life is an business opportunity for universities and institutes. eLearning graduate or post graduate courses are rare in Portuguese University and it is difficult provide technological and digital inclusion, simplifying physical and virtual interfaces and introduce accessibility for all in academic environment, professional internships and future jobs.

Moreover, it is urgent clarify accessibility culture and necessary explain in detail uneven realities, often confused and ignored, both in physical and virtual spaces, introduced by the World Health Organization (1980) in The International Classification of Impairments, Disabilities, and Handicaps.

Impairment is defined as “any loss or abnormality of psychological, physiological or anatomical structure or function.” Disability, on the other hand, means “any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.” Lastly, handicap is defined as “a disadvantage for a given individual that limits or prevents the fulfillment of a role that is normal.”

The word disability or others associated with public discourse, used arbitrarily and often in a derogatory way (presenting an idea of non-efficiency, something spoiled, which does not fit at all with the characterization of the full use of technologies and web contents) seem appropriate reflect about Solidarity Technologies implementation.

Take the paradigmatic example of Stephen Hawking who suffered since his 21 years old of Amyotrophic Lateral Sclerosis (ALS), a neurodegenerative disease that wears away at nerve and muscle, speak and communication function over time and confined the Physics Professor to a wheelchair. Although his profound disability, technologies made his life more easily and in Hawking’s best seller: A Brief History of

Time (1988) he say that he had led a fairly normal life having been fortunate to choose theoretical physics as a career, which is all in the mind, so that his disability was not a serious handicap!

The reality of disabilities, goes beyond mere definitions and seeks solutions, appearing in an overwhelming way in our fragile humanity, because at any moment of our lives, with greater or lesser severity, we already feel in physical or virtual spaces our physical, psychological or neurological limitations, which partially or totally handicaps our existence.

A historical perspective features accessibility and universality of ICT past and explain how it fits and justifies as an integral and fundamental part of the concept of Solidarity Technologies, highlighting the approach made by Tim Berners-Lee (1997) on the potential of Internet and its universality of access, based on networks, accessible to all, without barriers or obstacles.

I. Features and Concepts

Solidarity Technologies is different from the concept of Assistive Technologies (AT), also called Adaptive Technologies, Technical Aids or Support Technologies studied, among others, by Cook & Hussey (2002) and well defined in American with Disabilities Act (ADA, 1980). In this reference document, Assistive Technologies are a wide range of equipment, services, strategies and practices designed and applied to solve functional problems perceived by individuals with disabilities.

In the same transversal scope, HEART classification (Heroes Earnings Assistance and Relief Tax dedicated to American soldiers and veterans) combines knowledge about AT with technical, human and social components, described by Cook & Hussey (2002) as extrinsic capabilities of individual (as opposed to intrinsic abilities, such as motor control, perception, cognition, among others - which are human components), that can be divided into general capabilities (positioning systems, control interfaces, computers, digital devices, electronic outputs) and capabilities related to specific performance areas (communication, mobility, manipulation and sensory functions). In another perspective linked to technological activity, such as Matching Persons and Technology (MPT), AT are structured by following various tasks of daily life: domestic activities, health maintenance, leisure, personal care, employment, communication, guidance, mobility, vision perception, hearing impairments, cognition, reading / writing and learning difficulties.

In our opinion, Support Technologies are limited to various technical and technological aids (prostheses and orthoses) without including, in addition other dimensions like websites navigation, semiotics simplification of interfaces and the appropriate communication to networks, present in Solidarity Technologies: ICT accessible to all, which allow digital inclusion and universal access, bringing knowledge closer and making it available and suitable to all people, in a democratic and equitable way.

The identification of the target audience, knowing who are the people to whom the technologies are directed, the design and evaluation of the system, taking into account the intervention of different skills as ergonomics, cognitive and experimental psychology, semiotics, design and informatics in general, are other principles inherents to the concept

Roderick Sims (2008) highlights interactivity as an essential factor in Proactive Design for Learning (PD4L) and point six factors crucial design aimed at effective online teaching and learning: 1) a theoretical basis or theory that underlies selection updated teaching and learning methodologies; 2) innovation in actions and activities, incorporating the essential elements for carrying out a proactive assessment; 3) a design that brings together multidisciplinary teams to have relevant and appropriate skills to simplify tasks and achieve ergonomics; 4) interactions between course participants, as a basis for introducing new digital contents; 5) interactivity, giving the possibility to each participant to actively explore the contents, its relevance and its applicability; 6) personalization, allowing participants to be able to contextualize and situate their own learning objectives and outcomes.

Identification and use of Solidarity Technologies follow guidelines, specifications, software and tools provided by World Wide Web Consortium (W3C), a forum for information, communication, general knowledge, creation of consensus or standards for Web technologies, idealized among

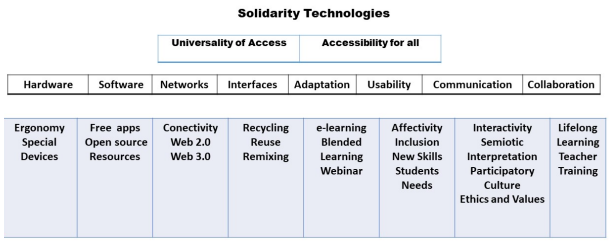
others, by Tim Berners Lee (World Wide Web and W3C mentor). The W3C guidelines enable the verification of interoperability, accessibility and usability of the Web standards and allow, for example, voice interaction in hypermedia documents (text, images, video and sounds), smartphones responsive screens and websites with accessibities specifications for all. The W3C created the Web Accessibility Initiative (WAI) in 1997. This group developed a set of accessibility guidelines for web content, presenting, in 1999, WCAG 1.0 (Web Content Accessibility Guidelines). In 2008, after almost a decade of improving WCAG and developing other guidelines such as UAAG and ATAG, this consortium presents an update of WCAG, with WCAG 2.0 since December 2008. In 2018, these guidelines were updated to WCAG 2.1, however enterprises, organizations and institutions worldwide forget the importance of accessibility and usability for all and rarely is a priority in their Websites or social networks navigation or browsers research.

The guidelines and Success Criteria from WCAG 2.1(2018) are organized around the following four principles of accessibility for all. Web content must be:

1. Perceivable - information and user interface components must be presentable to users in ways they can perceive (it cannot be invisible to all of their senses);
2. Operable - user interface components and navigation must be operable (the interface cannot require interaction that a user cannot perform);
3. Understandable - information and the operation of user interface must be understandable (the content or operation cannot be beyond their understanding);
4. Robust - content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies (as technologies and user agents evolve, the content should remain accessible).

If any of these principles are not true, users with disabilities will not be able to use the Web. Make electronic and information technology accessible to people with disabilities with standards for compliance is a real objective to Websites design. Compliance includes technical, functional and support standards are the important goals for WCAG and Section 508 of The U.S. Rehabilitation Act. The Americans with Disabilities Act or the ADA guidelines do not cover Web issues only technical and technological solutions. The ADA defers to WCAG 2.0 and 2.1 as acceptable accessibility standards for the internet.

The real scope of this paper is applying the characterization described here, based on a concrete case study experience presented a decade ago (Mourato, 2011) and verify its relevance and actuality, in order to adapt to another level of eLearning high education standards, without changes Solidarity Technologies concept core and main elements description (Picture.1).



Picture 1: Solidarity Technologies Main Elements.

According to Picture 1, Solidarity Technologies are:

-Accessible and adapted technologies to individual disabilities or impairments, ergonomically compatible, connected to technological devices, open source software and networks design simplification.

-Technologies for all: to have a voice, freedom and autonomy to communicate ideas, to participate in global debate, without any kind of constraint.

-Technologies that allow accessibility, usability, connectivity, collaboration, universality of access linked to hardware and devices adapted and customized, more than technical aids or supporting technologies.

-Technologies linked to Internet, social networks reality, chats, discussion groups, Web tools and software to collaborate, communicate and create a well-informed opinion and critical thinking.

- Technologies that enable the design of free and accessible educational resources for all, in collaboration or in autonomy, aimed at the inclusion of people regardless of their condition,

but versatile to adjust to physical limitations, disabilities or learning difficulties.
-Flexible technologies that allow communicating in both directions and transforming the way of learning and transmitting knowledge, namely the creation of step-by-step guidelines to simplify the use of the Web and technologies in general, as well as curriculum adaptation highlighting subjects as science, multimedia, computing, networks and telecommunications, in order to sensitize future professionals to create growing user friendly content, interfaces and devices.

II. Performance

Solidarity Technologies exhaustive identification mentioned above, explain how interactions between students' actual, real and physical needs are processed, how PBL methodology and semiotic interfaces development could provide virtual learning environments creation. Offer this Solidarity Technologies solution to eLearning of graduate and postgraduate courses and even lifelong learning, requires the analysis of some points of view:

1. Explore the theoretical basis for conceptualizing and measuring and how could adapt Solidarity Technologies at a real or virtual academic context, analyses students' needs, whether it is language apps, virtual tutoring, video conferencing tools, or online learning software;
2. Create and customize Virtual Learning Environment (VLE) where devices and resources specifications must be tailored shaping students progression, like alternative assignments (audio or tutoring reader), captioning & transcription for multimedia files, tagging images, simplify digital documents and electronic texts that could be read by OCR software (optical character recognition), using PDFs with text-to-speech programs, making any text accessible, regardless of one's personal needs.
3. Solidarity Technologies as digital community tools, where all courses documents could be delivery through the university library system, and students can access virtually to all files.
4. Introduce and define different dimensions of spreading information's and data application at problem-based learning objectives, outcomes, and expectations that originally set out to achieve.

The purpose of this VLE was to promote, in a semiotic perspective, the mediation of Learning Communities, collaboration, and communication practices with implications in participant' learning, perceptions and interrelations. Promote and operationalize Solidarity Technologies, concerning their attributes of universality and accessibility, in practical activities and Open Source Digital Resources development are others very important goals.
A constructivist approach (Vygotsky, 2003) to these principles implies questioning what skills and competencies are necessary for students to be able to use self-made technologies: researching, analyzing, organizing and presenting information in a collaborative way to their colleagues and teachers.
Speaking through an electronic device sometimes can remove interrelations and separate people in same academic perspective of life. It is crucial that this spirit of solidarity could be transport to eLearning courses.
The student's role in the acquisition and construction of their own knowledge is also logically altered, their learning is no longer individual or guided by others, but collaborative to be social and also to guide and facilitate learning.
Solidarity Technologies, can be centered on updating signs and metaphors for new virtual or technological learning spaces creation, in which pedagogical principles of Constructivism are explored. Perception about this subject is still an analogue process, each person has a particular way of seeing the World, reacts differently to environment provocations, interprets and interacts in their own way, has their own mechanisms and a unique life experience.
The teacher role in this context is to be a mediator, a learning advisor tutoring a set of qualified and carefully selected resources, in order to promote student development.

IV. Examples

Solidarity Technologies enable the use of Web 2.0. Communication, Collaboration and

Creativity tools such as social networks (Facebook, Twitter, Instagram, Tik Tok), personal pages (Netvibes, Pageflakes, Google sites), social bookmarking (Delicious, Strumple upon), news production (Digg, Podcast), social media (Youtube), personal learning spaces (Google universe) where everything can be copied, recycling, remixed and reconstructed.

With ICT it is easier to access the most diverse sources of information and cross-check information from different sources and of different nature (areas). Communication takes place in real or virtual time with other people (forum, chat, social networks) and fast and efficient means of information processing are available (analysis, classification, comparison of theoretical data, empirical experiences, simulation, among others).

An example of Solidarity Technologies application for resources creation happen on ICT and Multimedia disciplines in two semesters (2019/2020) at ISTEC.

It was possible to create group tasks using PBL methodology and collaborative tools such as Padlet, and a continuous assessment reflecting WCAG 2.1 principles. Students are invited to produce augmented reality demos, 3D images and videos using tools to provide all tags and description to develop user friendly contents, available for all. Students understand the importance of second language, semiosis analyses and accessibility paths in virtual interfaces for games and websites creation, using scripts and storyboards that must be accessible for all.

V. Conclusion

As mentioned, possible methodology based on Solidarity Technologies will be referred, to adapt the references previously described and apply them particularly in graduate and postgraduate e-learning courses in the field of Multimedia and Computer Engineering degrees, using previous experience, with the necessary adaptations and improvements. In this domain it can be suggested, to host at Advanced Technologies High Institute (ISTEC), a reference center for good practices in terms of Solidarity Technologies, linked to the existing research groups.

Another research hypothesis is promote a national repository of Solidarity Technologies for Universities, Institutes, Teaching Training Centre and lifelong learning, which includes step by step guidelines for anyone who wishes to assemble hardware and devices for physical or neuromotor impairments, how to use free software (with the possibility of source code changing) to implement adapted devices, as well as educational resources and electronic content recyclable, reusable and remixed, prepared to be applied in Web 2.0, Web 3.0, in semantic web and accessible for all.

UNESCO (2020) Sustainable Development Goal 4 (SDG 4) of the 2030 Agenda aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” by 2030. Tao Zhan, Director of UNESCO IITE describe that “advanced technologies provide unprecedented opportunities to reduce the historically contingent learning divide and increase access to knowledge and quality education, especially for vulnerable groups, including persons with disabilities. UNESCO IITE recognizes inclusive education as the capstone of equality and mainstreaming. Cutting-edge technologies and innovative tools substantially contribute to the implementation and actualization of these principles, particularly to ensuring equal access to information, education and self-fulfillment for all. At UNESCO IITE, we keep up our joint efforts to promote the high-potential use of Information and Communications Technology (ICT) for the creation of safe, healthy, non-violent, disability-sensitive, gender-responsive, equitable and inclusive educational environments.”

Maybe for this reason, UNESCO offers free courses about Guidelines and Success Criteria from WCAG 2.1 (2018), so that Web content marketing and advertising are completely readable for everyone. The objective is to retain and seduce designers and programmers to open the still closed world of World Wide Web to everyone.

Inspired by UNESCO Millennium Challenges about digital inclusion, this proposal tries to demonstrate how Solidarity Technologies, presented for first time as a theoretical and practical framework in my doctoral thesis case study based (Mourato, 2011) could be apply, only with small and predictable updates, for

potential implementation. This proposal meets reality to a wider field of inclusive education and the adaptation of ICT (hardware, devices and software) to interfaces design and interactive content.

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