Information and Communication Technologies in University Libraries: Relevance for Users with Disabilities

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Abstract

Digital and assistive technologies are of great relevance to the social, educational, and professional inclusion of persons with disabilities. Within this context, we aim to describe the relevance of information and communication technologies for persons with disabilities in the context of university libraries. Data were collected through a bibliographical research based on secondary sources, namely books, journal articles and other reference materials in the area investigated. The obtained results revealed that although resources such as digital and assistive technologies are available in the market to improve the user experience of persons with disabilities, most university libraries are still lacking several of these resources to supply these users' information demands. Even with laws ensuring the right to full accessibility, several higher education institutions are still omissive in this regard, leaving their students with disabilities on the margins of the learning process through the support of the university library. On this matter, we emphasize that university libraries must develop their abilities aiming to promote informational and communicational access to users with disabilities using digital and assistive technologies.

Keywords: digital and assistive technologies; university library; people with disabilities; accessibility.

1. Introduction

Digital Information and Communication Technologies (DICTs) constitute a more advanced technology type which will enable any information to be processed. This new scenario led to complex changes in people's lives with regards to the search for instant information and communication (Kenski, 2012). On this matter, Garcia et al. (2012) highlight that "[...] digital resources are computerized elements that enable contents

to be addressed in materials such as images, videos, hypertexts, animations, simulations, webpages, education games, among others" (*p. 82*).

In this perspective, digital technologies promote a context of social interactions and acquire a multiple, hybrid and multifaceted nature, because these forms of sociability point to displacements in the socializing process.

It can be deduced that digital technologies stem from the convergence of media such as video, sound, and images conveyed to resources such as laptops, tablets, smartphones, interactive whiteboards, among others. These technologies promote a new structure in the social space, bringing about changes and new forms of interactions between people, as well as diversified ways to acquire and transfer information and knowledge. DICTs enable several forms of socialization and identity building (both collective and individual), reflecting in a diverse way of teaching, prioritizing ethical formation, intellectual autonomy, and critical thinking (Ministério da Educação, 2000).

Furthermore, access to digital technologies as a tool to relieve social exclusion impacts directly on several teaching modes, among which is Special Education. It should be emphasized that this technological empowerment surpasses the right for education, inclusion in the job market and active participation in society.   As such, assistive technologies tend to enable the autonomy of persons with disabilities and/or special education needs through their tools and resources aimed mainly at promoting the independence of persons with disabilities and/or specific needs. On this matter, the Committee for Technical Help states:

> Assistive Technology is an interdisciplinary knowledge area, which encompasses products, resources, methodologies, strategies, practices, and services that aim at promoting functionality related to the activity and participation of persons with disabilities, inabilities, or reduced mobility, targeting their autonomy, independence, life quality and social inclusion. (Secretaria Especial de Direitos Humanos, 2009, p. 9, translated from the original version in Portuguese).

Therefore, these technologies may be used so that users can remotely execute ordinary daily activities such as opening and closing doors, turning lights on and off, among others, in a perspective of higher independence. In this sense, Pelosi (2003 cited of Vieira & Farias, 2017) clarifies that:

> Assistive Technology encompasses areas such as supplementary and/or alternative communication, adaptations for computer access; sight and hearing aid equipment; environmental control; game and playing adaptations; adaptations for the seating posture, alternative mobility, prosthetics, and the integration of this technology in different environments such as house, school, and workplace (p. 19376).

Assistive technology resources are organized according to the objectives to which they are destined for such as: prosthetics, orthoses, architectural projects for accessibility, adaptations in vehicles, posture adequacy, computer accessibility resources, as well as other artifacts.

For Sassaki (2019), inclusive spaces are those which implement measures to promote accessibility. They also promote the architectural, behavioral, communicational, instrumental, methodological, natural, and programmatic dimensions, which configure as accessibility dimensions that must exist in environments.

On this matter, communication accessibility is described, as it is directed towards spreading information regarding interpersonal communication (face-to-face, sign language), written communication (books,

journals, magazines, braille, and increased text size material), and the use of portable computers and mobile devices in the context of digital accessibility.

With this is mind, the following Research Problem was drafted: What is the relevance of Information and Communication Technologies to persons with disabilities in the context of university libraries? To provide an answer to this problem, the objective of this study is to describe the relevance of Information and Communication Technologies to persons with disabilities in the context of university libraries.

In this sense, we developed a qualitative bibliographical research in which data were collected in secondary sources, namely books, journal articles and other reference material related to the investigated area. According to Hutchinson (2018), this type of research deals with information and data that have already been collected from other sources and are easily accessed, thus being highly useful for several subjects. Still on bibliographical research, Boccato (2006) states that:

> [...] the bibliographical research aims to solve a problem (hypothesis) through published theoretical references, analyzing and discussing the various scientific contributions. This type of research will bring subsidies to the knowledge on what was studied, how and under what focus and/or perspectives the subject presented in the scientific literature was treated (p. 266).

As such, this article stems from a research conducted through surveys on informational material with analyzed and published data coming from printed and electronic sources.

2. The relevance of digital and assistive technologies in the context of information and communication of persons with disabilities

According to Decree n° 3.298 (1999), a disability refers to any loss or abnormality in the structure or psychological, physiological, or anatomical function, capable of leading to the inability in executing activities. Here we offer a brief clarification in terms of the following disabilities: vision (blindness or low vision); hearing disability and deafness; physical disability (which involves wheelchair users, persons with limited mobility and/or cerebral paralysis). Furthermore, we discuss the digital and assistive technologies for each specific case.

Vision impairment: can be characterized as a reduction in the visual response or a total lack of visual perception (Decree n° 5.296/2004). It includes persons with low vision, persons who can differentiate light and shape, and persons who are unable to make differentiations. In this sense, these individuals are divided into two groups: low vision, and blind.

On this type of disability, Rossetto et al. (2006) state: "Vision impairment refers to a diminished visual response, owing to congenital, hereditary, or acquired causes, even after clinical and/or surgical treatment and the use of conventional glasses" (p. 122).

In the context of visual disability, or blindness, there are many technologies able to promote autonomy and independence in activities to minimize the impacts of this disability. Indeed, bifocal, monofocal and magnifying glasses, canes, soroban, the cursive writing ruler, Perkins brailler and even resources such as canes with laser sensors, talking calculators and watches, are all available in the market.

When reporting to digital technologies, some of the resources used include text readers that act by transforming written text into speech (Jaws, Virtual Vision, Dosvox, NonVisual Desktop Access (NVDA)

and Voice over); Optical Character Recognition (OCR) digitizers and programs, which enable access to information through image digitalization and its targeting at screen-amplifying applications or screen and text readers; CPqDAlcance, which aids in smartphone use; Be My Eyes, which allows blind people to have assistance from volunteers, among others.

When discussing the educational context, Tesch (2015) emphasizes that the blind student is the one who needs the Braille System, or even other resources that help them in the development of academic activities. The low-vision student, on the other hand, is that who needs amplification, contrast, or optical resources (glasses with magnifying lenses, manual magnifying glasses, supporting magnifying glasses, teleloupe, Closed Circuit Television, etc.).

Regarding deaf or hard-of-hearing persons, Federal Decree nº 5.296 (2004) defines hearing disability as the bilateral, partial or complete loss, of forty-one decibels (dB) or more, measured by an audiogram at frequencies of 500 Hz, 1,000Hz, 2,000 Hz and 3,000 Hz. In this case, communication constitutes the most recurring obstacle in these persons' daily lives, owing to the predominance of the Portuguese language. As such, developing bilingualism is a necessary alternative to aid in these persons' communicational process, as emphasized by Almeida (2015):

> After several discussions, in the 1980s, it is settled that the Portuguese Language cannot replace the relevance of Sign Language in the deaf person's life. As such, as the etiology of the word tells us: Bilingualism is the use of two languages. Yes, of course the deaf person can learn an oral language, in the case of Brazil, Portuguese, but they should receive education in their natural language, and this is a right that serves them (p. 31).

Considering the changes that society goes through in terms of technologies, it is relevant to understand how communication and sociability ways can be better developed with the support of resources that will minimize information and communication divergence.

Among the resources available for deaf persons, there are auricular amplifiers and cochlear implants. In terms of digital technologies, we mention *Hand Talk* and *ProDeaf* (application with real-time translation of text and audio messages into Brazilian Sign Language – Libras); *VLibras* (application that aims to aid in propagating Libras; *Hearing Loop* (also known as T-coil, or Magnetic Coil, not very common in Brazil, which is used for hearing reception in cinemas and theaters for speech understanding).

In the sphere of persons with **physical disabilities** (wheelchair users, persons with limited mobility and/or cerebral paralysis), there are technologies able to make everyday activities more dynamic. According to Decree nº 5.296 (2004), persons with physical disabilities are those who show:

> Complete or partial alteration of one or more limbs of the human body, leading to compromised physical function which can manifest in the form of paraplegia, paraparesis, monoplegia, monoparesis, quadriplegia, quadriparesis, triplegia, triparesis, hemiplegia, hemiparesis, ostomy, amputation or limb absence, cerebral paralysis, dwarfism, limbs with congenital or acquired deformity, except for esthetic deformities and those that do not cause difficulty in performing functions (art. 5º).

In this sense, physical disability constitutes the loss of motor capacity, which may be a consequence of various types of congenital, hereditary, or acquired lesions. Among the most used resources by persons with physical disabilities we mention ramps for wheelchair users, as well as resources that help persons

with reduced mobility, such as walkers, wheelchairs, adapted vehicles, low sidewalks, adapted toilets, prosthetics, and orthotics.

In the case of physical disability, it is relevant to mention that prosthetics are devices aimed at replacing a limb or organ of the body, which has been possibly affected, while orthotics are devices aimed at correcting a certain alteration in a limb or body part. Regarding orthotics, Yamane (2017) clarifies that these are devices coupled to the body to stabilize or immobilize it. As such, they aid in the alignment, prevent deformities, protect against lesions or aid in movement or function.

On the functionalities of digital technologies, we mention applications such as Livox and TelepatiX, which promote alternative communication and aid persons with speech difficulties; the Guiaderodas, an accessibility that searches for more accessible places for persons with reduced mobility; the BioMob, which allows users to know where there are ramps and adapted toilets, for example.

It is also important to mention **deaf-blindness**, characterized as a disability due to the loss of both vision and hearing. It presents according to the degree of loss, which may be total or partial, affecting communication, mobility, and interaction.

On this disability, Reyes (2004) classified deaf-blind persons into four distinct groups: congenital deaf-blind persons, in which both channels are compromised since birth; deaf-blind persons with congenital hearing disability and acquired vision loss; deaf-blind persons with congenital vision disability and acquired hearing loss; deaf-blind persons who are born without sensory alterations but lose these functions over time.

In this case, it is relevant to point the role of the guide-interpreter, who knows two or more languages, as well as their communication systems and how to execute a visual description to guide a deaf-blind person. Because of the difficulties in the communication process, it is important to be close to this person; to touch them, to increase perception and comprehension, and to observe them as to make necessary adaptations.

Technologies are great allies in the perspective of contributing to create a more dynamic interaction process for these persons, since they can contribute to improve this aspect by using resources such as: gloves with small motors that vibrate and aid in communication; Morse Code, which is a letter, punctuation sign and number recognition system – although considered obsolete in the face of technological advances, is still used in certain situations –; clothes or smartphones that stimulate touch to transmit information.

On this matter, Nascimento (2006) states that, because of the interaction difficulties faced by these persons, the resources use for communication are: uppercase letters, dactilogic alphabet systems, tactile frames braille. As for alphabet systems, we mention adapted Brazilian Sign Language (Libras), lipreading, Tadoma (method in which the deaf-blind person puts their thumb on the mouth of the person who is speaking and the remaining fingers on their chin, to sense the movement of the lips and vocal cords), body movements, body signs, symbols, communication supplementary systems such as raising the head, drawing, among others.

As such, we conclude that knowing the specific needs of the deaf-blind person enables an efficient assistance, especially in the context of information and communication accessibility.

In the accessibility scenario, Reyes (2004) emphasizes that communication promotes the expression, reception and reframing of messages, with the purpose of dialoguing, understanding, informing, interacting, etc. As such, communication is peculiar to the human being, whether it is through gestures,

verbalization, signs, or codes. It is important that all individuals make use of the best artifact to communicate with others. For deaf-blind persons, there are specific resources that may be used to aid in this process.

3. Information and communication accessibility in university libraries

The matter of accessibility has been a widely discussed topic, such as in the specific cases of property, physical, and informational accessibility, among others. The term accessibility is not new, but rather gained repercussion due to the technological innovations of the modern world.

It is therefore necessary to integrate measures looking to fulfill the policies destined at persons with disabilities to minimize their hardships. In this perspective, accessibility is the way towards an inclusive society with favorable conditions of equity. Therefore, it is necessary to understand how university libraries can develop activities aimed at promoting the informational and communicational access, through digital and assistive technologies for users with disabilities.

Cunha (2000) emphasizes that the university library must analyze possibilities, understanding that the biggest challenge will be meeting the needs of an ever more dynamic clientele. This happens as new realities emerge in daily life, with remote classes, virtual environments, open science, institutional repositories, and new technologies, which enable the emergence of offers, creating demand for services and products related to them.

All in all, it is worth noting that university libraries are essential to support teaching, research, and extension activities in the university scenario, to mediate the informational access, as well as to aid in academic research through physical or electronic support. It is therefore worth noting that, according to the *International Federation of Library Associations* (1999), the university must:

> Provide access to information, ideas and works of imagination. They serve as gateways to knowledge, thought and culture;
> Contribute to the development and maintenance of intellectual freedom and help to safeguard basic democratic values and universal civil rights;
> Guarantee and facilitate access to expressions of knowledge and intellectual activity. To this end, libraries shall acquire, preserve and make available the widest variety of materials, reflecting the plurality and diversity of society;
> Libraries shall make materials, facilities, and services equally accessible to all users. There shall be no discrimination due to race, creed, gender, age or for any other reason (p. 1).

In this sense, it is necessary that the librarians, as information workers, position themselves to efficiently perform their roles in society, since their social responsibilities are beyond just the technical content. As for the library, it has several social responsibilities that need to be incorporated to the policy of the information unit to effectively perform its role.

As informed by Cysne (1993), the librarian work relies upon the technical competence that makes up the domain of the specificity of a certain knowledge, of skills with the goals of individual promotion, integration, and intervention, within a perspective in which the practice must be integrated into the social context so that the librarian knows its role in society.

With the National Policy on Special Education in the Perspective of Inclusive Education, there was a significant increase in the rate of students with disabilities and/or specific education needs in higher education institutions. This represents a challenge to university libraries and librarians in terms of full accessibility towards the target audience of Special Education, mainly regarding workers of the reference sector.

In relation to the accessibility requirements of students with visual disabilities, Ordinance nº 3.284 (2003) established a formal commitment of the institution in case it is required and until the student completes its coursework:

> a) maintaining a support room equipped with braille writing devices, braille printer coupled to a computer, voice synthesis system, recorder and copier with text magnification, screen magnification software, equipment for text magnification to assist students with subnormal vision, magnifying glasses, writing rulers, scanner coupled to the computer.
>
> b) adopting a plan to gradually acquire a bibliographical collection in Braille and audio tapes for learning purposes (pp. 1-2).

In this context, it is important that the library administration includes paragraphs in their policies encompassing services offered to this public in terms of practices, budgets, plans and objectives, as to guarantee access and inclusion.

Studies by Souza and Manoel (2008) state that for blind or low-vision persons, reading is done through the Braille language, audio books or document readers. However, most of the supports are still unavailable in libraries or in their planning processes.

Regarding deaf or hard-of-hearing persons, the challenges are equivalent; communication becomes an issue, since many librarians are unable to communicate using sign language, which makes the mediation process considerably difficult.

Federal Decree nº 5.626 (2005), in art. 2º, considers deaf persons as those who understand and interact with the world around them through visual experiences, expressing their culture through Libras. Persons with hearing disabilities may use sound amplifiers and lipreading as resources, which offer a significant support to the process of understanding these individuals.

Regarding library services, a shortage is seen in the communication process due to the difficulty in understanding the spoken or written languages, as well as a difficulty in using the internet, which consequently interferes with the search for information in databases, for example. On the other hand, it must be kept in mind that libraries can seek to improve the development of collections aimed at prompting reflections on the adversities that exist in society.

In this sense, Miglioli and Santos (2017) propose as strategies: selecting material on deaf persons, deafness and related subjects, making available a catalogue that can support the search on the theme, establishing contacts with external sources to request free material on deaf persons and deafness, verifying the possibility of electronic devices towards deaf person communication, such as *Viable* Brasil (Portuguese-Libras online translation), VLibras and ProDeaf (Portuguese-Libras translation software), among other applications in mobile devices, and considering the possibility of hiring qualified deaf personnel able to serve deaf users and who can train others in learning Libras and/or dactilogy.

Furthermore, it is important that libraries make adaptations that contribute to the visual context, such as lighting, which must be adequate to facilitate the comprehension – in the case of lipreading – as well as good signage in the sector.

In the context of users with physical disabilities (in wheelchairs and/or limited mobility), it is necessary to adapt entrances and railways, to lower front desks, and to create space between tables and shelves, so that users with physical disabilities can move around easily.

Torres et al. (2002) point that there was improvement in terms of accessibility of physical spaces, with reserved parking spots, for example. However, adaptation is necessary in certain institutions and facilities, so that persons with disabilities have the necessary autonomy to move around. Indeed, constant changes in society lead to displacements in the individual's identity building process, at the same time as they adapt to urgent needs. As such, in this process, libraries, as places of memories, forefront and knowledge building, need to accompany such demands and promote information access to its users.

In the case of deaf-blind users, tools such as the Braille system for reading and writing, tactile sign language as a mean of expressive and receptive communication, and tactile adaptation of resources are essential. The guide/interpreter has an extremely relevant role in this process of search for information in the library, with the possibility of working together with the librarian to promote these students' inclusion.

Samaniego and Muñoz (2004) highlight the need for developing different communication systems, which enable access to information and the establishment of interpersonal relationships, the use of touch as an information entrance channel and as a mean to compensate for sensorial losses in vision and hearing, and the fulfillment of the audience's needs through the multidisciplinary intervention of different areas of knowledge as significant in the intervention processes.

Therefore, considering that resources such as technologies may be used to minimize consequences stemming from these disabilities, the library has several adaptation possibilities so that it is effectively structured to meet these demands.

4. Final considerations

The accessibility theme, although an item safeguarded by the Ministry of Education in the process of institutional assessment of Brazilian university in the infrastructure item, still faces a long road ahead, since persons with disabilities and/or specific needs face difficulties in fully benefitting from the structures offered by institutions. Only a few of the several spaces available for students are reserved to this share of the academic community.

Even with laws regarding this theme, many higher education institutions are still omissive on the accessibility matter in its variants, leaving students with disabilities and/or specific education needs on the margins of the learning process, through the support of the university library.

Although resources such as digital and assistive technologies are available in the market to improve the assistance to users with disabilities, most university libraries lack these resources to meet this audience's informational demands. Investments toward this area are still scarce regarding the training of librarians who work in the reference sector, thus precluding accessibility to informational media.

Against this background, it is necessary for university libraries to have the following technologies: magnifying glasses; *audiobooks*; text readers (Jaws, NVDA, *Virtual Vision*, *Dosvox*, *Voice over*); Brailly System; OCR Programs to digitalize materials (OCR in *Google Drive*, *Software Simple* OCR); OCR for *smartphone* (*Camscanner* accessible, OCR *InstantlyFree*); screen magnifiers for blind persons or persons with visual disabilities.

As noticed, it is important to invest in visual communication, providing constant guidance on the need to keep silence in the library environment, as to not cause conflict in the comprehension of persons with hearing disabilities. Furthermore, collection-signaling strategies and technologies such as *HandTalk* and *ProDeaf* (Portuguese-Libras translation software) are welcome for communication support.

Regarding persons with physical disabilities – or limited mobility –, and deaf-blind persons, we notice the relevance of adapting physical spaces and of tactile resources for knowledge communication and comprehension.

The importance of hiring a Libras interpreter is also clear, because of the specificity of the disability for this person can support the process of information search in the library, at the same time as it can contribute to the people who already work there.

Lastly, the university library, whose mission is to contribute to the education of the students of the institution in which it is located at, must offer every support so that users with some kind of special need have accessible information, and that includes the collection, librarians and collaborators.

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