Interaction in Accessible Virtual Learning Environments: An Interdisciplinary Challenge

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Abstract

This paper discusses digital Accessibility and Digital Inclusion, especially the difficulties and barriers which deaf and blind people are submitted to in daily life activities from work, education and leisure. Research results show that, in general, contents that are available in web are restrictive, mostly because they are produced by people with little knowledge about accessibility, which results in a certain inadequacy of the final product. Among the factors determining this inadequacy, are the development of language and fluency of dialogue, which are significantly impaired for the interaction of blind, which relies heavily on the hearing, and the deaf that use the visuality to obtain the information necessary for their knowledge. Lastly, it presents the theoretical configuration of a digital technologic instrument able to intermediate a fluent communication between people with different abilities, but identifying the main barriers to a material realization of this technological resource. The merit lies on the offer of a reflection that brings Social Inclusion from Accessibility with autonomy, which already became a part of State Policies in several countries around the world.

Keywords: innovation; social inclusion; digital accessibility; deaf; blind

1. Introduction

Social Inclusion is a theme with a strong humanitarian appeal around the world, and in Brazil it is gradually standing out. Following this line, the presented article proposes an academic reflection from the data published by a research group in digital accessibility. One of the assumptions is that, some way, these data might have an equivalence, even if very slight, with most countries in the world, reason why it is settled the appeal and urgency for seeking innovative solutions that guarantee the participation of people with some kind of deficiency in society. Considering the theme's scope, it was adopted here only a part concerned to deaf and blind people. The Brazilian Institute of Geography and Statistics (IBGE, 2012) census shows that there are 45.491.710 people in Brazil with some kind of deficiency. From these, about 35 million have visual deficiency and 6.056.533 has severe visual deficiency, in addition to the 506.377 completely blind. People classified as part of the group of hearing impaired[5] sums 9.717.318 people, and of these, 344.206 are completely deaf.

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[5] In this paper, except in the case of references of data released by government agencies, it will used the term deaf, undestanding that the deaf as a member of a linguistic community with his own characteristics and culture.

The research criteria certainly will be adjusted in the next senses, with a possible change of percentages, but with the collected results it is possible to observe a tendency that must be verified in other countries too. Therefore, there is a mass of people who present interaction difficulties and are put aside the society due to the lack of one of their senses. The Ministry of Education (MEC), which is the official organ of the public and private Educational System, has been gradually implementing the scholar inclusion policy, lined up with principles of the Convention about the Rights of People with Deficiency (Brazil, 2014). This initiative is supported, in Brazil, by the Decrees nº 186/2008 and 6.949/2009, which guarantee the right to inclusive education in all levels. Although, the data published by the Scholar Census MEC/INEP 2012 (INEP, 2012), point that there is a number of 8.212 blind people who are enrolled in common and special schools, which represents 1,44% of blind people settled by the sense. Regarding deaf people, the sense points 37.410 enrolments, which represents 10,8% of all the deaf people, and less than 2.000 of them are in high school.

Despite the political and administrative efforts, there is an undisguised complexity and urgency of producing numerical and qualitative results of inclusion when there is the intention of providing a better world for blind and deaf people. There is no aim of a fair society without social inclusion as a substantial clause. On the other hand, inclusion is not only about school access, but also about all the benefits of social dynamics, which are associated to the free exercise of citizenship on an organized society. Therefore, this is related to the use of languages that provide communication and the share of knowledge. Following this line, Shintaku (2009) reassures that there is no communication without the use of language and there is no society without an effective communication where everybody can be a part of, without exclusions. The article is organized as follows: section 2 presents discusses de methodological procedures of the Research Group. Sections 3 to 6 are related to varied domains of knowledge, demonstrating the interdisciplinary character of the research: Section 3 introduces the theme accessibility and Section 4 discusses de relevance of the conducted research. Section 5 discusses the differences of perceptive senses of deaf and blind people and how these senses influence the knowledge formation; Section 6 discusses the importance of Language and Communication and the differences between deaf and blind. Section 7 is a discussion about the research conducted by the group; Section 8 presents the Concluding remarks; and finally it is presented the References of this paper.

2. Method

This paper is a result of the investigations carried out by master and doctoral students of Postgraduate Program in Inclusive Virtual Learning Environments. The developed researches approach the problem in a qualitative way, besides using bibliographic and documentary research procedures. In relation to the research subjects, the reason of choosing this crop is in the fact that blindness and deafness acquired in older childhood tend to influence the new knowledge acquisition due to residual visual or auditory images in his memories, which facilitate the new knowledge formation. In the case of people born blind or deaf, there is a greater differentiation of mental representations in relation to seers and hearers, or in relation to those who became deaf or blind lately. Thus, this can be considered an extreme situation, from which the other possibilities will be more easily investigated. Therefore, it is noteworthy that all content is an argument from the real needs of deaf and blind people, raised using interview and focal group techniques. By means of questioning, individuals themselves could describe and configure their comprehension barriers in relation to assessed materials and technologies. In this sense, merit lies on the offer of a reflection that brings Social Inclusion from Accessibility with autonomy, since subject already became a part of State Policies in several countries around the world.

3. Accessibility

Accessibility, while being an academic subject, is associated to the concepts of Universal Design, where the environments must be made and executed in order to attend everyone, by removing barriers that hamper the free exercise of citizenship. Following this principle, the Brazilian Accessibility Regulation – NBR 9050 (ABNT, 2004), defines accessible environment as one that can be perceived by all kinds of people, including those who present physical, intellectual or sensorial limitations. Therefore, Dischinger (2000) adds that accessibility occurs by the removal of architectural and information barriers. Bins Ely et. al. (2001), reassuring Wright (2001), amplify the importance of these arguments by affirming that the environments' design must guarantee the participation and interaction of several types of people as much as possible without the need of adaption.

From the legal point of view, the Decree nº 5296 from December 2, 2004 (Brazil, 2004) characterizes accessibility as an agent that regulates conditions of a safe, autonomous or assisted utilization, of spaces, furniture, urban equipment, services and others, for people with and without deficiency. In these conditions, the determinant factor lies on the comprehension and recognition of the existing differences between the individuals and the correspondent dimension of their world perception, regardless of them having deficiencies or not. The academic view of accessibility as a research field is guided to the interdisciplinary approach of these themes, accordingly to the losses that restrict disciplinary view might result in. The main orientation given to accessibility, with interdisciplinary bias, belongs to Technologies of Information and Communication (ICTs), especially the education based on web, for deaf and blind people. In other words, is in digital technology access, having as starting point the way of thinking of people with these characteristics, which are also whom found solutions will benefit. Having that said, the Accessibility mentioned here is referred to the action of giving access to ways of communication and entertainment available nowadays. Therefore, Digital Accessibility is basically a group of attitudes and products capable of promoting opportunities for all citizens, in order to provide, by an efficient and democratic manner, the digital technologies and facilitate their insertion in society. Then, the objective is to make the user auto-sufficient, without the need of any complementary help, support or interaction with other people to understand the technology functionality and the accessed content in their navigation. In this article, it will be approached only the particularities related to deaf and blind people, who constitute specific groups of people with different mental images due to their perceptual abilities.

4. Relevance

The numbers presented on the IBGE Census (2012) show with precision the tough reality, where only an insignificant number of blind and deaf people are in school, despite the existence of favorable legislation. On the other hand, formal education, based on public and private schools, are massively adopting the digital technologies supported on Internet and e-learning. However, the technologies that invade people's daily lives are thought and produced, in big majority, without consideration to the differences and abilities of deaf and blind people, and consequently creating barriers capable of exclude these people. The assistive technologies, those that seek to adequate technologies to people by giving them access conditions, come in shy presence and usually arrive late in the market. In this sense, digital technologies development faces an important challenge that demands innovation, since there are unexplored markets regarding digital inclusion, reassured by the National Inclusion Politic and by favourable current legislation. As an example, the decree Law nº 5.296 says that all the portals and sites of public administration must mandatorily have their contents accessible to people with different types of abilities and ensure them full access to the available information.

The World Wide Web Consortium (W3C), an international community that works to develop Web standards. Among the activities developed by W3C is Web Accessibility Initiative (WAI), which is a group that develops strategies, guidelines and resources to help make web accessible. This group produces a document called Web Content Accessibility Guidelines (WCAG) (Caldwell, Cooper, Reid & Vanderheiden, 2014), currently in version 2.0, that presents recommendations and guidelines to achieve this goal. According to WAI (2014), the four guiding principles of web content accessibility are: Perceptible, Operable, Robust and Comprehensible. In other words, web content must be perceptible, operable, robust for use with assistive technologies and comprehensible to its users. Due to these principles and other constraints, it was developed a group of guidelines that seek reducing barriers for people with distinct abilities. However, Kelly et al (2007) argue that, although flawless in its structure, WCAG is too generic, being applicable to simpler contexts. According to the researchers, the recommendations are not sufficient to contexts that require analysis and interpretation, such as learning contexts. In addition, according to Macedo (2010), WCAG's recommendations are generalizing and are not trivial for teams and publishers. These arguments motivated the researcher to propose supplementary recommendations to e-learning. Nevertheless, there still is a vast explorative field in this direction, especially if considered the characteristics and particularities of deaf and blind people.

5. The Perception, Congenital Blindness and Deafness

Perception, in this work, is considered as the representation of objects, places, people and even feelings, in individuals' minds due to their experiences within the world and how this information is processed in their brains. This experience with the world and the correspondent mental representation are built from the accumulated sensory stimuli throughout life, but differ from one person to other.

But, it seems that this difference is more pronounced for deaf and blind people because to them, the sensory experiences are different. Even without a consistent scientific proof, authors tend to claim that the knowledge of people is formalized by an importance order: from visual to hearing, then to tactile-kinesthetic and finally to smelling and tasting. The adoption of this argument ensures the prevalence of vision and audition on mental representations' composition, which might be directly connected to the individual's "knowledge". Cattaneo et al (2007) highlight that mental representation is equal to object perception on its physical absence and the relation between mechanisms of perception and mental representations is a theme of intense reflection in Cognitive Psychology. Ormelezi (2000) argues that to perceive, learn and acquire a concept – in other words, acquire knowledge – is necessary a dynamic and constant psychological process of elaboration and organization of what is sensed, perceived and understood.

The formation process from most of the new knowledge of blind people, according to Nunes and Lomônaco (2010), is started by hearing, tactile and kinesthetic sensations, and for deaf people, the sensations are visual, tactile and kinesthetic. The authors ensure the argument that mental representations differ to deaf and blind people. Amiralian (1997), however, says that this perception is not better neither worse from those who see and hear, but only different, due to the presence of vision or auditory stimuli, or not. Nunes & Lomônaco (2010) share this point of view by arguing that blind people, especially congenital, have a different world experience from those who see. However, the final result of the acquired knowledge incorporates this difference in both cases. According to Duarte (2011), the blind congenital person only perceives the object on its totality if it fits on his palm; furthermore, he also does not comprehend ideas of space, shades, aesthetic and many other values built from the perception of static and dynamic images. Especially in relation to space, Sacks (2006) asserts that blind people defines it according to time of displacement and the contact with objects of interest, reassuring that blind people have in temporal relation a big part of their knowledge anchors. It means that the mental register of a blind person is sequential-temporal and not visual-spatial; also, it is thru speaking that this person can comprehend and develop abstract concepts. Lastly, Nunes (2008) adds that the lack of vision does not block the cognitive development of the blinds, however it settles different ways to achieve it. Regarding deaf people, the cognitive process has a similar functionality to the process in blind people, although with the replacement of hearing sensations to visuals. They create cortical registers of tactile and visual sensations that support the linguistic structure, even if poorly, thru signs. The image for them has the power of meaning contents, concepts, messages and emotions, which are the basis for cognitive development. This is the reason why kids who receive proper motivation from their families while in childhood have better conditions of producing interpretations and mental images more complex than those kids who do not receive external motivation (Quevedo, Busarello & Vanzin, 2013). Therefore, the main mental register in blind people is visual-spatial that will allow this person to build his abstract concepts.

6. Language and Communication

According to Quevedo (2013) Idiom and Language, even though frequently confounded, are different but very close things. Idiom is the formalized and structured Language. Language contemplates the idiom, but involves a group of meanings that go beyond the written and spoken word, due to its expressive multiplicity. Language, as a cerebral function and perceived by sensory organs, is in the center of human cognition. As a dynamic product of the acquired idiom, it allows the development of cognitive structure of people. The author adds that the "idiom is the front door to the establishment of language as a structuring factor of thinking" (Quevedo, 2013). Faraco & Moura (1998) follow this line by affirming that men was only capable of collecting knowledge due to the creation and use of language. As a consequence, the inexistence of an idiom hampers the language development and compromises the cognitive processes. On the other hand, the excessive use of language on information description, also known as "verbalism" might compromise the learning process and cause confusion in a blind person's mind. In this situation, according to the author, the blind person does not understand the meaning of the content even if he is able to repeat it; in that case, there is no knowledge acquirement. Thus, in order to categorize an object, the blind child depends on verbalization built with arguments congruent with his hearing and haptic experiences. From a social point of view, language supports communication, which is the responsible for sharing knowledge and the cultural development of any society. In this direction, Quevedo (2013) adds that "the richer, more diverse and fluent a language is, the bigger the capacity of comprehend, feel, reflect and judge".

On the foundations of Idiom and Language, according to the semiotic orientation of Quevedo (2013), lies signs and symbols, which together, form a sense generating unit via significance and significant, that are the basis of the communication process. This process composes the bidirectional transmission of information between sender and receiver that encode, decode and interpret the messages.

Acting concomitantly with language, there are also the non-verbal forms of communication, formed by gestures, facial expressions, static and dynamic images that are systems of non-linguistic signs, yet complementary. The Sign Language (SL), due to its expressivity, is considered by the researchers, the most adequate and important for deaf people because it represents better their social behavior and provides more expressive resources. Therefore, the visual-spatial language is considered as the "natural language" of deaf people. In Brazil, Libras (Brazilian Sign Language) was officially adopted as the natural language of deaf people. However, the habituated and fluent people in this language show severe difficulties on reading and expressing themselves in Portuguese language, especially in long, complex and metaphoric texts. To Pereira (2002) what guarantees text interpretations by deaf people is the visual-spatial language, since it allows deaf people to immediately find context clues, in which anchors the hypotheses of text content. The author adds yet that they need to know the writing "to be able to find words, the sentence's structures, as well as create strategies which allow them understanding the texts they read". In this direction, according to Vygotsky (2001), "a meaningless word is not a word, is an empty sound. Thus, the meaning is a constructive feature indispensable for the word.

7. Discussion

The Research Group motivation is to seek ways of utilizing digital technology in order to allow interaction between blind and deaf people. The researches' acting scenery is an accessible virtual learning environment, where both technology and contents are accessible for deaf and blind people. Approximately 95% of congenital deaf people have hearing parents and brothers and grow up in an environment where the language is in oral modality and they cannot perceive and communicate. This social-familiar environment demands a gestural communication since the beginning, although not always it is structured accordingly to the official sign language. Among the time this migration might happen or not, depending on the family's initiative. The learning of Portuguese language, in the case of Brazil, is frequently a late decision that requires a bigger effort from the deaf person in order to obtain the compatibility of signs that belong to sign language with the words written in other language and which they are not familiar, nor have a frequent utilization. So, for those who learn Portuguese, it becomes their second language, with a whole different grammatical and semantic structure. The sign language, for deaf people, has better potential on expressing feelings, anguishes, pains, pleasures, apathy, importance and many others. These expression skills, is of great difficulty for them when manifestation is in Portuguese language. The Sign Language is basically structured without prepositions, pronouns and cohesive links between phrases. For example, the grandmother address, in Little Red Riding Hood's story, is shown in this phrase: "I live near the mill and the lake, next to the big three". In Libras, the syntax would be: "mill near lake next three big" (GOULÃO, 2014). This conversation, when mediated by human translators, occurs with certain naturalness; although the automation thru digital technology requires dozens of softwares and database, and a high processing capacity. Nevertheless, until nowadays there is no software that is sufficiently developed and fully capable of these tasks. There are only a few experimental software, whose solutions are still quite far from allowing a fluent interaction.

The resources available to deaf people, on television or internet, are restricted to the presentation of closed caption, videos previously recorded of human Libras translators or people making simultaneous translation, by appearing on a small window on the right side bottom of the computer or TV screen. One possibility is in signwriting use, which is sign language writing system. However, it is not yet sufficiently available and widespread among deaf people. On the Learning Objects Production, the research group currently studies several narratives that might help the knowledge acquisition process. These few resources, however, are insufficient to convince deaf people to not form communities composed exclusively by deaf. In this sense, Obregon (2011) rescues Jungian's vision of the psychological factors that reassure the voluntary isolation that they are submitted to. More than a physical difference, deaf and hearing people have a language difference and, without a shared language, it is difficult to have an interaction. Blind people's main way of communicating is through audition and speaking, but this process requires the verbalization of all visual information (Quevedo & Ulbricht, 2011). Due the language, the interaction between blind and seers is easier than the interaction between deaf and hearing people, but the full comprehension is given by a good perception and the mental alignment between them.

Television, cinema, theater, museums and landscapes, the collective games and others are visual experiences of difficult sharing with congenital blind people, but a little easier with people who become blind in late childhood.

In relation to Braille writing system, there is a myth regarding its efficiency. The National Federation of the Blind[6] published the results of a research which shows that less than 10% of the American blind population does not know how to read Braille and consider this method overpassed when compared to the possibilities of screen readers and audio description (CMDV, 2014). It is estimated that in Brazil this number does not go beyond 5%. The computer use and the internet access is possible for a small part of the blind population, although for not having the vision of elements that compose the screen, they are restricted to TAB key, which takes too much time of navigation. On the other hand, the blinds only have access to contents that can be identified by screen readers, that are software relatively well developed for this task, although cannot describe images. The task of describing images in order to make them understandable for blind people still depends on human interference, especially through audio description (Nunes, Machado & Vanzin, 2011). Regarding the content related with TV and Internet, Masini (1996) affirms that nowadays the blinds are submitted to patterns adopted by people with normal sight, in which knowing requires seeing. This author defends a deconstructive attitude of this paradigm that stimulates communication barriers with blind people. In other words, make the visible more audible and tactile; since for an adequate comprehension about how blind people perceive the world it is necessary to contemplate the perception question. The meanings of things are given by deaf people through their sight perspective and by blind people through their audible and tactile perspectives. It means that there is a linguistic and perceptive conflict between them that must be overcome, since they need to unite perception with the information given to them. These aspects are still far from being overcome by technology, which means that technology does not yet offers automated instruments capable of making the necessary linguistic conversation and fluent of signs in voice and voice in signs.

8. Concluding Remarks

Communication between blind and deaf people might currently be the biggest challenge to Information Technology. Nevertheless, there is still an indisputable possibility of scientific investigation in the universe of deaf and blind people in order to know its real dimension and truly associate the technologic digital innovations to their needs. The resources and solutions that are offered to the deaf and blind people must first be properly explained as requirements, by means of their participation. Only in this way there will be the use of technology to include these people. The challenges are big, but the social relevance of this theme is even bigger. To Science, the challenges are put in order to reach solutions that will respond to technologic innovation. Having that said, there is a vast field of opportunities with humanitarian relevance presenting a big challenge: Social Inclusion. There are very important initiatives in this direction in several Universities around the world, showing commendable results and decisive contributions. In the same way, this Research Group aims to obtain resources and services that amplify functional skills of deaf and blind people and allow them to develop their lives independently in the society. Therefore, our technologic horizon aspires a communicational multi-linguistic platform, able to provide the syntactic and semantic conversation of different languages with their emotional ingredients, socio-affective and metaphoric, able to effectively integrate people who perceive differently, but are actually equal between them. The challenge remains.

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