

Assistive technology and its relationship to the quality of life of people with disabilities

Tecnologia assistiva e suas relações com a qualidade de vida de pessoas com deficiência

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ABSTRACT: Introduction: Assistive technology offers products, resources, methods, strategies, practices and services that promote the functionality of people with disabilities, aiming at their autonomy, independence, quality of life and social inclusion. Its development and deployment can be considered an attempt to neutralize the barriers caused by disability. *Objective:* To understand and point out the relationship between assistive technology and quality of life of people with disabilities. *Method:* Topical life story was used. Three subjects with physical/motor disability, three with visual impairment and three with hearing impairment were interviewed. The relationship between assistive technology and quality of life was individually identified for each subject, in addition to the common patterns in responses considering the “group” of the disability. *Result:* Applications of assistive technology include activities of daily living, instrumental activities of daily living, education, work and leisure, which have different implications on the relationships with quality of life. *Conclusion:* Assistive technology is related to the quality of life of people with disabilities as it facilitates and enables the performance of activities, promoting autonomy and independence, and thus creating individual and social positive effects.

KEYWORDS: Disabled persons; Self-help devices; Quality of life.

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RESUMO: *Introdução:* A tecnologia assistiva apresenta produtos, recursos, métodos, estratégias, práticas e serviços que promovem a funcionalidade de pessoas com deficiência, visando sua autonomia, independência, qualidade de vida e inclusão social. Seu desenvolvimento e disponibilização podem ser considerados uma tentativa de neutralizar as barreiras causadas pela deficiência. *Objetivo:* Compreender e apontar as relações existentes entre tecnologia assistiva e qualidade de vida de pessoas com deficiência. *Método:* Utilizou-se a história de vida tópica. Foram entrevistadas três pessoas com deficiência física/motora, três com deficiência visual, e três com deficiência auditiva. Identificou-se individualmente a relação entre tecnologia assistiva e qualidade de vida, e os traços em comum nas respostas considerando o “grupo” da deficiência. *Resultado:* As aplicações da tecnologia assistiva englobam atividades da vida diária, atividades instrumentais de vida diária, educação, trabalho e lazer, que implicam diferentes relações com a qualidade de vida. *Conclusão:* A tecnologia assistiva está relacionada à qualidade de vida de pessoas com deficiência ao facilitar e possibilitar a realização das atividades, promovendo autonomia e independência, gerando efeitos positivos individuais e sociais.

DESCRIPTORIOS: Pessoas com deficiência; Equipamentos de autoajuda; Qualidade de vida.

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INTRODUCTION

Assistive technology (AT) is an interdisciplinary area of knowledge, which offers products, resources, methods, strategies, practices and services that promote the functionality of people with disabilities, impairments, or reduced mobility, aiming at their autonomy, independence, quality of life (QOL) and social inclusion¹.

AT can be applied in activities that require human performance, such as basic tasks of self-care and even professional, social, cultural, sports, and leisure activities². Galvão Filho and Damasceno³ say that to develop and make AT available are two of the attempts to neutralize the barriers caused by disabilities, which would enable the insertion of the individual in rich environments for learning, coming from culture. Rocha and Miranda⁴ point out that society needs to adapt to the needs of people with disabilities, dividing its spaces with equality, respect, and acceptance of differences. AT can assist it by providing or broadening the functional abilities of people with disabilities, promoting independent living and inclusion.

Access to the same things that other people have is a right that cannot be taken from people with disabilities, even if the mode of organizing the activities is rethought and modified⁵.

Accessibility promotes inclusion, equality of opportunities, and the exercise of civic consciousness for all. Actions that ensure accessibility for people with restricted mobility to transport systems, urban equipment, and movement in public areas raise the respect of their fundamental rights as individuals (p.46)⁶.

Technology already exists to communicate by phone with a hearing impaired person, and a person who is visually impaired or has severe physical limitations can communicate using the Internet. People with hearing or visual disabilities can participate in conferences with videos and spoken lectures. Braille, LIBRAS (Brazilian Sign Language), audio description, closed-captions, the DAISY system for books, and other adjustments of information are available, but used rarely (by television stations, book publishing houses, telephone companies, and conferences), for remaining unknown for people in general⁶.

QOL is a relatively new area of research, which is consolidating its borders and concepts and, in this sense, the definitions received by it are common, but usually disagreeing⁷. The World Health Organization (WHO) defines QOL as:

The individuals' perception of their position in life, in the context of culture and value system in which they live and regarding their goals, expectations, standards, and concerns (p.32, 33)⁸.

This definition incorporates two concepts to understand QOL:

Objectivity of the material conditions (the position of the individual in life and social relationships); and subjectivity (the knowledge of the physical, emotional and social conditions related to temporal, cultural and social aspects as they are perceived by the individual) (p.33)⁸.

The analysis of QOL under the objectivity of material conditions includes quantifiable and concrete elements, which may be modified by human acts. It aims to address the basic needs for survival, such as food, housing, access to health, employment, sanitation, education, and transportation. The subjective aspect emphasizes the historical, social, and cultural changes related to the conditions of material goods and services, which are interpreted individually. It characterizes not only life levels of objective data, because it connects the subjective and emotional conditions, expectations, achievements, perception about life, and issues such as pleasure, happiness, anguish, and sadness. It is not possible to exclude the impact of these variables, because they vary according to the individuality⁷.

Original and review articles have verified empirically and conceptually the use of AT for different purposes and populations⁹⁻¹². To analyze the ATs used by adults with different disabilities, and their relationship with QOL, contributes to their valuing, by highlighting their effects, which go beyond the functional scope, involving ethical, aesthetic, emotional, and subjective aspects, among others¹². Thus, this article tried to understand and point out the relationship between AT and QOL of people with physical/motor, visual and auditory disabilities.

METHODOLOGICAL PROCEDURES

The research was funded by the National Council for Scientific and Technological Development (CNPq), and approved by the Research Ethics Committee of the School of Medical Sciences of the State University of Campinas – FCM/UNICAMP, (opinion 794060).

The topical life story was used as methodological reference, considering the analysis of a phase or sector of

the personal life¹³. This method reflects the experiences and definitions provided by individuals, groups, or organizations. For this, an in-depth interview is made, in which there is usually release of critical thinking, and the expression of a careful look on the individual's own experience or on a fact. With this report, it is possible to reflect on the collective dimension from an individual point of view¹⁴.

The subjects were recruited by convenience. Inclusion criteria were: (a) condition of physical/motor, visual or hearing disability; (b) aged over 18 years, and (c) using AT. Exclusion criteria were: not having a disability, having other types of impairments or disabilities, being underage, and not using AT.

Nine interviews were made: three with people with physical/motor disabilities; three with people with visual disabilities; and three with people with hearing disabilities, in places of their preference. We prioritized in-depth research and not a high number of interviews, within a period of 6 months (period stipulated for the study), while maintaining a balance in the number of participants according to the analyzed disability.

All participants signed the Informed Consent Form, thus authorizing the use of their data for academic purposes. For people with visual disabilities, the form was read aloud in the presence of a witness.

The biographical interview was based on three issues: (1) life story, highlighting the condition of

disability; (2) types of AT used and desired; and (3) use of AT and social life.

When necessary, the interviewer added questions, but none on QOL, to assess whether the volunteers related AT to QOL spontaneously, what indeed has happened. The interviews were recorded and transcribed¹⁵, aiming at the full content of the data. People with hearing disabilities were interviewed with the aid of a sign language interpreter.

Data were categorized according to the disability of the subjects. First, the relationship between the use of AT and QOL was identified individually. Then, the common traits on the answers considering the disability "group" were considered, so we could elucidate the existing differences and needs, which manifested themselves according to the condition. The information were arranged in charts and additional descriptions were addressed textually.

RESULTS

Chart 1 presents the general characteristics of the respondents. We observe that the younger respondent was 26 years old, while the oldest was 45 years old. Seven men and two women participated in the study. Additionally, the prevalent education level was higher education and graduate studies.

Chart 1 – Characterization of the research subjects

Subject	Age	Sex	Disability	Education level	Occupation
Respondent 1	37 years old	Male	Physical/motor – Acquired	Graduate studies	Teacher, Athlete
Respondent 2	26 years old	Male	Physical/motor – Acquired	Higher Education	Athlete
Respondent 3	33 years old	Male	Physical/motor – Acquired	Technician	Tool maker
Respondent 4	27 years old	Male	Visual – Acquired	Graduate studies	Sociologist
Respondent 5	42 years old	Male	Visual – Acquired	Graduate studies	Physicist, Professor
Respondent 6	28 years old	Female	Visual – Congenital	Technician	Administrative Officer
Respondent 7	29 years old	Male	Hearing – Congenital	Higher Education	Administrator
Respondent 8	29 years old	Male	Hearing – Acquired	Higher Education	Network technologist
Respondent 9	45 years old	Female	Hearing – Acquired	Technician	Administrative Officer

The AT applications reported by respondents referred to activities of daily living (ADLs), instrumental activities of daily living (IADLs), education, work, and leisure. Charts 2, 3 and 4 present the description of the AT, its relationship with the QOL, and the AT desired by the respondents, according to the type of disability.

Respondent 1 (R1) had tetraplegia, without sensitivity or movement from the armpit level down. In the upper limbs, he had a considerable strength deficit, as he

was unable to move his fingers and his wrist movements were restricted. Respondent 2 (R2) also presented tetraplegia, although he had recovered some of the upper limbs movements and sensitivity throughout his whole body. Respondent 3 (R3), on his turn, presented paraplegia. The AT applications reported by the respondents with physical/motor disabilities referred to activities of daily living (ADLs), instrumental activities of daily living (IADLs), education, work, and leisure (Chart 2).

Chart 2 – AT used, relationship with QOL, and AT desired by the respondents with physical/motor disabilities

Subject	Type of disability	Main AT used	Relationship with QOL	Main desired AT
Respondent 1	Physical/motor Tetraplegia	Adapter for toothbrush and shaver; bath chair Adaptation for keyboard and TrackBall mouse Wheelchair Adapter for markers and chalk Adapter for table tennis racket Adapted vehicle	Perform tasks of personal hygiene Use the computer Move around Write Practice sports Drive	Adapter for small remote control buttons, phones, others Motorized wheelchair External skeleton
Respondent 2	Physical/motor Tetraplegia	Adapter for razor blades Transfer board Wheelchair Adapter for harmonica and drumsticks Adapted vehicle	Perform tasks of personal hygiene Move from one place to another Move around; improve posture, breathing, balance and safety of the trunk Play instruments Drive	None
Respondent 3	Physical/motor Paraplegia	Orthosis for orthostatic and ambulation in the home environment Aerobike Wheelchair Adapted vehicle	Walk Practice physical activities with the lower limbs Move around Drive	None

Regarding ADLs, R1 used an adapter to feed. Over time, the instrument was abandoned for lack of practicality. Regarding personal hygiene, he was not able to do it without the use of an adaptation. For brushing teeth or shaving, for example, he used an adapter made by himself using EVA. For the bath, he relied on a bath chair, among other strategies.

At the time of the research, R2 was able to hold toothbrushes and forks with no need for adapters, but continued using an adapter for his razor blade (verbal information).

Concerning functional mobility, R2 used a board to transfer, but resented not being able to use the strength of his own triceps for not knowing any other technology that could help in this regard (verbal information). He also reported that the use of the wheelchair helped in matters of posture, breathing, and safety and balance of the trunk (verbal information). R3 used an orthosis that allowed him to stand and walk inside his house, but not walk on a street, since its objective was only orthostatism (verbal information). R1 shared the desire to have a motorized wheelchair, because maybe, a motorized chair could help him get out of his

house to do something in the region without having to go by car. The motorized wheelchair might be a facilitator to climb slopes and ramps without help of a third party. He also cited the desire to have an external skeleton, which would help him stand and walk.

Regarding IADLs, in communication management, R1 used an adapter for writing, but discontinued the use for considering it troublesome, preferring to use other ways to hold the pencil. R1 possessed a computer keyboard adapter, and due to his difficulties of moving the conventional mouse (such as positioning the cursor on the screen and the time required for the execution of this activity), he chose to use the TrackBall mouse (verbal information). The peculiarity of the TrackBall mouse is that the user must handle a sphere typically located in its top to move the cursor on the screen, unlike the conventional mouse that requires moving the whole device on a flat surface or mouse pad. Due to his difficulty to make the pinch movement, R1 would also like for smaller objects to have adaptations,

such as remote controls, phones, objects with buttons, and even flash drives. As for R2, for not presenting any movement of the fingers, and consequently, having difficulty pushing buttons, he would rather use the mouse pad, and also the touch screen system for cellphones (verbal information).

Regarding leisure activities, R2 used to play musical instruments before acquiring the disability, and therefore, the rehabilitation team provided for him an adaptation for harmonica and drumsticks. It is important to mention that the respondent highlighted the role of the rehabilitation center in the restoration of his autonomy and independence (verbal information). R1

reported the use of an adapter for being able to hold a pool cue, however, as he was unable to position himself correctly to the pool table, the adapter did not work very well, and was thus abandoned. He used another adapter that allowed him to play table tennis, which already has the format to be fitted in the index finger (verbal information). R3 reported using an aerobike, when performing movement with his hands/arms, feet and legs also moved.

Concerning people with visual impairments, the respondents presented total acquired blindness, acquired subnormal vision (generated by Stargardt disease), and total congenital blindness (Chart 3).

Chart 3 – AT used, relationship with QOL, and AT desired by the respondents with visual disabilities

Subject	Type of disability	Main AT used	Relationship with QOL	Main desired AT
Respondent 4	Visual Total acquired blindness	Adapters for teaching materials Braille Cane Screen reader on the computer	Assistance in learning Read Move around Use the computer	Guide dog
Respondent 5	Visual Acquired subnormal vision (Stargardt)	Speaking clock Screen reader on the computer Braille	Information about the time Use the computer Read	Digital radio Environmental Accessibility in public universities as ramps, tactile floors, adapted elevators
Respondent 6	Visual Total congenital blindness	Adapters for teaching materials Screen reader on the computer Braille	Assistance in learning Use the computer Read	Braille printer Greater availability of films with audio description in theaters

Respondents quoted different strategies and resources employed for the activities of education and communication management during their period of literacy teaching. Respondent 4 (R4) stated that when he had low vision, having access to a notebook with wide lines and a ballpoint pen was essential. He pointed out that the adaptation of learning materials, depending on the approach, can be considered as an AT. For example, in childhood, when using texture for bodily schemes, mathematics models, cubes and prisms, to which he had access (verbal information). Respondent 6 (R6) reported that she received literacy teaching from her mother, through tactile stimulus that consisted of strings glued on paper, in the shape of the letters. She learned Braille after some time, when she moved from the countryside to the city. She entered a regular school at the age of 13, in the fourth grade, and through equivalency

education. Sometimes, her exams were given in Braille, and other times orally by teachers (verbal information).

Respondent 5 (R5) reported using Braille sporadically, but has changed it for the convenience of computers. He made use of a speaking clock which he described as very useful. In addition to a service of his cellphone operator for the alarm clock. For R5, even web pages are not accessible because they are developed for sighted people, while the person with visual impairment depends on specific programs to have the same opportunity. He did not have access to his own email by the system of the college to which he worked, as the device was completely inaccessible.

R6 cited that many things are released to the public, but it takes time for them to be accessible to people with visual impairments. One example of this

are the online social networks (Whatsapp, Youtube, and Facebook, for example) (verbal information). R6 commented that before having Internet access she was excluded from the conversation of her friends.

Regarding the use of AT to the mobility within the community, R4 highlighted the use of the cane as very significant to vision loss, as it becomes a stigma, at the same time that it is a feature that enables independence and freedom. At first, people with visual disabilities who are seen with the cane are labeled. Given this, its use is a way to socially assume being blind, since a person with visual impairment that is seen standing, without dark glasses and without a cane has his disability unnoticed (verbal information).

R4 commented that if he had another routine of life, and lived in a larger city, he would like to have access to a guide dog, which is still very limited in the country (verbal information). R6 missed having a Braille printer, and reported difficulties in his English course, for not having access to study materials. He would also like to have a car,

and that audio description movies were more available in theaters (verbal information) as a leisure activity option and/or of social participation. R5 would like to have a digital radio that tuned in to various radios, easy to handle. He would also like public universities to be adapted as they still lack accessibility, such as ramps, tactile floors, and proper elevators.

People with hearing disabilities who participated in the research were impaired, and only respondent 7 (R7) had congenital hearing loss (Chart 4). In summary, they highlighted the use of hearing devices, and LIBRAS (Brazilian Sign Language), even being oralized.

Respondent 7 (R7) did not use any other kind of technology beyond the hearing aid device. Respondent 8 (R8), in the other hand, explained that despite not liking to wear the hearing aid, if he did not it, he feels a certain revolt, by not knowing what people are talking about (verbal information). Respondent 9 (R9) pointed out that he would like some places to provide their contact via e-mail rather than phone numbers (verbal information).

Chart 4 – AT used, relationship with QOL, and AT desired by the respondents with hearing disabilities

Subject	Type of disability	Main AT used	Relationship with QOL	Main desired AT
Respondent 7	Hearing Congenital	Hearing Aid Device LIBRAS	Hear Communicate	None
Respondent 8	Hearing Impairment	Hearing Aid Device LIBRAS	Hear Communicate	None
Respondent 9	Hearing Impairment	Hearing Aid Device LIBRAS	Hear Communicate	Contact via e-mail of establishments

DISCUSSION

People with physical/motor disabilities stated to abandon the AT when it is difficult to handle or transport. The AT relies on the adaptation of the own user, therefore, must be easy to use. Its success does not depend solely on the disposition of the AT to replace the absence of the member or of its functionality, but also the adhesion of the person with disability¹⁶.

Adults with visual disabilities¹⁵ confirmed the relevance of software, citing DOSVOX, JAWS, Virtual Vision, TALKS, and Victor Reader (screen readers) and the touch screen system for cellphones. The subject-object relationship generates the experience, being able to connect the individual with the outside world. An example of this is when a person with visual disability can get a glimpse of a landscape provided by JAWS, experiencing sensations focused on the image produced by the software¹⁶.

The new information and communication technologies are the vehicle of visibility in the middle of other visible beings. It is possible to see beyond the visible eye. Your body is a tactile being, it can touch and be touched, as when the JAWS software through hearing, gives the visually impaired person a reading of the world (p.86)¹⁷.

For Santos and Pequeno¹⁷, accessibility to digital knowledge maximizes the time and capabilities of the digitally included person, because informatics is a support able to improve the living conditions of people. On the Internet, the person with disabilities find information about health, education, work, among others, in addition to socializing. For the authors, digital inclusion is essential for people with disabilities, and their access should not be limited to the information network, but the architectural barriers should be eliminated, appropriate programs and equipment inserted, and content in various forms provided.

For Fialho and Silva¹⁸, technology is relevant to the person with visual disability (by facilitating access to information), and to the people with whom they have relationships. Its effects go beyond the individual and reach the collective sphere. Technology must be disclosed and accessible to all persons with disabilities, including financially. The lack of information or financial conditions may cause families not to accept them, as cited in the interviews.

Maciel¹⁹ explains that non-acceptance is greater along those who have few economic resources, which minimizes their opportunities of qualified care. The potential and skills of people with disabilities are little valued in their communities of origin, certainly for having little clarification about these disabilities. The lack of knowledge leads society to consider disability as a chronic illness, a burden, or a problem.

To the subjects of the research, many people with disabilities are even prejudiced about themselves, when, for example, they do not use the cane, for finding it strange or out of fear of the opinion of others. The cane can be a stigmatizing symbol, for the person with a disability that uses it¹⁶.

Individuals with hearing disabilities use only the hearing aid device. Even not liking the device, not using it can lead to revolt. Not understanding the speech of people can lead people with disabilities to feel excluded, or suffer prejudice, which states the influence of the AT in social relations.

People with disabilities, by breaking their limitations in performing everyday tasks, establish a moral compensation, with the aim of remedying physical inequality, to save their dignity and facilitate their inclusion in social relations, even when it appears that this duty leans too much on their own volition, disregarding the external conditions to moderate such process¹⁶.

For Martins and Barsaglini¹⁶, any position adopted by the person with a disability does not cause his/her self-image to stop being corrupted by comparison, in the sense that, publicly, presenting oneself as different from the standard will always be in evidence. The visible or invisible difference can influence the dynamics of social interactions, because, to hide the difference, even if it is a defense against over exposition, the person still has the fear of being discovered, which is equivalent to questioning the events that the chronic conditions present. For Goffman²⁰, many attitudes of “normal” people are guided by ignorance, and bare no bad will. Such people need to be helped, and their indelicate remarks of unkindness and disdain, should not be responded.

The universal force of stigmatized symbols of disability manifests itself by being generalizing, incorporated and introjected even in cultures separated in time and space, perpetuating the experience of generations, always referring to the physical and moral depreciation of their bearers, and which may be visible to all (p.119)¹⁶.

There is an ambiguity regarding technologies, as they do not eliminate the stigma through the modifications carried out by the technical resources, which is often disregarded in the building of such devices. In some situations, the visibility of prostheses, wheelchairs, among others, publicly becomes the principle of the stigma, due to exacerbation of the difference. The use of AT, especially those hard to cover, can be associated to what Goffman²⁰ called stigmatizing symbols that, as bodily marks, convey social information that call attention to the difference, and therefore reduce the valuing of the person¹⁶.

According to ABNT²¹, accessibility is the possibility and condition of reach for use, with security and autonomy, urban buildings, spaces, furniture, and equipment. Architectural barriers (obstacles constructed in urban areas or in buildings) that prevent or hinder access to internal or external environments in public or private buildings, are important issues to be discussed²².

Society can only be accessible with a few basic issues, which are allied to technology:

- a) architectural accessibility: without physical environmental barriers in houses, buildings, spaces or urban facilities and individual or collective modes of transportation;
- b) communication accessibility: without barriers in interpersonal communication, writing and virtual;
- c) methodological accessibility: without barriers in the methods and techniques of study, work, community action and education of children;
- d) instrumental accessibility: without barriers in the instruments, devices, and tools for study, work, leisure or recreation;
- e) programmatic accessibility: without invisible barriers embedded in public policies and standards or regulations;
- and f) attitudinal accessibility: without prejudice, stigma, stereotypes, and discrimination (p.18)²³.

This discussion points out that AT extends the opportunities and maintenance of occupational roles, which leads to change in the lives of people with disabilities, possibly impacting directly on their QOL. The individual condition should be reflected (in tetraplegia, for example, there is a plethora of different compromises), because each person has specific needs and preferences, which lead them

to use a particular AT. The measurement of this singularity can be considered a limitation of this study.

CONCLUSIONS

AT can be related to QOL of people with disabilities as it is a facilitator of activities, and above all, enables participation, promoting autonomy and independence. This generates positive individual and social effects, helping people with disabilities to go from being unable to individuals able to perform the same activities that people without disabilities perform.

As for types of disabilities addressed and their relationships to QOL, we observed that for people with physical disabilities, the use of AT is linked to independence and autonomy to perform ADLs; health issues related to posture and breath; and locomotion and accessibility. For people with visual disabilities, the use is related to locomotion and access to information. People with hearing disabilities presented a less restrictive profile compared to other disabilities, which did not diminish the importance of the AT, essential to assist their audition. In all cases, the AT is subject to approval of the user, who need to adapt to it in order to use it.

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