

Common functional tasks using electronic assistive devices

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INTRODUCTION

Assistive technology (AT) professionals prefer solutions for consumer problems to be commercially available devices that have universal appeal and are typically less expensive than those devices specifically designed for Persons with Disabilities (PWD);[1]. Thus, using Information Communication Technology (ICT), such as mobile technology devices and the internet of things, is appealing to meet every day functional needs of PWD. Both able-bodied and PWD have adopted computers, laptops, apps, smartphones, smart speakers, and the internet as convenient ways to participate in banking, navigating to new places, restaurant reservation making and communicating with one another [2]. Curious as to how PWD use of ICT differs from people without disabilities, we sought to determine what are common functional tasks that all individuals with or without disabilities use ICT to complete. We set out to understand which domains of daily functioning these internet-connected devices have impacted. As a result, we conducted an exploratory literature review identifying the common domains of functional tasks that people complete using electronic assistive devices (EADs). For this study, EADs refers to any ICT or electronic device or software such as smartphone, laptops, the internet, or apps, that assist with promoting, maintaining, or enhancing the ability of PWD to live independently in society or improve the quality of their lives.

METHODS

The authors began this exploratory literature review by searching the Engineering Compendex, Inspec, Embase, PubMed/MEDLINE and Scopus databases to identify studies that would help to define those IADL domains that could be completed using EADs. Inclusion criteria for the studies considered for this review were: (a) written in English, (b) peer-reviewed articles, conference proceedings, or book chapters with full text available for review, and (c) relevant to ICT and/or EADs. Common functional tasks or needs fulfilled with ICT/EAD were researched using the following free-text search words: information and communication technology, purposes, daily functions, and functional needs. In the iterative search process, subsequent to the search with an undefined population, refined searches included additional key words along the domains of cognitive disabilities, learning disabilities, sensory disabilities and physical disabilities. The search for common functional tasks or functional needs associated with various disabilities enabled comparison to that of the able-bodied population in terms of ICT needs. An item bank, consisting of 111 items was derived based on the literature review data. Subsequently, two reviewers, the first author and a student intern, incorporated a functional need, shared characteristics and item-fit iterative approach, to sort the 111 items in the item bank, into 10 categories of common functional tasks with ICT. Table 1 represents the list of common functional tasks with ICT/EAD categories, providing examples of activities for better understanding of the corresponding goal, and examples of electronic devices, which may aid in completing the activity.

This literature review was carried out for analyzing existing ICT literature to establish common reasons for its use. The method also helped to validate that both able-bodied people and PWD share common goals for ICT use, though the process for accomplishing the same task may differ for the two populations.

RESULTS

Ten domains of instrumental activities of daily living were identified in the literature as being completed with the use of EADs by both able-bodied people and PWD. These domains include: 1) Communication, 2) Memory Aids, 3) Health & Safety, 4) Accessing & Storing Information, 5) Employment, 6) Entertainment, 7) Education, 8) Online Shopping, 9) Travel, and 10) Banking. Each domain is summarized below.

Communication is information being shared electronically, including audible and visual forms of messaging. Common EADs used include Smartphones, tablets, and computers that allow for a variety of communication forms including calling, text messaging, email, instant messaging, voice mail, and video conferencing [3-5].

Memory Aids act to retain information in a device rather than relying on memory alone, which may be unreliable and prone to error. Electronic alarms remind the user of a time-sensitive task or events. Examples of electronic memory aids include voice recorders, pocket-sized digital calendar, alerting software and cell phone alarm apps.[6]

Health and Safety includes the use of EADs to promote a safe environment, healthy lifestyle, or care of the body and mind. Examples include home monitoring or identification notification soft- and hardware, a fitness app and

digital pedometer, medicine dispensers and nutrition app for monitoring wellness. An environmental control unit or smart speaker can be used to safely control appliances, adapt surroundings, and meet daily self-care needs. [3,7].

Accessing Information from an EAD requires electronically obtaining data or material of any subject, in print or digitalized, video, or audio form, through internet access using a smartphone, tablet, PDA, or computer. Storage on common EADs may include pictures, contact information, appointments, shopping lists, and expense tracking [8].

Employment is completed with computers, tablets, smartphones, teleconferencing, apps and the internet, but may require modified keyboards or a trackball rather than a mouse, or a different activation method such as an eye-gaze system to be completed by PWD. Screen readers, speech adaptation systems and smartpens may also assist the PWD [3,6].

Entertainment is the goal of holding the attention of the EAD user by offering an activity of enjoyment. Common EAD provided activities including movies, music, pictures, reading, and gaming. A PWD may require a screen reader software or adapted input devices to access entertainment functions on his or her EAD [3,6].

Education is meant in the broad sense of an EAD aiding in the learning process; educational activities are completed with computers, tablets, smartphones, teleconferencing, apps and the internet, but may require modified keyboards or a trackball rather than a mouse, or a different activation method such as an eye-gaze system to be completed by PWD. Screen readers, speech adaptation systems and smartpens may also assist the PWD [3,6]. Educational games are designed for students to explore future work skills on common EADs [9] or for a person with a disability to further develop rehabilitation skills such as cognitive fitness on interactive gaming systems like the Wii [5].

Online Shopping or e-shopping allows the consumer to purchase goods and services directly. An EAD user accesses a virtual store via internet access using an EAD to place an order, indicate delivery address, and method of payment to buy a product [10]. Electronic money transfers are possible through online checking apps and banking websites, through typical or modified use of common EADs. It offers several advantages including a wide range of items; anytime and anywhere access; lower cost; no travel time; and instantaneous real-time financial transactions. Disadvantages are limited to experiencing a product or service through viewing a video or picture of the product; and reading product reviews by other buyers [11].

Travel is a domain referring to an EAD providing information that aids in the user getting to a desired destination, rather than being a literal vehicular means of transportation. The travel information includes functions such as GPS directions or digital mapping app, access to public transportation routes via Smartphone apps, or traffic updates through any EAD with internet access [3,12].

Banking allows the consumer to pay bills, transfer funds, apply for loans, and maintain up-to-date knowledge as to his or her financial standing. Electronic money transfers and bill paying are possible through online checking apps and banking websites, through typical or modified use of common EADs. It offers several advantages including anytime and anywhere access, no travel time; and instantaneous real-time financial transactions [11].

Table 1 summarizes examples of activities that are included within the established common functional tasks with EAD categories. The common functional tasks with EAD categories have been shown with the corresponding electronic device examples, which able-bodied individuals may use to complete these activities. Further, the table also lines up these categories with an alternative method of completing the same activity for PWD. The visual representation in Table1 enables comparison between both the able-bodied individuals and PWD, with regard to completing the same common functional tasks using alternative methods and/or ICT devices.

Insert Table 1 here

DISCUSSION

In this day and age of a ICT based life, this study reviewed common functional tasks that all individuals, with or without a disability, use ICT or EAD to complete. It is clear from this review that everyday functioning for all individuals has been significantly impacted by ICT or EADs. It is also evident that the 10 common functional task categories, this study has identified, fall along the domains of Instrumental Activities of Daily Living (IADLs). This

further suggests, that use of ICT or EADs has become critical for living independently in the community. This study came up with the EAD terminology. However, this term is not recognized in the existing literature. Although, a range of search terms, and databases were used for this review. However, there is a possibility that all common functional tasks may not have been identified. This is particularly so, because the field of ICT has very fast paced development, and range of tasks and activities that can be done using ICT or EAD are continually expanding. Furthermore, the search was limited to articles, book chapters and conference proceedings in English. Therefore, there is a possibility of missing on relevant searches in other languages.

CONCLUSION

Thus, the common functional tasks all people, with or without disabilities use ICT or EAD for can be broadly condensed along the IADL domains of: communication, memory aid, health and safety, accessing and storing information, employment, education, entertainment, on-line shopping, travel and banking. It is clear from this review that ICT or EADs play a pivotal role in enabling people with or without disabilities to live independently and enjoy a high quality of life. Furthermore, this study also validates the assumption that even though able-bodied individuals and PWD may use different electronic devices and/or methods to meet their EAD related functional needs, the common functional tasks or needs with EAD are the same for both able-bodied individuals and PWD. This study also suggests the growing need to conduct further research, and develop outcome measures for assessing satisfaction with meeting functional needs using ICT or EADs.

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Table 1. Common Functional Tasks that can be completed by ICT/EADs

ICT Category of Functional Tasks	Able-bodied Individuals - Functional Need Examples	Able-bodied Individuals – Device Examples	Persons with Disabilities – Functional Need Examples	Person with Disabilities – Device Examples
Communication	Call, text message, email, social media, video conference, voice mail	Mobile or smartphone, desktop or laptop computer, tablet	Speech, call, text message, email, social media, video conference, voice mail	Modified keyboard, mouse, or activation method of mobile device, computer, computer access software like screen readers (for electronic communication such as email), speech adaption systems (text-to-speech, digital speech synthesizer)
Memory Aid	Notes, alert notification, calendar	Alarm clock, alarm app, calendar app	Notes, alert notifications, calendar	Verbal recorder, scheduled alert systems, wristwatch alarm, talking /enlarged clocks, memory notebook, accessible smartphones & apps
Health & Safety	Physical health, mental health, home security, privacy	Fitness app, home monitoring app, pedometer, nutrition app, medicine dispenser, identification & privacy notification systems	Physical health, mental health, home security, privacy	Environmental control unit, biomedical vital monitors, nutrition medicine dispenser, voice recognition identification privacy system
Accessing & Storing Information	Internet, news, weather, pictures, contact information, electronic records	Camera app, cell phone, computer tablet, expense tracking app	Internet, news, weather, pictures, contact info, electronic records	Internet via Dynavox (Windows), modified computer access (keyboard, mouse, or activation)
Work & Employment	Call, text message, email, video conference, voice mail, internet, document storage and accessibility	Mobile or smartphone, desktop or laptop computer, tablet	Call, text message, email, video conference, voice mail, internet, document storage and accessibility	Modified keyboard, mouse, or activation method of mobile device, computer, computer access software like screen readers (for electronic communication such as email), speech adaption systems (text-to-speech, digital speech synthesizer)
Entertainment	Digital games, music, videos, movies, reading, pictures, social media	Books on iPad, Nook, kindle, game apps, game systems, cell phone, computer, tablets, audiobooks	Digital games, music, videos, movies, reading, pictures, social media	Remote for music and movie players, screen-readers, closed captioning, audiobooks
Education	Study, research, calculation, educational games	Online textbooks, study apps, online flash cards, university app, calculation software, internet database via computer/phone	Study, take notes, rehabilitation	Learning disability devices, study aids, SmartPen, rehabilitation videogames, educational software programs
Online Shopping	Website purchases, budgeting	Budgeting and banking apps, tip calculator, retail website via smartphone, computer, tablet	Website purchases, budgeting	Retail website via smartphone, computer, tablet (modified mouse, keyboard, voice control activation)
Travel	Maps, public transportation routes, traffic updates	Cell phone, GPS, maps, apps, public transit app	Information on wheelchair accessibility, travel packages, public transportation routes	Internet via cell phone, computer tablet (modified mouse, keyboard, voice control activation), public transit app
Banking	Money transfers, bill paying, budgeting	Budgeting and banking apps, smartphone, computer, tablet	Money transfers, bill paying, budgeting	Budgeting and banking apps, smartphone, computer, tablet