Research Review Paper ■

Models and Instruments for Selection of Assistive Technology for Computer Access

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Abstract. Assistive technology for computer access is a necessity for computer control for people with disabilities that cannot use standard interfaces. Several solutions are available, but the challenge is to select an appropriate assistive technology for the individual user. We reviewed models and instruments for the selection and advisory process of assistive technology reported in current scientific and technical literature. Based on the review, we propose which of those models and instruments could be appropriate for the specific field of selection of an appropriate assistive technology for computer access.

Modeli in orodja za izbiro podporne tehnologije za delo z računalnikom

Izvleček. Podporna tehnologija za delo z osebnim računalnikom je nujna za delo z računalnikom za ljudi z zmanjšanimi možnostmi, ki ne morejo uporabljati standardnih uporabniških vmesnikov. Na voljo so različne rešitve, a problem se pokaže pri izbiri prave tehnologije za posameznega uporabnika. Pregledali smo modele in orodja za izbiro primerne podporne tehnologije, opisane v znanstveni in tehnični literature. Na podlagi pregleda predlagamo, kateri modeli in orodja so lahko primerna tudi za ožje področje izbire primerne podporne tehnologije za delo z osebnim računalnikom.

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Introduction

Utilizing information and communications technologies (ICT) as a tool for social and economic progress is an opportunity long held in high regard by the community. Impacting society the ICT tools help us address major social, economic and environmental challenges, reports the World Economic Forum.[1] The ICT include anything that has to do with communication and the devices that enable us to use it are, among others, phones, mobile phones, smart phones, netbooks, laptops, tablet personal computers and stationary personal computers. In the information society, those are necessity to connect to the internet. Statistics for EU[2] countries report that in 2009 65% of households, 94% of enterprises and 98% of employees had access to the internet and the numbers are still growing. People use computers daily at work and at home (with regular use of 60%),[2] mostly with standard interfaces (a keyboard, a mouse, a monitor). People that cannot control a computer in a standard way due to their disabilities, need assistive technology (AT) for computer access, so called computer access technology (CAT).[3] The concept of AT for ICT, which includes CAT, is shown in Figure 1.

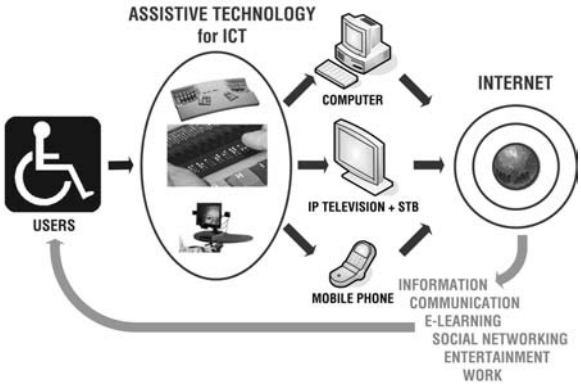

Figure 1 The concept of assistive technology for ICT with regard to the user, ICT, internet access and the services that AT for ICT enables.

Two classifications of AT were found:

- The framework developed by the World Health Organization within its International Classification of Functioning, Disability and Health (ICF)[4] provides an overview of important life domains that may be considered when assessing the need for and evaluating the effectiveness of assistive technology device (ATD) use.

- The International Standards Organization classifications of "Assistive Products for Persons with Disability" (ISO 9999:2007), defines AT as "any product (including devices, equipment, instruments, technology and software) especially produced or generally available, for preventing, compensating for, monitoring, relieving or neutralizing impairments, activity limitations and participation restrictions".[5] ISO 9999 is part of the WHO Family of International Classifications (WHO-FIC) and uses the terms and definitions of the ICF.[6] AT can enable participation in life situations and can be a key factor in attaining inclusion in society.

In this review, we define AT selection as any activities of those who provide AT for a potential user, the process of becoming acquainted with the AT, and the evaluation process.

CAT enables people with disabilities who have difficulties using the standard keyboard and mouse, are blind or have difficulties seeing things on the screen, or are deaf or have difficulties hearing sounds from the computer, to use a computer in an alternative way.[3] CAT includes both simple and technologically advanced hardware and software: alternative mice and keyboards, automatic speech recognition, text-to-speech, eye-gaze tracking, brain-computer interfaces etc. It is a true challenge when a specialist or a multidisciplinary team of experts has to assess and select the appropriate CAT that would enable the user to control a computer as efficiently as possible with as little as possible fatigue. Another issue is that the user has to adopt the AT, as there are reports of ineffective, suboptimal use of AT or even its abandonment in up to 33 % of users.[7-9]

Literature[10-29] reports on a number of models and instruments that should help assessing user's satisfaction with AT or serve as a guide to selection of an appropriate AT. Berndt et al.[10] performed a systematic literature search of the existing models and instruments for the selection of assistive technology in rehabilitation practice. They also report a lack of reliable and valid models and instruments for the selection process of AT in the scientific literature. The study performed by Friederich et al.[11] also showed that rehabilitation professionals, working in 29 neurological rehabilitation centers in six Western European countries, use various methods, models and instruments that are general and not AT specific to perform the selection process of AT, thus commonly filling the gap with self-developed instruments. They emphasized the difference between scientific work and clinical practice, since models and instruments for the selection process of AT exist in theory but are seldom used in practice.

We extended these reviews and considered some more instruments used in rehabilitation practice (or have been proposed for it) which are (or can be) used also in selecting appropriate CAT.

Methods

Publications were mostly searched in MEDLINE, the National Library of Medicine's premier bibliographic database. We used the PubMed (www.ncbi.nlm.nih.gov/pubmed), InformaWorld (www.informaworld.com) and Google search engines.

We chose different terms for AT. The keywords used were: assistive technology, assistive device, assistive equipment, computer access, technology access, AT assessment, computer and disability, AT selection.

Results

Models

Seven models for AT selection in rehabilitation practice have been stated.[10] Three models are AT specific and therefore appropriate for AT selection. All these three models describe complex circumstances of AT use with the aim of facilitating an effective match between the person, AT and the environment, where individual goals and user satisfaction are considered.

The Matching Person and Technology Model (MPT)[12,13] is most frequently found in literature as an appropriate model for the process of AT selection. It derives from a theoretical study, which was validated for people with disabilities, aged above 15 years. It is a holistic model, user-centered and composed of six phases of assessment, in terms of paper-and-pencil measures of through an interview. The aim is to facilitate the selection of the most appropriate AT regarding the user's perspectives and abilities, the specifics of AT and the individual environmental conditions. There are different assessments for this model, from short screenings to comprehensive tools. One of them is the Assistive Technology Device Predisposition Assessments (ATD PA),[14,15] for which evidence was shown for inter-rater reliability, internal consistency, criterion-related validity and predictive validity. According to Scherer,[16] rehabilitation practitioners who use the ATD PA may achieve enhanced assistive technology service delivery outcomes by using this evidence-based measure. Assessments for young children up to the age of 5 years, based on MPT, were developed and named Matching Assistive Technology and Child (MATCH).[17]

The Framework for Modeling the Selection of ATD, developed by Scherer et al.,[18] is an enhancement and a complement of the Framework for Modeling the Outcomes of ATD,[19] whereby both integrate the perspective of ICF. Besides the aim of matching the person, AT and the environment, the provider's factor is also

regarded. It is important to separate subjective and objective needs for a certain AT; ATD PA is recommended for measuring the user's personal goals. No special instruments are provided directly for this framework.

Cook and Hussey presented the Human Activity Assistive Technology (HAAT)[20] model, based on the Model of Human Performance (by Bailey, 1989). It is user-centered and emphases the uniqueness of every technological system regarding the specific user, desired activity and environment. It describes AT as extrinsic enabler that provides performance possibilities for people with disabilities. The value of a personal assistant is also highlighted, especially for people with severe disabilities. Validation of the HAAT model has not been performed. No assessment tools are presented for this model, either. However, the importance of assessments for selecting the appropriate AT is emphasized.

The other models mentioned in the relevant studies[21,22] are either not AT-specific, or focus on the use or non-use of AT rather than on the selection process.

Instruments

Among the instruments found in the literature, only 12 were developed for the AT selection and advisory process. Seven MPT-specific instruments[15] offer a broad range of tools depending on the user and the type of technology, are AT-specific, suitable for the selection process and directly match the perspective of AT-specific model.

Another two AT-specific instruments, suitable for the selection of AT, are the Lifespace Access Profile (LAP) for people with severe disabilities (Williams et al., 1995)[23] and the Lifespace Access Profile Upper Extension (LAPUE) for people with physical disabilities (Williams et al., 1994).[23] There is a computerized version for both tools, guiding the AT selection process and the implementation of AT through client-centered and team-based approach. Copley and Ziviani[23] applied both tools in practice and realized that AT service delivery is more effective with these instruments compared with an unstructured procedure.

A CAT-specific method for selection of appropriate assistive technology for computer access[24] (MSATC) has recently been designed for, and validated on, people with muscular and neuromuscular diseases.

Two instruments not published in the scientific literature yet specially developed for use in a specific rehabilitation setting were found (Hoenig H et al., 2005; Verza R et al, 2006).[10] They are coupled with a process description of the AT selection and advisory process in the Netherlands and a standard approach from the Dutch Association for Occupational Therapy (Hubert M, 2003).[10]

Other instruments designed for measuring the effects of AT use and user satisfaction, but not for the AT selection process, are the Psychosocial Impact of Assistive Devices Scale (PIADS),[25] the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST 2.0)[26] and the Individually Prioritised Problem Assessment (IPPA).[27] The World Health Organization Disability Assessment Schedule II (WHO-DAS II)[28] scale is a non-disease-specific ICF-based disability assessment instrument developed to measure activity limitations and restrictions to participation. It is interview-based and has been evaluated for detecting short-time changes following the provision of AT.

Widely used is rehabilitation practice is the Canadian Occupational Performance Measurement[29] (COPM), which is a non-AT-specific but is user-centered. Using COPM, AT users define their needs; which makes it usable in AT selection combined with other instruments.

Discussion

A review of the literature on models and instruments for the selection and advisory process of AT was conducted. We propose that they can be used also for CAT selection, combined with specific tools for objective assessment of the CAT use.

In the literature, the Matching Person and Technology Model by Scherer[11] is evidently prevalent. The model can be used as a tool for the specific area of CAT selection process, as well as some assessments and tools developed for this model, like ATD PA.

The Framework for Modeling the Selection of ATD is also appropriate, though tools for objectively assessing needs for certain AT are not included, but could be introduced. MSATC could be generalized for people with sensory and motor impairments as it appears to be an efficient guide for an unskilled clinician to choose an appropriate CAT. However, it does not include subjective factors.

Considered to be a framework, the ICF itself cannot be used to analyze the process of successful matching of person and AT or the complex set of influences on the outcome of the match.

The findings across a variety of studies indicate that understanding consumer needs and preferences prior to AT selection can positively impact the appropriate match of person and device and be helpful in planning training in use and the nature of both formal and informal supports for use.

Implementing a consumer-focused AT selection process requires that rehabilitation professionals adopt a collaborative team perspective in order to facilitate the process of consumer articulation of priorities and preferences, as well as background experiences with AT and other forms of support. Professionals also need to be supported in doing this by policies that reward comprehensive initial assessments, realizing that time, money and other resources will be saved by making better initial decisions rather than having to make corrections, revisions in plans etc. after AT acquisition.

To achieve the best results for the specific area of CAT selection, a combination of subjective and objective assessments, as well as the team-based approach is recommended.

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