

Theoretic models for recommendation and implementation of assistive technology¹

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Abstract: Introduction: The latest international researches seek to understand the factors affecting the successful use of assistive technology (AT) devices through studies regarding the assessments systematizing; abandonment of devices; or theoretic models that consider the aspects of those devices implementation. In Brazil the researches are focused on developing new technologies and there are still not sufficient studies related to the successful use of devices and ways of assistive technology implementation. Objective: To identify conceptual models used for recommendation and implementation of assistive technology devices. Method: Literature review. The review was conducted in six databases: CINAHAL, Eric, GALE, LILACS, MEDLINE e PsycInfo. A critical analysis described by Grant and Booth was used. Results: There are no records of a Brazilian survey and among 29 selected articles, 17 conceptual models used in the area of AT were found; of these, 14 were specific to AT. The results showed that the new conceptual models of AT are under development and the conceptual model “Matching Person and Technology – MPT was the most mentioned. Conclusion: We can observe that the practices related to AT area in international context shows a correlation with conceptual models, thus, we hope this study might have the capacity to contribute for the propagation of this precepts at national level.

Keywords: *Self-help Devices, Evidence-Based Practice, Rehabilitation.*

Modelos teóricos para indicação e implementação de tecnologia assistiva

Resumo: Introdução: Pesquisas internacionais buscam compreender os fatores que influenciam o uso bem sucedido dos dispositivos de tecnologia assistiva (TA), seja por meio de estudos de sistematização de avaliações, de causas de abandono dos dispositivos ou de modelos teóricos que abordam aspectos necessários à implementação dos mesmos. No Brasil, as pesquisas estão focadas no desenvolvimento de novas tecnologias, sendo ainda escassos os estudos sobre o uso bem sucedido dos dispositivos e as formas de implementação de TA. Objetivo: Identificar os modelos conceituais mais utilizados para a indicação e a implementação de dispositivos de tecnologia assistiva. Método: Revisão da literatura em seis bases de dados: CINAHAL, Eric, GALE, LILACS, MEDLINE e PsycInfo. Foi utilizada a análise crítica descrita por Grant e Booth para avaliação das pesquisas localizadas. Resultados: Nenhum estudo brasileiro foi encontrado e, dentre os 29 artigos internacionais selecionados, 17 apresentavam modelos conceituais utilizados na área de TA, sendo que, destes, 14 eram específicos de TA. Os resultados mostraram que novos modelos conceituais de TA estão em desenvolvimento e que o modelo Matching Person and Technology – MPT foi o mais citado. Conclusão: Pode-se observar que as práticas envolvendo a área de TA no contexto internacional apresentam uma correlação com modelos teóricos e espera-se que este estudo possa contribuir para a replicação destes preceitos também no âmbito nacional.

Palavras-chave: *Tecnologia Assistiva, Prática Clínica Baseada em Evidências, Reabilitação.*

1 Introduction

The technology has been used to assist individuals with disabilities in getting greater autonomy and performing daily tasks.

In 2006, the Brazilian Committee of Assistive Technology (CAT), among its actions, established the research to propose an official terminology to define technology that helps individuals with disabilities:

Assistive technology is an area of knowledge, interdisciplinary character, encompassing products, resources, methodologies, strategies, practices and services that aim to promote the functionality related to the activity and participation of people with deficiency, disability or reduced mobility, for their autonomy, independence, quality of life and social inclusion² (BRASIL, 2009, p. 9).

Considering international research involving the assistive technology (AT) area, the main topics are the factors influencing the successful use of assistive technology devices; the determinants for the abandonment of assistive technology devices; the identification of variables to be considered in the indication and implementation of the devices, and the search for effective measures to assess the use of AT devices, among others (RIEMER-REISS; WACKER, 2000; SCHERER et al., 2005, 2007).

In the national literature, there are many publications addressing indications of devices that can foster the best performance of individuals with disabilities, as seen in the work of Manzini and Deliberato (2006), Bersch and Pelosi (2006), Schirmer et al. (2007), Cruz and Ioshimoto (2010) and Agnelli (2012).

In the international literature, studies on implementing AT devices are most commonly found. They follow theoretical approaches based on conceptual models formulations and practical approaches, describing implementation procedures (JUDGE, 2002; LENKER; PAQUET, 2003, 2004; FUHRER et al., 2003; PARETTE; BROTHERSON, 2004; SCHERER et al., 2007; BERND; VAN DER PIJL; WITTE, 2009).

Regarding the theoretical formulations described in the international literature, the studies point to the importance of having theoretical models supporting the practical implementation of AT.

In a review study by Bernd, van der Pijl and Witte (2009), the theoretical models and tools for

selection and implementation of AT devices, there were seven models presented, highlighting the Matching Person and Technology Model - MPT (SCHERER et al., 2005). The authors discussed that there are few systematic models with not standardized evaluations and less applicable to clinical practice.

Lenker and Paquet (2003) highlighted three models: the MPT; the Human-Activity Technology Model (HAT), and the International Classification of Functioning, Disability, and Health (CIF), considering the most complete because they classify and describe characteristics associated with the individual and the environment.

Considering these three models, the Matching Person and Technology - MPT (SCHERER et al., 2005) suggests that three areas should be addressed when evaluating the predisposition of an individual to the use of technology: a) the psychosocial factors; b) the environmental factors in which the assistive technology device is used, and c) specific technology factors (SCHERER et al., 2005).

The model described by Cook and Hussey highlighted the importance of the person, the activity, and the context when choosing the assistive technology. Changes in any of these components may require changes in technology. This conceptual model shows that assistive technology can link the person to the activity, and if the AT is removed, it can separate the individual from his job performance (COOK; POLGAR, 2008).

Although the CIF is not a specific model of assistive technology, it presupposes to unify, conceptually, the description of health and the states related to it. The AT devices are included in this classification as part of the environmental/contextual factors, being the physical, social and attitudinal environment in which people live and conduct their lives, acting as facilitators or barriers (ORGANIZAÇÃO..., 2008).

Regarding the research focusing on AT implementation practices, some of them are evidenced in the literature, for example, Practice Based on AT Evidence, Practice-Centered in the User and Practice-Centered in the Family.

Practice Based in AT Evidence, described by Fuhrer et al. (2003) aims to investigate and validate the contribution and the impact brought by the AT to the individual. The authors proposed that the implementation of AT starts with the device search from identifying the need for the individual and the types.

At first, the starting process of using the device is characterized by the short-term use. Later, the effectiveness, efficiency, satisfaction, well-being and moderating factors are investigated (cost, physical and environmental factors), determining the exchange or maintain the device. The long-term use has the moderating factors as determinant factors.

The Practice-Centered in the User described by Lenker and Paquet (2004), proposes that the user decides in the AT devices. The implementation process should be a continuous process in which the user identifies the advantages or disadvantages brought by the device, being determinants to generate personal opportunities and together with the contextual factors allow its intended identification use or not.

Studies using this approach used the Quebec User Evaluation of Satisfaction with Assistive Technology – QUEST, Psychosocial Impact Assistive Devices Scale – PIADS and the Canadian Occupational Performance Measure – COPM to evaluate the benefits of the AT device, either through user satisfaction research, quality of life and performance of daily activities related to the use of AT respectively.

The Practice-Centered in the Family regarding the AT is described by Judge (2002) and Parette and Brotherson (2004) proposing to train the user's family for the AT devices - usually children - for selection, decision making, and the device use. This approach suggests that there is a demand for research, decision making, user's need identification and priorities, knowledge of the culture, the relation of children's characteristics with AT., environment characteristics, natural user activities and services are available.

Thus, for the various theoretical and practices approaches described in the international literature, and the lack of systematization for indication and implementation of AT devices indicated by national research, this study aims to identify and discuss the main theoretical models used in assistive technology, according to the literature.

2 Method

This study adopts the theoretical and conceptual methodology based on bibliographic literature review.

The Critical Review of the Literature (GRANT; BOOTH, 2009) were used where the researcher conducts an extensive literature search and critically evaluate its quality according to the authors. This method goes beyond mere description, exercising a degree of analysis and conceptual innovation. In general, it is a hypothesis or model, seeking to identify the most significant field items.

In this review, the conceptual models and approaches used for the indication and implementation of AT devices were sought.

For the scientific articles search, six databases were used: Cumulative Index to Nursing and Allied Health – CINAHAL, Education Resources Information Center – Eric, GALE Cengage Learning, Latin American Health Sciences – LILACS, Online System Search and Medical Literature Analysis – MEDLINE and the database of the American Psychological Association - PsycInfo.

The descriptors were combined with terms related to AT and the descriptors of models and evaluations as shown in Table 1.

The period selected was from 2000 to 2012 and English, Spanish and Portuguese were considered.

The studies with discussions on conceptual models of AT were included in the analysis. Articles that focused on specific AT devices such as a wheelchair, or specific populations such as people visually impaired were excluded.

The critical analysis (qualitative) described by Grant and Booth (2009) was used, which seeks to identify the conceptual contribution, incorporating the existing or to derive a new theory for the evaluation of the identified studies.

Theoretical references applied in the study; descriptive characteristics; an indication of outcome measures; validation in the literature and useful references for professionals were considered items of qualitative analysis.

Table 1. Descriptors used in the literature.

Descriptors used Related to AT	Descriptors used related To the Conceptual Model
Assistive device	Evidence-based practice
Assistive technology (AND)	reference
Self-help device	Model

3 Results

There were 1,072 studies found, using the combination of the descriptors. After the selection of 1,072 titles, 29 articles responded to the pre-established selection criteria.

In the analysis, there were 17 theoretical models identified; 14 were specific AT, that is theoretical models only based on Assistive Technology.

Tables 2 and 3 show the most five specific conceptual models for AT cited in the literature.

Table 4 shows the other models found and their references.

There were 14 specifics for AT among the 17 cited conceptual models. The three non-specific models were the Perceived Attributes Theory, CIF and Human Occupational Performance Practice Integration Theory, describing bases for the individual adaptation of concepts to new situations, the

concept of occupational health and performance, respectively, also used as guiding for the use and implementation of AT

Regarding the specific conceptual models for AT they were most cited in 3 articles out of 29: MPT, followed by HAAT and by Gitlin's model. The MPT model was the most mentioned/described and presented in nine studies. The HAAT and Gitlin's model were cited less frequently (five and four studies, respectively), and other models have been reported in three studies or less, as can be seen in Figure 1.

Specific models presenting validation studies in the literature were MPT, CATOR, the Caregiver and Lenker's Model.

The models showing or indicating an evaluation instrument were: MPT, suggesting the use of the Survey of Technology Use – SOTU; Assistive Technology Device Predisposition Assessment – ATD PA; Educational Technology Device Predisposition

Table 2. Main theoretical models identified from the Literature Review (continued).

Conceptual Model	Conceptual Base	Cited evaluation	Model Validation	References ¹
1. The Matching Person and Technology Model-MPT	Show the need for a <i>Combination</i> between Individual and Technology factors. Three guiding elements: - Technology: its functions and characteristics; - Social medium/ environment: factors influencing the use; - Personal and psychosocial factors: Considering the needs of the user. Use of CIF as a reference.	SOTU ATD PA ET PA WT PA HCT PA	Yes. 150 professionals 25 U.s. states Training: Distance learning course Application ITD-PA	Steel et al. (2011), Bernd, van der Pijl and Witte (2009), Schreuer (2009), Gitlow and Rakoski (2009), Lenker and Paquet (2004), Scherer et al. (2005, 2007), Hersh and Johnson (2008a), Wielandt et al. (2006)
	Technology has a role in relation man and activity: physical and social context is considered. Three guiding elements: - Human: neurocognitive attributes → <i>inputs</i> , Central processing and <i>outputs</i> ; - Activity: what the individual would like to perform; - AT: used to overcome the environmental barriers Use of CIF as a reference.	No	No	Bernd, van der Pijl and Witte (2009), Schreuer (2009), Hersh and Johnson (2008b), Wielandt et al. (2006), Lenker and Paquet (2004)

¹References: There were articles that cited or discussed the models being presented by the first author's name and the year of publication.

Table 3. Main theoretical models identified from the Literature Review (conclusion).

Conceptual Model	Conceptual Base	Evaluation Cited	Validation Model	References ¹
3. Gitlin's Model for an AT user is carer	Model focused on AT user's caregivers Considering: - Different stages of Independence and Use of AT; - Associated factors to its use or not.	No	No	Bernd, van der Pijl and Witte (2009), Schreuer (2009), Lenker and Paquet (2004), Fuhrer et al. (2003)
4. The Social Cognitive Model of Assistive Device	Focused on cognitive-perceptual aspects of AT use - Perception on the impact of AT: ▪ benefit expectation on its use; ▪ effort and cost of AT; ▪ consequences on not using it.	No	No	Steel et al. (2011), Bernd, van der Pijl and Witte (2009), Lenker and Paquet (2004)
5. Comprehensive Assistive Technology-CAT	Focused on the relationship between technology and individual. Three guiding elements: - Person: characteristics, social aspects, attitudes; - Context: cultural, national, local; - Activity: communication, mobility, cognitive, daily life, education and Work, leisure time.	No	No	Hersh and Johnson (2008a, b)

¹References: There are articles that cited or discussed the models being presented by the first author's name and the year of publication.

Table 4. Models found in the literature review and references.

Conceptual Model	Specificities for the AT ¹	References ²
6. Efficiency of Assistive Technology and Service – EATS	Yes	Person et al. (2002), Wessels et al. (2000)
7. Consortium on Assistive Technology Outcomes Research (CATOR)	Yes	Schreuer (2009), Jutai et al. (2005)
8. Caregiver	Yes	Demers et al. (2009)
9. Lenker's Model	Yes	Lenker and Paquet (2004)
10. Ender's Model	Yes	Enders (2000)
11. Student Environment Tools and Tasks model (SEET)	Yes	Gitlow and Rakoski (2009)
12. Decision-Making Model	Yes	Wielandt et al. (2006)
13. Bain Assistive Technology System (BATS)	Yes	Wielandt et al. (2006)
14. Smith's client-centered adaptative equipment provision model	Yes	Wielandt et al. (2006)
15. The Perceived Attributes Theory	No	Bernd, van der Pijl and Witte (2009), Lenker and Paquet (2004)
16. Internacional Classification of functionality, Disability and Health – CIF	No	Steel et al. (2011), Gitlow and Rakoski (2009), Hersh and Johnson (2008a), Jutai et al. (2005), Lenker and Paquet (2004)
17. Human Occupational Performance Practice Integration Theory	No	Smith (2002)

¹AT Specificity: this item shows the theoretical models basing their concepts exclusively on the Assistive Technology theme.

²References: There were articles that cited or discussed the models being presented by the first author's name and the year of publication.

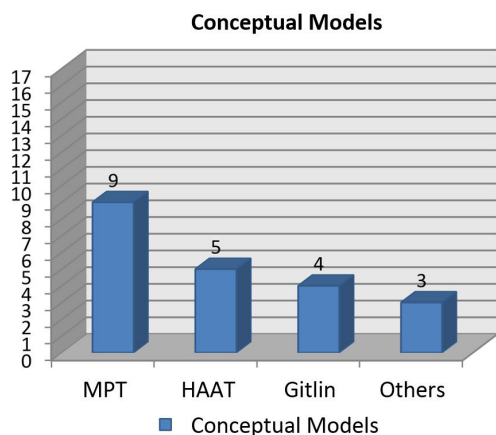


Figure 1. More cited/discussed Conceptual Models in the literature.

Assessment – ET PA; Workplace Technology Device Predisposition Assessment WT PA; Healthcare Technology Device Predisposition Assessment HCT PA; CATOR, indicating the use of CIF from Quebec User Evaluation of Satisfaction with Assistive Technology – QUEST and the Psychosocial Impact of Assistive Device Scale – PIADS; EATS, indicating the use of EuroQuol, and the Lenker’s Model also suggesting the use of QUEST and PIADS.

4 Discussion

From the analysis of the results, it was observed that there was not national research found. This gap reinforces the findings of Alves and Matsukura (2012) and Alves, Emmel and Matsukura (2012), who pointed out that the studies in Brazil are still focused on the development and introduction of new technologies, and few research on theoretical models implementation of assistive technology and efficacy assessments.

Regarding the theoretical investment in research in the area, Alves, Emmel and Matsukura (2012) investigated the formation and practice of Occupational Therapists indicating AT devices in large rehabilitation centers in São Paulo, and they found that only 64% of the participants on Occupational therapists research often publish works in the area, and these publications are concentrated in national conferences.

From this context, it is hypothesized that there are difficulties of the professionals indicating AT devices in the national context, basing their practice

on theoretical models and conducting research on the topic.

Considering the findings from this review, it is understood that this hypothesis can be extended to professionals worldwide.

Although the topics of international research advance more on their content, such as theoretical research, AT, the abandonment causes, the efficacy studies, among others, the number of international publications is still scarce, that is 29 articles in 11 years.

However, as seen in this study, new theories are under development and MPT model was the most referenced in scientific studies. Therefore, the MPT has been described, translated into Portuguese and detailed in the study of Alves (2013), as well as the cross-cultural adaptation assessment instrument to Brazil described by the model, the ATD PA.

The model of Matching Person and Technology - MPT - arose from research conducted in the eighties, by Scherer and Sax (2010) on the investigation of the use and non-use of AT devices by patients who had a variety of disabilities.

The model is based on the existence of three key areas, which act as primary components in the influence of using AT They are:

- a) the medium/ environment (s): referring to the medium/environment (s) in which the user will interact with technology, including components as well as the support of the family, peers, the employer; the benefits of using the device, and external demand;
- b) the needs, preferences and individual predisposition: including psychosocial factors of the user, such as the motivation, cooperation, optimism, patience and self-discipline; the positive experiences of life; the skills to use the device, and perception between the desired and the current situation;
- c) the desirable functions and characteristics and appropriate technology: there are the specific factors of the technology device, such as the ability to be used without discomfort or stress; compatibility with other technologies; the cost; device credibility; ease of use in the present and future, and the transportability (SCHERER et al., 2005, 2007; SCHERER; SAX, 2010).

This model highlights the personality of the individual and social factors influencing the desire or ability of a person to use assistive technology devices. These components contribute to a positive or negative influence on the use of AT and satisfaction when using it.

According to Scherer and Sax (2010), as more negative influences, the satisfaction with the use of AT is considerably reduced. The technology seems as perfect for a need can be used inappropriately or not be used when personal criteria, social characteristics or environmental needs are not considered, leading to personal frustration and waste of resources. Therefore, the model suggests that the incompatibility between the proposed technology and the potential user should be identified early in order to reduce the inappropriate use or not use, and eliminate a disappointment and frustration considering that on average, there is one-third of the AT devices abandoned by its users (SCHERER; SAX, 2010).

Thus, the MPT model was constructed from an evaluation process, consisting of a series of measures that promote individualized and practice in the person, aiming to match individuals with the most appropriate technology. There is an evaluation process based on collaboration between the consumer and the professional, together in a series of evaluations. These evaluations can range from a rapid implementation of the specialized test (performed in 15 minutes) to a more comprehensive evaluation (performed in 45 minutes) and applied by a trained and experienced professional. The MPT is used in a variety of users and settings, and the changes of the individual can be observed over time by new application of evaluation measures.

Scherer et al. (2005) suggest that the evaluation focused on an assistive device must pass a more traditional clinical model to models focused on performance results, such as a) what happens to the individual as a result of technology, b) quality of life reported by consumers c) evaluations that provide results on the benefits received by the user, the implementation progress, and resource efficiency.

However, with the survey of scientific studies, other models also seemed to give important contributions and absent in the MPT model as the Comprehensive Assistive Technology - CAT, created by Hersh and Johnson (2008a).

The CAT model is described by the authors as a complete model, since it considers as part of the relationship between the individual and the technology, and to personal factors and technology, cultural and

national factors (political). However, in this research, it was not found, besides to research presenting the CAT model and refuting the MPT model, described by the authors (HERSH; JOHNSON, 2008b).

5 Conclusion

The presented research reinforces the lack of specific methods based on evidence for the selection and implementation of AT, especially in Brazil.

It is observed that the international literature has shown the continued development of theoretical models to guide the indication of AT and that practices involving the AT area in the international context, have a correlation with theoretical models, with specific evaluations used either for research or the display elements.

This study had the intention to enable the professionals, researchers, and other interested parties having an overview of the systematization in the indication and implementation of AT. It is expected that this study can contribute to the replication of these precepts also at the national level.

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Author's Contributions

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Notes

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² See Brasil (2009).