DIGITAL TECHNOLOGY AS A PART OF HABILITATION AND REHABILITATION SERVICES FOR PEOPLE WITH DISABILITIES

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Abstract: *Human expressing is a need and right. Effective communication is important tool for self-determination, learning and development, education, personal care, social engagement and employment. This paper discusses consideration that should be taken into account when we choose electronic devices as a tool for augmented and alternative communication*

Keywords: *disabilities, alternative communication, complex communication needs*

1. INTRODUCTION

Along with congenital disabilities and anomalies, many of them are acquired as a result of diseases, injuries, disasters, accidents, catastrophes, natural phenomena and cataclysms, as well as physical aggression.

Aggression also includes wars, which are characterized by high mortality and a large number of wounded - most of them with acquired permanent injuries. Despite calls for peace and understanding, military conflicts are an integral part of the daily lives of many peoples. The number of war invalids and war casualties is growing day by day.

According to the World Health Organization there are currently more than 1 billion disabled people in the world. A disabled person is anyone who has “a problem in body function or structure, an activity limitation, has a difficulty in executing a task or action; with a participation restriction”[6].

Effortless communication is not an option for all people. The four major types of disabilities include **physical, developmental, behavioral or emotional, and sensory impaired disorders**. While many disabilities fall under one of these four umbrellas, many can fall under two or more.

FIG. 1 Types of disabilities

During last two decades we have seen the rapid development of electronic technologies, devices and services. Their affordable price, benefits and conveniences from their use lead to their implementation in the daily lives of more and more people with disabilities.

Assistive devices and technologies are those whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall well-being [2].

Examples of assistive devices and technologies may be prostheses, wheelchairs, hearings aids, visual aids, and specialized computer software and hardware that increase mobility, hearing, vision, or communication capacities.https://www.physio-pedia.com/Assistive_Devices - cite_note-1

The International Classification of Functioning, Disability and Health (ICF) defines assistive products and technology as any product, instrument, equipment or technology adapted or specially designed for improving the functioning of a person with a disability.

The International Organization for Standardization (ISO) defines assistive products more broadly as any product, especially produced or generally available, that is used by or for persons with disability: for participation; to protect, support, train, measure or substitute for body functions/structures and activities; or to prevent impairments, activity limitations or participation restrictions.

Assistive devices can have high purchase and maintenance costs, especially for users that undergoing rehabilitation with expected improvement whose growth or changing abilities mean they will outgrow their assistive devices [1].

Consideration and strategies for providing assistive devices

UNICEF describes barriers to individuals using assistive devices as follows [8]:

- Lack of products;
- Inaccessible environments;
- Lack of awareness;
- Lack of governance including legislation, policies and national programs;
- Lack of services;
- Lack of human resources;
- Financial barriers;

Along with barriers UNICEF also consider principles of 5 As &Q[5]:

- Availability - Services and products are available in sufficient quantity as close as possible to people with disabilities;
- Accessibility - Services and products are accessible to everyone who needs them;
- Affordability - Services and products are affordable to everyone who needs them;
- Adaptability - Services and products are adapted and modified to ensure they are appropriate to the needs and requirements of individuals. They need to accommodate differences in terms of individual factors (for example, health condition, body structure, body function, capacity, gender, age, ethnicity and preference) as well as environmental factors (for example, physical environment, psychosocial environment, climate and culture).
- Acceptability - Services and products are acceptable to everyone. Factors such as reliability and comfort should be taken into account;

- Quality - Services and products are of appropriate quality. Product quality can be measured through applicable technical standards or guidelines in terms of strength, durability, capacity, safety and comfort.

2. DIGITAL TECHNOLOGY FOR HABILITATION AND REHABILITATION

More and more providers of electronic devices and services are offering augmented and alternative communication, as an instrument to replace natural human speech or writing. In order to achieve effective results, the essence of the needs of the users, the ways of compensation and the type of characteristics of the respective electronic devices and their implementation by the engineers and developers of such solutions must be understood. Augmented and alternative communication (AAC) can be classified according to the method of transmission of messages - assisted or not [7].

AAC interventions can be classified by the methods used to transmit messages (i.e., aided or unaided). Unaided symbols do not require an external device or apparatus; nothing other than an individual's body parts are needed to transmit a message.

Technology for aided AAC can be further classified into low, medium and high technological.

Low-technological - Equipment in this group do not directly use devices that need batteries or electricity to work. The most typical representatives of this type are the sets of printed and laminated pictures and symbols, as well as communication boards and albums containing numerous symbols, organized by themes or by categories. Although low-tech augmented and alternative communication tools can be made entirely by hand, as has been the case in the past, specialized software is usually used to meet all the communication needs of a user, symbol systems (dictionaries) with thousands of standardized symbols, color printers, laminators, etc.

FIG. 2 Low-Technological AAC

Medium-technological - Medium-tech AAC tools use battery-powered devices, but do not include computers, synthesized speech, and specialized software. Typical examples of such technologies are the so-called "Tokers" (eg GoTalk, Attainment Company, Talk sense). Devices of this type allow the use of a limited number of communication boards, and a voice message is recorded for each picture, which is played when the picture is pressed.

Other commonly used medium-tech tools are the "talking" [5] buttons with recorded messages, which can be activated with a single press with minimal effort. They can be combined with a voice recorder and play pre-recorded words or phrases when activated.

Although medium and low-tech tools are convenient to use in some cases and are cheaper than high-tech, have serious limitations and are increasingly being replaced by tablets and specialized software that provide incomparably more opportunities.

FIG. 3 Medium-technological AAC (Go Talk, Express, Go Talk Button, Go Talk Card, Go Talk 9)

High-technological - These tools use a tablet, laptop or computer, synthesized speech and specialized software. Specialized software includes one or more symbol systems (each with tens of thousands of symbols, including high contrast to be applicable to visual impairments), templates for different situations, the ability to communicate through symbols and text using synthesized software speech that can read any pre-typed text, facilitate the use of social networks, the internet, email and software installed on the computer.

FIG. 4 High-tech specialized speech generation device I-110 (Tobii Dynavox) with touch screen.

The choice depends on the capabilities of the user as general motility, fine motor skills, intellectual or cognitive abilities, ability to perform serious, consistent movements or actions.

In some cases, such a sequence of movements is not possible and requires a change in the choice of means of communication or the use of devices with different technology. The systems must be integrated without aids, low and high-tech assisted communication must be available. This is part of the planning - what to do in case of device damage.

Requirements to augmented and alternative high technological communication devices includes: durable batteries, strength, fixed interface, reliability, good voice output and connection to other technologies, compatibilities with other devices low cost etc.;

Table 1. Advantages and disadvantages of high-tech AAC devices

Smartphones, tablets and laptops	
Advantages	**Disadvantages**
- Stable - Upgradeable - Subject to change when needed - Adapted to the needs of the user - Easily used by non-specialists and people from the user's environment	- Sensitive and unsuitable for use in poor conditions - May need screen protection and volume boost - Battery life and reaction time at rest

There are four ways to work with the devices:

Directly - Touch the screen of the devices, most often with our fingers, in order to select a symbol - a sound recording of the meaning of the symbol is heard. The fastest and most intuitive way - is easy to learn. Requires good control of hands and palms. Some people use their feet or nose instead of their hands. Some devices / applications have the "Touch Enter" option - useful for users with disabilities. Their movements become stable when they touch the screen (for example, SwitchTrainer).

A swipe can be used to operate the device. Most people use this movement to browse the web on their phones. Sliding may be difficult for some users. Devices must also have navigation keys (touch instead of drag). ICT-AAC Communicator 2 supports both modes of operation

Some assistive devices [3] can be adjusted so that the cursor stays on the symbol for at least a second (or more) to activate it. This option is excellent for users who may inadvertently touch the screen while moving their hand towards the desired symbol, for example Grid 3 device supports this option.

Special Stylus Holders - Many of us use pens (such as the Apple Pencil or S-Pen) for tablets. There is a wide selection of special pens that can help users who have difficulty controlling their hands. They are especially useful for users who find it difficult to point with one finger. The pens can be held in different ways.

Also, can be attached to the head of a 3D-printer can be printed pen that perfectly matches the way the user holds the pen.

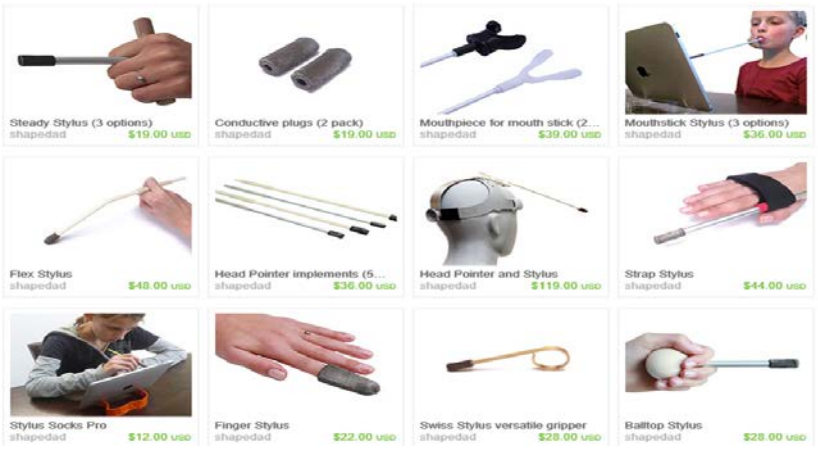

FIG. 5 Special Stylus Holders [4]

Cursor control - We all use the cursor control function when using the mouse when working with the computer. Some users who have difficulty with the direct method may

use a mouse or a specially adapted mouse. The user must make a certain effort when changing the position and movement of the cursor in different directions.

FIG.6 Cursor control

The user can use his mouth to operate a special joystick.

FIG. 7 Special mouth controled joysticks

The headpointer allows us to move the cursor on the screen with head movements. There is an option to attach a camera to the top of the aid.

Visual control - Allows people who cannot consistently control their movements to access a computer and speak using a computer. Many people cannot take advantage of this method because it requires good control of eye movement, and some conditions, such as cerebral palsy, have a negative effect on it.

For people with intellectual disabilities, vision management can be confusing. Sight control does not work in an environment with a lot of natural light, for example, outdoors.

When the person looks at a certain symbol indoors, the camera can calculate exactly where he is looking by tracking the movement of the pupil. In sight control the user can choose a symbol using the following methods:

- Hold (holds your gaze in place for about a second)
- Blinking (intervals are carefully set to differentiate from natural blinking)
- Button (located somewhere on / next to the body

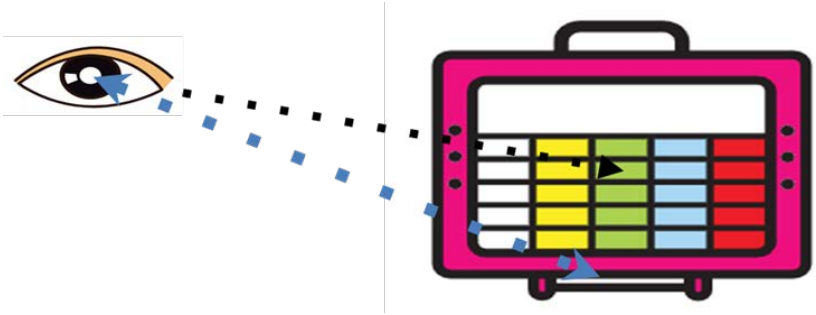

FIG. 8 Visual control

With switches / buttons Easy to use buttons to access the aid by pressing. Search or scan system. The computer searches for characters on the screen by checking them one by one. The symbol is usually highlighted, but for some users it is easier when the meaning of the symbol is read aloud. When the computer illuminates a symbol in green, the user selects it by pressing the button.

CONCLUSIONS

People with disabilities and anomalies that have complex communication needs are around us and we often can't communicate effectively with them without any previous basic preparation.

Facial expressions and sign language are not always applicable for people with physical and sensory disorders. AAC is an alternative option that is not fully realized in many cases. Educators, speech-language pathologists, physical therapists, occupational therapists, those who design new technologies, rehabilitation engineers and technicians who provide AAC intervention services should cooperate narrowly to relief users' needs.

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