



ASSISTIVE TECHNOLOGY: AN ANALYSIS OF THE CONCEPT

TECNOLOGIA ASSISTIVA: UMA ANÁLISE DO CONCEITO

TECNOLOGÍA ASISTENCIAL: UN ANÁLISIS DE CONCEPTO

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ABSTRACT

Objective: to analyse the concept of Assistive Technology. **Method:** a conceptual analysis study, using the steps of the Concept Analysis Model: choice of concept, determining the objectives of the analysis, identification of the concept uses, determining the defining attributes, identifying model cases, developing other cases, identifying antecedents and consequences, and definition of empirical benchmarks. Searches in SciELO, Scopus, BDNF, Medline and LILACS were conducted, using the term Assistive Technology. Articles that discussed the concept in question were selected and analysed according to the Concept Analysis Method. **Results:** technology and training were shown to be precedents. As for attributes representing the concept, terms such as interdisciplinary area of knowledge, resources, services, methodologies, strategies, practices, products, technology and equipment were found. The resulting identified were autonomy, independence, better functional performance, increased quality of life. **Conclusion:** It is important to understand the concept of assistive technology for the practice of health care professionals, specifically nurses. **Descriptors:** Assistive Technology; Concept Formation; Health; Nursing.

RESUMO

Objetivo: analisar o conceito de Tecnologia Assistiva. **Método:** estudo de análise conceitual, utilizando as etapas do Modelo de Análise de Conceito: escolha do conceito, determinação dos objetivos da análise, identificação dos usos do conceito, determinação dos atributos definidores, identificação de casos modelo, desenvolvimento de outros casos, identificação de antecedentes e consequentes, e definição dos referenciais empíricos. Realizaram-se buscas nas bases SciELO, Scopus, BDNF, Medline, LILACS, utilizando o termo Tecnologia Assistiva. Selecionaram-se artigos que discutiam o conceito em estudo, analisados de acordo com o Método de Análise de Conceito. **Resultados:** evidenciaram-se tecnologia e treinamento como antecedentes. Quanto aos atributos que representaram o conceito, verificaram-se termos como área do conhecimento interdisciplinar, recursos, serviços, metodologias, estratégias, práticas, produtos, tecnologia, equipamentos. Os consequentes identificados foram, autonomia, independência, melhor desempenho funcional, incremento na qualidade de vida. **Conclusão:** é relevante compreender o conceito de Tecnologia Assistiva para a prática do profissional de saúde, especificamente, do enfermeiro. **Descritores:** Tecnologia Assistiva; Formação de Conceito; Saúde; Enfermagem.

RESUMEN

Objetivo: analizar el concepto de Tecnología Asistencial. **Método:** estudio de análisis conceptual, siguiendo los pasos del Modelo de Análisis de Concepto: elección del concepto, determinación de los objetivos del análisis, identificación de los usos del concepto, determinación de los atributos definitorios, identificación de casos modelo, desarrollo de otros casos, identificación de antecedentes y consequentes, y definición de referentes empíricos. Fueron realizadas búsquedas en las bases de datos SciELO, Scopus, BDNF, Medline, y LILACS utilizando el término Tecnología Asistencial. Se seleccionaron artículos que discutieron el concepto en estudio, analizados según el Método de Análisis de Concepto. **Resultados:** se evidenciaron tecnología y formación como antecedentes. En cuanto a los atributos que representaron el concepto, se observaron términos como conocimiento interdisciplinario, recursos, servicios, metodologías, estrategias, prácticas, productos, tecnología y equipos. Los consequentes identificados fueron: autonomía, independencia, mejor rendimiento funcional, aumento de calidad de vida. **Conclusión:** es importante comprender el concepto de Tecnología Asistencial para la práctica del profesional de salud, específicamente del enfermero. **Descriptores:** Tecnología de Asistencial; Formación de Concepto; Salud; Enfermería.

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INTRODUCTION

The use of technology is increasing every day. In health care, it acts as interlocutor in the professional/user relationship. It appears in various fields of knowledge with an infinite range of uses. Assistive Technology (AT) is a concept that has been used in some areas, particularly in health and education, in reference to the tools, methodologies and equipment used to enhance the quality of life of elderly and disabled. The term was defined in the United States in 1988.¹ In Brazil, since 2007, it has had the following definition:

An area of knowledge, with interdisciplinary characteristic, which encompasses products, resources, methodologies, strategies, practices and services that aim to promote the functionality and participation of people with disabilities, aiming towards their autonomy, independence, quality of life and social inclusion.^{2:2}

The National Health Policy for the disabled person states that users should receive comprehensive health care, and they are guaranteed to receive assistive technologies, classified as aids for daily living (materials and products to aid in tasks such as eating and dressing), alternative communication (resources that enable communication), environment control systems (control of electronic devices, security systems), designs for accessibility, orthotics and prosthetics, postural aid, aids for the blind and deaf, vehicular adaptations (wheelchairs, mobile bases, walkers, lenses and magnifiers, Braille for equipment with speech synthesis, large print screens, phones with keyboard - teletype (TTY) systems with visual-tactile alert) and computer accessibility features (voice synthesis, modified keyboards, special software).

The main objectives of AT are to promote accessibility, quality of life and inclusion³, as well as eliminating gaps between the functional performance of an individual and the demands of the functional tasks of daily living, thereby increasing the quality of the life.⁵ Assistive technology has been used for the purpose of encouraging autonomy and inclusion of people with disabilities, and also to increase functional capacity, autonomy and quality of life for the frail elderly.

In this context, considering “Assistive Technology” as a recent and widely-used term, it is necessary to analyse it further in order to better understand it, and to discover its design and use. The literature states that concept analysis is the examination of the

structure and function of the basic elements of a concept, considered an abstract idea that is expressed in some way.⁶ The analysis provides a way to identify and express the key ideas about the practice, helping nurses to understand it, helping to clarify or redefine a concept, having as its purpose: to help distinguish the concepts; refine concepts which are ambiguous in theory; help to clarify the vague concepts that are prevalent in nursing; increase the construct validation; and assist in instrument construction or evaluation.⁷

This study used the Concept Analysis Method, which comprises eight steps⁷: choice of concept; determining the objectives of the analysis; identifying the uses of the concept; determining the defining attributes; model case identification; development of other cases; identifying antecedents and consequences; and definition of empirical benchmarks.

For the choice of the concept, one must consider its relationship to the work and concerns related to practice. The purpose of the analysis is to clarify the meaning of a concept, develop operational definition, and renew existing theory, among others. At the stage of identifying the uses of the concept, it is relevant to find them through dictionaries, encyclopaedias and literature. It is important to look beyond just one aspect of the concept or the health literature⁷.

Next, the determination of the defining attributes discloses the features that are associated with the concept. The model case is an example of concept use that demonstrates its defining attributes and the description of additional cases, which help to decide what constitutes a defining attribute to the concept of interest, and what does not. Cases may be present examples from real life, from literature or from nursing practice, or even created by the authors of the concept analysis.

The antecedents are those events that should precede the occurrence of the concept, while the consequences are the ones occurring as a result of the concept. The antecedents are useful to help identify basic assumptions about the studied concept. The consequences help to determine neglected ideas, variables or relationships that can generate new research. Finally, the empirical benchmarks are classes or categories of the current phenomenon that demonstrate the occurrence of the concept through their existence or presence. In many cases, the defining attributes and empirical benchmarks

will be identical.⁷

Concept analysis is fundamental to Nursing, as it contributes to the development of a standardized language that describes its practice. Thus, this study's objective is to analyse the concept of Assistive Technology, which has been used by the authors in different contexts.

METHOD

In this study, the steps proposed by the Concept Analysis Method⁷ described above were chosen, with the understanding that it helps to clarify the concept, supporting the study's goal.

The choice of the Assistive Technology concept was motivated by a desire to go deeper into the topic, specifically in the health care area, because it is a relatively unexplored subject, although widely-used in technologies which ensure autonomy to the disabled person.

In order to identify the uses of the concept, a search was carried out between November 2011 and March 2012, using the terms "tecnologia assistiva", "assistive technology", in the databases Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Science Literature Database (LILACS), Database of Nursing (BDENF), Medline (administered by the U.S. National Library of Medicine - NLM) and SCOPUS.

Inclusion criteria were: full research articles, free and available electronically, published in English, Portuguese or Spanish. Articles that mentioned the term "assistive technology" without describing it were excluded, as well as those that had no connection with the study's objective.

In order to determine the attributes of the concept, the characteristics which appeared more than once were listed. After determining the defining attributes, the model case and the opposite case were described.

The antecedents and consequences were

identified from the occurrence relationship established with the studied concept, as well as the empirical benchmarks. Thus, the identification of antecedents, consequences and of the empirical benchmarks was guided by the questions: What events, situations or phenomena contribute to the evidence of the concept of assistive technology? Which phenomena occur as a result of the concept? Which categories demonstrated the occurrence of the concept?

The data was analysed and presented according to the concept analysis themes (uses, attributes, antecedents, consequences and empirical benchmarks).

RESULTS

♦ Uses of the concept of Assistive Technology

Theses, dissertations, articles and editorials were found, totalling 652 documents. After reading the abstracts, 616 papers were excluded for not constituting research articles, not being available free and electronically, and not presenting sufficient evidence for the concept analysis.

Through the survey, it was observed that the Assistive Technology concept has been used in several areas such as nursing, phonoaudiology, medicine, physiotherapy and occupational therapy. The main definitions are shown in Figure below.

Definition	Área	Reference*
A multidimensional phenomenon that involves the mechanical, biomechanical, ergonomic, functional, kinesiological, ethical, aesthetic, political, emotional and subjective aspects, and as such should be analysed.	Physiotherapy	1
Any experience of systematized professional service, invented to new services situation, or reinvented for services that require adaptation and upgrade.	Nursing	10
Any product, instrument, strategy, service and practice used by people with disabilities and elderly persons, especially produced or generally available to prevent, compensate, relieve or neutralize an impairment, disability or handicap, and improve the independence and quality of life. A set of adaptive measures or equipment, aiming to facilitate the functional independence of people with disabilities.	Nursing	11
All resources and services that contribute to provide or enhance the functional abilities of people with disabilities, and thus promote independent living and inclusion.	Nursing	4, 12
A class of compensatory interventions that uses types of electronic equipment to facilitate the performance of functional tasks.	Medicine	13
Several types of strategic aid devices aimed at reducing the impact of physical dysfunction, providing a connection between the functional limitations of the individual and the demands of the physical environment.	Occupational Therapy Physiotherapy	5
Products, tools, equipment or technology adapted or specially designed to improve the functionality of the disabled, encouraging personal autonomy, total or assisted.	Phonaudiology Engineering	14

Figure 1. Definitions of assistive technology, according to the knowledge areas. *Refers to the number of reference at the end of the article.

● **Defining attributes of Assistive Technology**

After identifying the uses of the concept, it was possible to identify the characteristics or attributes most often associated with assistive technology. Those that stood out were: area of interdisciplinary knowledge, resources, services, methodologies, strategies, practices, products, technology and equipment.

◆ **Case development**

The model and the opposite case were developed by the authors, using the theme of health education for blind people, owing to their contact and the development of studies with them. The model case was constituted by the attributes, antecedents and consequences of the analysed concept, while in the opposite case these elements are not present, in order to aid and clarify what is not the concept.⁷

◆ **Model case**

◆ **As a model for the assistive technology concept, the following case is highlighted:**

The family health team conducted a drug-prevention activity for the community. Blind people also participated in the activity. In order to provide information, the team used resources, strategies and methodologies such as computer speech synthesis, a Braille

booklet, magnifying glasses, lenses, and a screen with enhancing reading, allowing an increase in quality of life, social inclusion and autonomy in the health promotion process.

◆ **Opposite case**

◆ **As a model for the opposite case of assistive technology concept, the following case is highlighted:**

Health service users with visual disabilities, enrolled in the Family Health Unit, participated in educational activities on the prevention of drug use. The family health team used educational videos and printed materials which did not facilitate access to information and did not stimulate the autonomy of users, making it difficult to increase the quality of life and the process of promoting users' health.

◆ **Identification of antecedents, consequences and empirical benchmarks**

The antecedents, consequences and empirical benchmarks were identified from the reading of selected articles, and displayed in Figure 2.

Antecedents	Consequences	Empirical benchmarks
Technology	Autonomy	Practices
Training	Independence	Practices
	Quality of Life	Products
	Social inclusion	Resources
	Better functional performance	Technologies
	Accessibility	Services
	Health	
	Safety	
	Increased self-esteem	
	Encouragement	
	Organize ideas	
	Write clearly	
	Health Promotion	

Figure 2. Presentation of antecedents, consequences and empirical benchmarks of the Assistive Technology concept.

DISCUSSION

The analysis of the Assistive Technology concept allowed identifying its use in healthcare, and also similarities between the definitions, characterizing this concept as an interdisciplinary area of knowledge, resource, service, methodology, strategy, practice, product and equipment.

We sought to understand the cited attributes in order to analyse them thoroughly and therefore better understand the studied concept. Thus, resources are the materials used by and adapted for disabled people, while services constitute professional assistance to people with disabilities, in which Assistive Technology is selected, developed or used.⁴

The terms resources and services complement each other and integrate the AT concept, involving materials and professional assistance, which in this study considered as health care.

Furthermore, the concept under study is considered to be an area of interdisciplinary knowledge, which enables involvement of various professionals such as occupational therapists, phonoaudiologists, physiotherapists, psychologists, nurses, social workers, opticians, hearing specialists, and in prosthetics.⁸

Interdisciplinarity is a joint effort between professionals whose goal is the development of transformative practices in caring for the disabled person, besides enabling the interaction between these professionals, and a new “know-how” from the exchange of knowledge. It not only refers to the multiplicity of disciplines in the same sphere, but to a scope consisting of the intersection of different knowledge and practices.

In health, Assistive Technology (AT) has been used as a tool in health education activities for people with disabilities, given

that the regular resources cannot serve this group as they predominantly use written information or televised images.

The actions of health education aim primarily at health promotion, understood to be a process of enabling people to work on improving the quality of life.¹⁵ In this sense, individuals, families and communities are encouraged to share responsibility for the health care production process, alongside with health professionals.

Through the use of Assistive Technology, the health professional will feel safer in addressing health education content and be sure that they will be contributing to knowledge sharing.¹² Therefore, AT is constituted as methodology, strategy and practice, being part of the care for people with disabilities, whether in health promotion, disease prevention, rehabilitation and inclusion.

Moreover, products and equipment are developed as assistive technology to help elderly or people with disabilities in performing activities of daily living.^{4,10,12} The equipment and products tend to support, encourage or increase the functional performance of the individual, while the limitations and needs of the user, caregiver and environment should be considered during manufacturing. Thus, equipment and product constitute characteristics of AT.

The terms technology and training were highlighted in the literature as the concept antecedents. The assessment of the user physical, cognitive and sensory abilities and their needs deserves attention.

In this way, technology is a process established by a set of abstract and concrete actions that have purposes. It can be considered as the result of processes for achieving scientific knowledge, building products and causing interventions in practice.¹⁷ Technology has been used in today’s world in an increasing sophisticated

way and with greater belief on its efficacy.¹

Technological resources are more present in everyday life. In the study, it was found that the technology precedes the assistive technology, which involves concrete technology (equipment) and theoretical technology (knowledge). To become effective, it is necessary that its use is grounded in the users' life experiences, in exercising autonomy and citizenship.¹

Technologies can be hard, soft-hard or soft. The first refers to equipment structured to produce health products, while the soft-hard relate to how each professional applies knowledge to provide care. Soft technologies are the relationships established between professionals and users, and inter-relational spaces and attitudes in the care process.¹⁸

The concept in question can be considered hard technology when referring to equipment and materials used in the production of health care for the elderly and disabled, as well as soft by composing attitudes that promote their inclusion and autonomy. It can be also considered soft-hard when the professional uses his knowledge of assistive technology. In the process of care for the elderly and disabled, soft technologies should be emphasized, as attitudinal barriers prevent self-care production for these users. In this way, it becomes clear that in order to have Assistive Technology, it necessary to know how to use it, along with the technology itself.

In the development of AT, it is relevant to choose materials that can be used considering the accessibility and independence of people with disabilities. Therefore, prior training in the use of these technologies is required so they can be better used. A lack of training can lead to the misuse or underuse of technology.

Consequently, an increase in various aspects of the disabled person's life quality is recognized in the application of Assistive Technology. Autonomy was identified in the literature as the main result, or in other words, personal freedom based on the right to free expression. To be autonomous, the individual must be able to think rationally and manage themselves. In this principle of autonomy, the disabled person decides on the use of the resource that should be related to the everyday user.¹

Several features of Assistive Technology are being developed to increase the autonomy of people with disabilities, like ceiling/hand fixed bars to assist in the transfer from bed to chair, communication boards, computer tailored programs, speech synthesis, global

positioning system (GPS), talking books, expanded reading systems, Braille printers.^{4,8,11,19} Accordingly, autonomy contributes to independence, quality of life, social inclusion, self-esteem and better functional performance.

The use of AT enables performing daily activities with greater security, contributing to increased independence and autonomy, preventing disease and improving quality of life.⁵ The method also provides partially-blind people with better performance in reading and writing, meeting their needs.²⁰ Another important gain is the revival of their self-esteem, expressed by the feeling of well-being and gradual social inclusion.

Self-esteem is the value judgment that an individual has of himself, being important to their relationship with themselves and others, influencing the perception of events and especially their behaviour.²¹

The concept of oneself is important for the individual to live well and happy. People with self-esteem rely more on their potential and have greater ability to overcome difficulties and achieve their goals. Those with low self-esteem feel unhappy and insecure.²²

Additionally, preventing and reducing the risk of falls and fractures occurs, which promotes accessibility, improved mobility, reduced dependency, improved socialization and increased functionality.⁵ Technology has the potential to improve capabilities of individuals with disabilities, and may fix the damage and help them to complete a task, reduce dependence and increase inclusion and citizenship.^{9,23}

Access to Assistive Technology provides independence to students with visual impairments in enhancing communication, mobility and environmental control, being an important tool in the process of inclusion.²⁴ Due to this, assistive technology is a relevant instrument, methodology and strategy, aiming for the independence and autonomy of people with disabilities. Therefore, it stands out in the literature as a technology that helps in daily activities, well-being, self-esteem and quality of life, usually with low cost and high effectiveness.

CONCLUSION

The conceptual analysis of Assistive Technology has allowed the identification and understanding of the defining attributes, antecedents and consequences, enabling insight and further clarification on the subject. The main characteristics that best

define and represent the concept were methodologies, strategies, practices, resources, services, products, technology and equipment.

Regarding precedents, it is vital to consider this concept as multidimensional and interdisciplinary, being relevant training for the use of technology, assessing user needs and cognitive, physical and sensory abilities. As for consequences, higher autonomy, independence, better functional performance and increased quality of life were evidenced.

The study showed the implications of the use of assistive technology, both in terms of research and practical application, specifically in health, providing general a perception of this concept.

Standing out as a limitation of the study is the small number of search bases, the limited amount of electronically available articles that discussed the concept, and significant research in other databases. Moreover, the need for research that synthesizes productions on the analysis of concepts must be addressed so they can be refined and contribute to science, especially health.

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