

 <https://doi.org/10.56238/alookdevelopv1-169>

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**ABSTRACT**

According to the World Health Organization (WHO), the state of health of an individual is not due to the absence of disease, but to a complete state of physical, mental and social well-being. The new concepts pointed out by the International Classification of Disability and Health Functionality (ICF), appropriates a new view on the concept of disability, transferring this scope that the architectural barriers, social conducts and technological resources are situations amenable to the inclusion of the individual in the social sphere. Based on this assumption, we can interpret that the individual should be seen and cared for holistically. We should promote social spaces where diversity is favored, creating possibilities for inclusion of people with disabilities or reduced mobility through assistive technology resources (Pelosi, 2007).

**Keywords:** Occupational therapy, assistive technology.

**1 INTRODUCTION****1.1 OCCUPATIONAL THERAPY: A PERSPECTIVE ON THE IMPORTANCE OF ASSISTIVE TECHNOLOGY**

According to the World Health Organization (WHO), the state of health of an individual is not due to the absence of disease, but to a complete state of physical, mental and social well-being. The new concepts pointed out by the International Classification of Disability and Health Functionality (ICF), appropriates a new view on the concept of disability, transferring this scope that the architectural barriers, social conducts and technological resources are situations amenable to the inclusion of the individual in the social sphere.

Based on this assumption, we can interpret that the individual should be seen and cared for holistically. We should promote social spaces where diversity is favored, creating possibilities for inclusion of people with disabilities or reduced mobility through assistive technology resources (Pelosi, 2007).

According to the concept proposed by the Technical Aids Committee (CAT) of the Secretariat of Human Rights of the Presidency of the Republic: assistive technology is an area of knowledge, of interdisciplinary characteristic, which encompasses products, resources, methodologies, strategies,

practices and services that aim to promote functionality, related to the activity and participation of people with disabilities, disabilities or reduced mobility, aiming at their autonomy, independence, quality of life and social inclusion (CAT, Minutes of Meeting VII, SDH/PR, 2007).

The Occupational Therapist works in the daily lives of people enabling human doing, uses technology since birth. According to Pelosi, 2005 Occupational Therapy has been appropriating the practice of Assistive Technology.

The insertion of this resource in undergraduate courses in Occupational Therapy is still recent, but it is indispensable to say that this very brief insertion will be made in all undergraduate courses in the country (Pelosi, 2007).

When performing its function through this resource, it is of value to the Occupational Therapist to analyze the physical, sensory and cognitive capacities of the individual. Where the sociocultural aspects and the environment in which the individual is inserted should be considered (Pelosi, M.B, 2005).

The focus of the Occupational Therapist through this work is to promote function, that is, valences in the daily life of the individual. It is from the demand brought the Occupational Therapist must have an individualized look build with the individual assistive technology resources that will fit as helpers of greater autonomy and independence (Fukuyama, 2018).

To deepen the importance of the occupational therapy professional in the Assistive Technology Roll, it is important to rescue historical concepts described in the following section.

## **2 HISTORICAL INTERTWININGS OF OCCUPATIONAL THERAPY AND THE INDUSTRIAL REVOLUTIONS**

Occupational Therapy has as a historical landmark of birth in the Anglo-Saxon countries, in the early twentieth century, having as a principle the moral treatment (Morrison, 2016), consisting mainly of women nurses and social workers. The first considered Occupational Therapists were Eleanor Clarke Slagle, Social Worker, Susan Cox Johnson, Nurse, both of whom sought to prove that the occupations helped the physical and mental health of patients (Morrison, 2016).

However, Susan Elizabeth Tracy, considered the first Occupational Therapist, published in her book "Studies in Invalid Occupations" of 1910, the first text of Occupational Therapy, where only properly trained nurses could use the occupation for the therapeutic (Morrison, 2016; Reis, 2017), In contrast, the first training school for Occupational Therapists took place in 1915 in the city of Chicago in the United States of America (Morrison, 2016).

Although Occupational Therapy had its genesis in the early twentieth century, historical milestones of the Industrial Revolution had already happened, the 1st Industrial Revolution (1IR)

[1765-1800] and the 2nd Industrial Revolution (2RI) [1870-1900] (Dathein, 2003). The first two revolutions were marked by the transition from the manufacturing mode of production, that is, a manual mode of production that used the artisanal capacity of the one who produced, to the use of machines in the production line, replacing men with machines and sectorizing the workers, thus making a form of serial production, where several specialized workers (with the help of machines) were separated into several specific and repetitive functions (Dathein, 2003).

With the first and second world wars there was an expansion of Occupational Therapy in several areas (orthopedic, neurological and psychiatric) since the profession was configured making the so-called "reconstruction auxiliaries" (Valer, Ortega, & Montaña, 2013). At this moment it is understood that the Occupational Therapists performed the rehabilitation of the mutilated from wars thinking about the reinsertion in the labor market to compose labor in the production lines of the industries for the reconstruction of the country (Valer, Ortega, & Montaña, 2013).

The beginnings of the 3rd Industrial Revolution (3RI), which began in the 50s, had as a distinction the improvement and new advances in the technological field, began to cover the field of science, integrating it into the productive system (Maia, 2012). This phase is known as the Technical-Scientific-Informational Revolution (Maia, 2012). Around this same time, the World Federation Occupational Therapy (WFOT) was founded in 1952, with only ten countries initially (Liu, 2018).

3RI has had a great technical and scientific development. In this period the first electronic equipment was created, such as televisions, satellites, robots, computers, among others, in this way electronics emerged as the center of modernization in the twentieth century (Cuogo, 2012).

In several countries, especially developed ones, they have begun to use these new technologies in the health process. Occupational Therapy has also begun to make use of these resources such as: telerehabilitation, use of motorized wheelchairs, use of video games for rehabilitation, as well as studies with robotic therapy (Liu, 2018).

From the turn of the century there was a progress in electronics and all the technology developed at 3R, thus starting a new process, the 4th Industrial Revolution, called Industry 4.0. Thus, Industry 4.0 presents an automation of processes, favoring a speed in work processes (Schwab, 2019; de Oliveira, & Simões, 2017).

With Industry 4.0, there were significant changes for men and their occupations, such as: leisure, work, education and health, so Occupational Therapy began to use various resources such as applications on mobile devices, 3D Printing and internet of things, to assist in their performance favoring gains to the patient and in their occupations.

### 3 INDUSTRY 4.0 AND THE PRACTICE OF OCCUPATIONAL THERAPY

The fourth industrial revolution, or Industry 4.0, is a concept developed by the German Klaus Schwab, director and founder of the World Economic Forum. Today, it is a reality that covers all areas. According to him, the fourth revolution "will fundamentally transform the way we live, work and relate." (Schwab, 2019).

Industry 4.0 is supported by 9 technological pillars (Fig. 1), namely: Autonomous robots; Simulations; Integration of horizontal and vertical systems; Internet of Things; Cybersecurity; Cloud Computing; 3D Printing/Additive Manufacturing; Augmented Reality and Big Data (Schwab, 2019; de Oliveira, & Simões, 2017).

Due to the technological immersion experienced with Industry 4.0, there are also changes in the performance of occupations. In this way, several immersions were carried out of the performance of Occupational Therapy with the rise of Industry 4.0, thinking of achieving the various possible therapeutic objectives.

The use of the 3D Printer along with the practice of Occupational Therapy has been growing, whether in the development of prostheses, orthoses and adaptations. (Junior, de Souza Cruz & Sarmanho, 2018) They show the development of prosthesis research with the use of the 3D Printer, enabling interventions and improvements for the occupational performance of users.

(Amaral et.al 2017) point out the use of 3D Printing in the confection with the patient with Parkinson's, in the development of a universal adaptation and how this favored for the occupational performance of the patient. (Assad et.al 2017) discuss the development and application of a shoulder orthosis, from the scanning, modeling and 3D printing and verified that in addition to presenting an interesting design to the user, it also allows him to perform the Activities of Daily Living and Instrumental with independence.

Another pillar of industry 4.0 with a lot of use in occupational therapy is augmented reality, also known in the therapeutic environment as game therapy. (Leontius Caiana, Lima Nogueira & Dantas de Lima 2016) describe some consoles and devices used by occupational therapists in clinical practices, such as: Nintendo Wii ®; Playstation Move®; XBOX Kinect®; Software and Applications.

(Days et.al 2019) They point out that the introduction of technological resources in the occupational therapeutic process can be a strategy to favor, in the intervention of occupational therapy, a better performance in a significant activity for the subject.

Among the Occupational Therapy sessions, game therapy can be used with different audiences, so that established therapeutic goals can be sought. Thus, Occupational Therapists use augmented reality with children, young people, adults and the elderly with different pathologies (Cerebral Palsy, Autism, Down Syndrome, Learning Disorders, Stroke, Parkinson's and Dementias, among others)

(Days et.al 2019; Pelosi, Texeira and Nascimento 2019; Moraes et.al 2016 & de Oliveira, dos Santos & Rocha, 2020).

Some studies were directed to the development of games, software and applications, such as: Timocco platform as a platform developed by occupational therapists as a work tool in child rehabilitation (Pelosi, Texeira and Nascimento 2019), the electronic game Duschs Ville (Klein et.al 2015), The construction to promote improvement in the organization of day-to-day tasks (Vicente et.al 2018) and the software develops® (Alves de Oliveira, 2015).

Another perspective is the increase in the use of telecare and telemonitoring, much driven by the COVID-19 Pandemic (Macêdo et.al 2020) and the use of Robotics in the rehabilitation processes with patients with Stroke (Eras-Garcia, 2020) (Terranova, 2012), with patients with head trauma in childhood (Vallejo; Rosendo 2017).

#### **4 IDEOLOGICAL PERSPECTIVES OF SOCIETY 5.0**

Society 5.0 is a proposed model of social organization in which technologies are used to create solutions focused on human needs. In line with this innovative potential of the concept of Society 5.0, brought by the Japanese government, to face the present and future challenges, building a future in a different society, that is, centered on the human being and its complementarities, and in the resolution of social problems in a systemic and integrated way (Fukuyama, 2018).

However, the idea of Society 5.0 goes beyond the search for greater productivity and efficiency of processes with the help of internet networks, sensors and microchips. It is about the convergence of all technologies with the aim of facilitating the lives of human beings (Fontanela, Silva dos Santos, & Albino, 2020). It seeks to offer solutions to the problems of the twenty-first century, which include the cure of diseases. Thus, Occupational Therapy must integrate its knowledge, with technological and social changes to favor better occupational performance with the help of technology.

#### **5 ASSISTIVE TECHNOLOGY AND BRAZILIAN LEGISLATION**

Considering that it is fundamental to have effective legislation and public policies that guarantee quality of life, accessibility and rights to people with disabilities, the process of reflection is necessary to understand the current scenario to promote access to equal rights, (Scatolim, 2016).

In Brazil, the Technical Aids Committee - CAT was established by ORDINANCE No. 142, OF NOVEMBER 16, 2006, which brings the following concept:

"Assistive Technology is an area of knowledge, of interdisciplinary characteristic, which encompasses products, resources, methodologies, strategies, practices and services that aim to promote functionality, related to the activity and participation of people with disabilities, disabilities or reduced

mobility, aiming at their autonomy, independence, quality of life and social inclusion" ATA VII - Technical Aids Committee (CAT) - (2007).

In Brazilian legislation, the term "technical aids" is still used when it comes to the guarantee of resources that has as its main objective, to improve the functional abilities of people with disabilities.

The terminology "Assistive Technology" was approved by the Technical Aids Committee - CAT in 2007, considering the national trend already established in academic contexts and in the product market, starting to be used in the legal documentation produced by it, in order to encourage the use of the term in the context of human resources training and research Ordinance no. 142 (2006).

The CAT proposes that the terminologies "technical aids" and "assistive technology" be considered synonymous, due to the presence of both in our legislation, in addition to indicating that the term "assistive technology" is used in the singular, because it is an area of knowledge and not a set of equipment, which should be addressed as "assistive technology resources", or services and procedures, which should be addressed as "assistive technology services" Ordinance no. 142 (2006).

Considering Decree 3.298 of 1999, Art. 19, technical aids are defined as compensating elements for functional limitations of motor, sensory and mental origin, with the objective of overcoming barriers and favoring the social inclusion of people with disabilities, namely: I hearing, visual and physical prostheses; II - orthoses that favor functional adequacy; III - equipment and elements necessary for the therapy and rehabilitation of the disabled person; IV - equipment, machinery and work utensils specially designed or adapted for use by persons with disabilities; V - elements of mobility, care and personal hygiene necessary to facilitate the autonomy and safety of the disabled person; VI - special elements to facilitate communication, information and signaling for people with disabilities; VII - equipment and special pedagogical material for education, training and recreation of the disabled person; VIII - environmental and other adaptations that guarantee access, functional improvement and personal autonomy; and IX - collecting bags for ostomy patients Decree n. 3,298 (1999).

Decree 5.296 of 2004 presents Chapter VII entitled "OF TECHNICAL AIDS" which describes various governmental intentions in the area of assistive technology, technical aids are again addressed that are defined as products, instruments, equipment or technology adapted or specially designed to improve the functionality of people with disabilities, with reduced ability favoring personal autonomy, total or assisted Decree n. 5.296 (2004).

The resolutions No. 316 of 2006 and No. 458 of 2015 made available by COFFITO, brings as competence of the occupational therapist the use of Assistive Technology and other measures and specifically in the Activities of Daily Living - ADLS and Instrumental Activities of Daily Living,

reinforcing the relevance of the same for the practice Resolution n. 316 (2006) and Resolution n. 458 (2015).

## **6 THE ABANDONMENT OF ASSISTIVE TECHNOLOGY**

In today's world, technology is present in almost every context, from grocery shopping, payment of boletos or a simple walk to the city center. Digital codes, biometrics, calipers, surveillance cameras, payment by card approach, forms of music playback in MP4, Spotify, videos on Youtube, among others. Everything goes through the advances of technology. And if, for people with "intact" physical and intellectual capacity, technology is a facilitating element, for people with motor and/or cognitive disabilities, technology promotes possibilities of being and being in the world.

When talking about technology for people with disabilities, we think beyond the technological resources created to meet the demand of modern time and space, we refer to rehabilitation technologies, responsible for returning the individual to his function (resources such as ultrasound, TNS, FES) and the so-called Assistive Technology (Anson, 2005)

Assistive Technology (A.T.) is important for people with disabilities, they are guaranteed rights and facilitate everyday life. Why, then, are there so many reports of abandonment?

Imagine a five-year-old boy, student, active, highly sociable, who has just won a puppy robot with artificial intelligence. The robot barks, wags its tail, runs, fetches the ball and the child, at first, feels very lucky to have such a dog. Fun and that does not need to clean and train. However, the robot dog cannot be wet or exposed to dust, so it cannot be taken to school, nor to the park and you have to be very careful with the games, cannot share with friends, because it was an expensive and fragile gift. How does the boy feel over time? Will the puppy robot be your favorite toy? Will he play with it too much?

Among the causes of the abandonment of Assistive Technology are the inadequacy of the resource to its user (Phillips & Zhao, 1993). Although technologies can favor social participation and improve quality of life, ineffective use of devices can lead to the abandonment of technology (Bernd, Van Der Pijl, & De Witte, 2009) Research shows that 30% of AT devices are abandoned. (Costa, Ferreira, Bortolusb, & Carvalho, 2015)

Among the reasons for abandonment of AT devices are non-acceptance of disability and depression, low quality of the devices, deficiency in social support in the environments, factors related to rehabilitation intervention for the purchased product (Wessels, Dijcks, Soede, Gelderbom, & De Witte, 2003), disbelief in benefits, aesthetic problems, safety, architectural barriers, (Cruz, Emmel, Manzini, & Braga Mendes, 2016) problems with the physical state of the user, lack of information and training of both professionals and users, pain, functional limitations, preference for another device

or use of remaining capacities, high weight of the device, changes in the conditions of the device, difficulty of use, dissatisfaction, discomfort and noise of the device (Costa, Ferreira, Bortolus, & Carvalho, 2015).

As much as a technology is interesting and innovative, it may not meet the needs of the individual, because the resource itself does not bring the solution. There are numerous justifications for abandonment, most of which are related to the user and their social, physical or occupational contexts.

## **7 THE ROAD TO ASSISTIVE TECHNOLOGY PRESCRIPTION**

A well-trained professional, who has updated and in-depth knowledge of technologies is a key factor for the correct implementation of devices, and should, in addition to prescription, monitor the implementation and use (Alves, Emmel & Matsukura, 2012).

A complex evaluation, centered on the user and not on the technology, is necessary, based on the desired task and not on the diagnosis for a more effective prescription of resources. In addition, for the prescription of an AT should be considered the physical and social context in which it will be used. The complexity of the selection of Assistive Technology concerns the heterogeneity in the relationship between the individual and their contexts, environments and proposed device (Bernd, Van Der Pijl, & De Witte, 2009).

Many professionals may be involved in working with Assistive Technology, such as engineers, educators, prosthetics, speech therapists, social workers, nurses, physical therapists, occupational therapists, among others (Pelosi, 2005).

Since its birth, Occupational Therapy has nurtured a close relationship with ED. The work of the occupational therapist in this area involves the assessment of the needs of the users, their physical, cognitive and sensory abilities, the acceptance of changes involving the sociocultural and physical conditions of the environment where the AT will be used and he must promote the instructions and training of the use of the device. (Pelosi, 2005).

## **8 THEORETICAL MODELS OF ASSISTIVE TECHNOLOGY IMPLEMENTATION**

There are theoretical models that support the practice of implementing Assistive Technology. (Alves & Matsukura, 2016) In the review conducted by Bernd, Pijl & Witte in 2009, seven models were found, three of which were specific to Assistive Technology and suitable for the selection of devices. All three describe the use of AT in a complex way, facilitating user, device and environment interaction. In them, individual goals and user satisfaction are considered in a biopsychosocial perspective consistent with the ICF model. The models are: Matching Person and Technology Model

(MPT), Human-Activity Technology Model (HAT) and the International Classification of Functioning, Disability.

Among these three models, the Matching Person and Technology, a holistic and customer-centered model, stands out. The purpose of the model is to facilitate the selection of the most appropriate Assistive Technology with regard to the user's perspectives and abilities, the specificities of the device and the individual environmental conditions (Bernd, Van Der Pijl, & De Witte, 2009). The evaluation revolves around three areas: psychosocial factors, factors of the environment in which the A.T. device will be used and the specific factors of the technology (Alves & Matsukura, 2016).

In addition to the Assistive Technology implementation models, we have three practices evidenced in the literature: Evidence-based practice in TA, User-centered practice and Family-centered practice in relation to A.T. (Alves & Matsukura, 2016)

Usually, professionals evaluate the effectiveness of AT devices through interviews and clinical judgment or with standardized instruments not specific for A.T. such as the Canadian Occupational Performance Measure - COPM, Barthel Index, Functional Independence Measure - MIF. Among the most widely used specific protocols are Quebec User Evaluation of Satisfaction with Assistive technology – QUEST, Psychosocial Impact of Assistive Device Scale – PIADS, Individually Prioritised Problem Assessment – IPPA. (Alves & Matsukura, 2014).

In Brazil, professors Drs. Ana Cristina de Jesus Alves and Thelma Simões Matsukura performed the translation and cross-cultural adaptation of the MPT-based assessment instrument, the Assistive Technology Device Predisposition Assessment (ATD PA) in 2016. (Alves, Matsukura, & Scherer, 2016).

## **9 ASSISTIVE TECHNOLOGIES IN THE BRAZILIAN SCENARIOS**

In the mid-70's Assistive Technology began to gain space in the national scenario, especially aimed at the functional improvement of the elderly and people with disabilities. In the 90s, especially in school contexts, there was a growing number of studies involving adaptations of activities and making of devices, but without a homogeneity of concept (not all were called Assistive Technology). With the guidelines of the Technical Aids Committee in 2006, there was a better consensus regarding what would be Assistive Technology and a better investment in the area. In Brazil, in general, AT is a promising area of great social relevance and receives incentives from government agencies for its development. In 2018, there were 53 AT Research Centers linked to Universities and Federal Institutes (Calheiros, Mendes, & Lourenço, 2018).

However, as Calheiros et al. (2018) point out, some barriers prevent the access and use of A.T. from meeting the investments and expectations, such as high cost of some products due to importation,

lack of specialized training of professionals who accompany the user and the non-monitoring of training and use of devices.

Added to all predictors of abandonment of the reported devices and scarcity of instruments translated and validated in Brazil for a better evaluation of T.A., a panorama of underuse of possible resources to improve the quality of life and functionality of people with disabilities is glimpsed.

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