Odborný studijní text k projektu
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FACULTY OF EDUCATION

Alternative and Augmentative Communication

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Objectives

The objective of the present study text is to define the basic concepts of alternative and augmentative communication (AAC). AAC systems as presented in this publication are means of re-education, rehabilitation, and compensation of disrupted communication ability. The text explains the importance of AAC for various age groups and describes the advantages and disadvantages of its use in practice. The text also includes a part focusing on the issue of technical aids and programmes applicable in AAC.

For better illustration the authors included product pictures and references to manufacturers where applicable. The text also contains numerous references to relevant videos on websites designed for free sharing of video files (https://www.youtube.com/).

Upon reading the text you should be able to

- Define the concepts of alternative communication; augmentative communication; assistive technology; AAC systems;
- Describe the types of AAC and define the specifics of various AAC types;
- Describe practical applications of AAC means;
- Be knowledgeable about available support in terms of technical aids and software;
- Describe in detail the function and specific features of various aids and programmes;
- Have knowledge of the legislation directly applicable to the technical aids and software;
- Know the possibilities of professional support in the area of AAC across relevant sectors.

Study guide

The chapters of the study text are designed to achieve these objectives. As mentioned above, the text includes references to video resources. To achieve better understanding, the text includes figures. However, a rule applies that it is best to have hand-on experience, and the authors of the present text believe that it is absolutely beneficial to take AAC courses including practical demonstrations of AAC components that the team of authors are able to provide (also as a result of the mentioned project).

The authors would like to emphasise that there is no better or worse method or means of AAC. A combination of a tablet and a special communication programme might seem to be a perfect option for a specific individual, while it may fail in another case. It is always necessary to test, vary and search for what best suits the individual, not the provider. Moreover, all

existing AAC systems must be considered (not only technical ones). There are less and more effective methods of AAC support, and this can only be determined by incessant confrontation with practice in everyday systematic work (very often based on the trial and error method) with those who are personally affected by this issue, i.e. individuals with significantly *disrupted communication ability and persons in their surroundings.*

TERMINOLOGICAL BACKGROUND

Communication (from the Latin communicatio = communication, sharing) is mediation or exchange of information within biological, technical or social systems, or between individual systems (Vašek, 1993).

Communication can also be interpreted as a means necessary to achieve effective self-expression. It transmits messages in the form of speaking, writing, reading, activity, or pictures. It takes place between people and as such affects the individual, group, community, etc. (Mikulaštík, 2003).

Speech is usually considered a completely natural and specifically human ability. However, there are individuals who are for various reasons unable or have a limited ability to communicate through speech. Their need to communicate with others is just as urgent and is not reduced in any way. This is the main reason for alternative methods through which these persons could express what is normally expressed by speech and could actively influence their lives and their surroundings, develop, and increase the quality of their lives.

Augmentative and alternative communication (AAC) is an umbrella term that encompasses the communication methods used to supplement or replace speech or writing in persons with disability in the production or comprehension of spoken or written language. The term **alternative communication** represents systems that fully *replace* speech, while the term **augmentative communication** represents an *addition* or *extension* of existing communication (Vymazalová, 2012).

The main goal of AAC is to minimize the possibility of communication deficit in persons with physical or multiple disability (combined with disrupted communication ability) and make them equal communication partners by providing a supportive or substitute communication system (Bendová, 2013).

In the Czech Republic, the area of AAC began to develop after 1989 under the influence of foreign trends coming especially from Nordic and western countries. In 1994 the AAC Association (SAAK) was established, and a few years later special educational centres began to be established focusing on AAC in children and youth (Vymazalová, 2012).

In this context, the term **assistive technology** or **adaptive technology** should be mentioned. The term can be defined as any: *"specifically modified item, piece of equipment, or product*

that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities. The purpose is to mitigate the consequences of a disability or disease in the life of the individual as much as possible" (Cook, Polgar, 2015). The sphere of application of assistive technology is very wide and includes both highly sophisticated devices and electronic tools, as well as "simple" components. The reason is the broad focus on all areas of life of the target group in order to eliminate any barriers that these individuals are faced with in the society.

These include for example removal of structural barriers or accessibility of the home or work environment; use of aids, devices and applications that decrease or eliminate the sensory deficit; aids or devices used to increase mobility and self-reliance in persons with mobility impairment, aids designed for leisure and sports activities, and last but not least ICT aids, devices and applications ranging from an **ordinary computer, notebook or tablet to specially modified devices or communication programmes primarily intended and developed to increase the communication competence of persons with significantly disrupted communication ability** (Georgia Department of Education, 2014).

Control questions

1) Define the following terms: communication, alternative communication; augmentative communication.
2) How would you define the term functional communication?
3) Briefly describe the historical development of AAC.
4) What is assistive technology and what is it used for?

2 ADVANTAGES AND DISADVANTAGES OF AAC

The implementation of AAC systems in the communication of persons with significantly disrupted communication ability (internationally referred to as *complex communication needs)*, brings many **advantages**. These primarily include:

- Overall decrease in the tendency to be passive;
- More communication possibilities;
- Personality development;
- Participation in educational and leisure activities;
- Encouraging the development of cognitive (mainly speech) functions;
- Possibility of independent decision making;
- Possibility of independent expression and presentation;
- Possibility to be active in cases where the AAC user would have previously been a passive and often neglected listener (Kubová, 1996).

In relation to the application of AAC systems there are also some **disadvantages** (limitations/barriers). These disadvantages can more or less influence the introduction and use of AAC systems both by other persons with special educational needs as well as people in the social environment. Therefore, it is recommended to communicate these disadvantages to the users of AAC, their legal guardians, carers and workers in auxiliary professions who are in daily contact with the individuals with severely disrupted communication ability. Regarding the number of advantages that AAC have in communication and involvement in daily activities, these disadvantages are considered an inseparable part of integration of AAC systems in practice.

The disadvantages of AAC include the following:

- Lower social applicability compared with speech;
- Longer time required for training;
- Public attention;
- Parents are concerned that the use of an alternative system will discourage their children from trying to speak;
- Time delay of the real application of an alternative expression system (Krejčířová, 2011).

Significant barriers often reported by authors include insufficient human resources (understaffing) especially in the area of social services (homes for persons with health disability, day care centres, retirement houses, etc.) and in the health care area (rehabilitation centres, long-term care hospitals, etc.)

Control questions

1) Describe the advantages of AAC.
2) Describe the disadvantages of AAC.
3) Describe other limitations (obstacles) in practical application of AAC.

3 SELECTION OF COMMUNICATION SYSTEM

The right selection of a communication system or a combination of systems is of a **clearly individual nature,** and as has already been mentioned, none of the AAC systems (methods) can be prioritized. It is always necessary to respect the possibilities and abilities of the individual with health disability or disease. Significant aspects of AAC selection primarily include diagnostic conclusions in the area of communication competences and other factors including the following:

a) Level of understanding of non-verbal communication signals;
b) Degree of speech comprehension;
c) Current methods of communication (verbal and non-verbal) of the individual and their success, including possible spontaneous use of alternative forms of communication;
d) Abilities of the individual to express agreement or disagreement;
e) Understanding of symbols;
f) Level of reading skills;
g) Level of gross and fine motor skills – extent, speed and accuracy of hand movements;
h) Motivation of the individual to communicate and understand what is being communicated;
i) Social skills;
j) Emotional expressions;
k) Behaviour;
l) Cognitive abilities;
m) Sensory abilities;
n) Social environment of the individual;
o) Ways and possibilities of spending leisure time;
p) Assessment of the expectations of the client and people in the client's environment, and possibilities of providing support (Bendová, 2008).

Control question

1) Try to list and specify the areas that need to be considered in the selection of a suitable AAC system for a specific individual.

4 CLASSIFICATION OF AAC METHODS

Considering the aspects of AAC selection, relevant methods can be defined. Laudová (in Škodová, Jedlička et al., 2007) classifies AAC as follows:

1) **Communication systems *with aids***
2) **Communication systems *without aids***

Another criterion for the selection of a communication system is their classification into **dynamic systems**, which include gestures and signs (e.g. finger alphabet, sign language, Makaton), or **static systems**, in which symbols are presented to a non-speaking person in a two- or three-dimensional form, e.g. pictogram system, Bliss symbols or PECS, etc. (Janovcová, 2004).

The following chapter briefly introduces an AAC system **with aids of a non-technical nature** and an AAC system **without aids**. The authors recommend the following professional resources – study texts and scientific publications:

- BENDOVÁ, P. (2013*). Alternativní komunikační techniky*. Olomouc: Univerzita Palackého. ISBN 978-80-244-3704-0.
- BENDOVÁ, P. (2013). *Alternativní a augmentativní komunikace 1.* Olomouc: Univerzita Palackého. ISBN 978-80-244-3703-3.
- BENDOVÁ, P. RŮŽIČKOVÁ, V. (2013). *Alternativní a augmentativní komunikace 2.* Olomouc: Univerzita Palackého. ISBN 978-80-244-3705-7.
- ŠAROUNOVÁ et al. (2014) *Metody alternativní a augmentativní komunikace*. Praha: Portál. ISBN 978-80-262-0716-0 (Chapter 2: General overview of AAC methods)
- BATTYE, A. (2018) *Who's Afraid of AAC? NY: Routledge*. ISBN: 978-1-911186-17-5. (Chapter 5: No-tech, low-tech and light-tech AAC).

Control question

1) Describe the system of resources used within AAC.

5 DESCRIPTION OF SELECTED AAC SYSTEMS

This chapter includes an overview of basic resources used in supporting communication skills in persons with significantly disrupted communication ability in the following areas:

a) Without aids;
b) With aids (non-technical);
c) With aids (technical).

The issue of AAC – **technical aids and programme support** (light-tech, mid-tech, high-tech) is analysed in the following chapter.

A) AAC resources without aids (unaided communication) – this method of communication is possible without technical aids and at the same time does not require physical assistance of another person. These systems include the following:

1) **Oral speech** – vocalization with a communication intent (e.g. each vowel is assigned with a different communication meaning);
2) **Sign language** – is a natural language of the deaf which may also be used by persons with physical disability and severe communication disorder provided that their upper extremities are not severely impaired);
3) **Finger alphabet;**
4) **Lorm alphabet;**
5) **Makaton;**
6) **Signs in speech** – signs are used in speech to facilitate comprehension in case of severely impaired verbal expression;
7) **Other means of non-verbal communication** – gestures, facial expressions, proxemics, posture, paralinguistics, communication through act, etc.)

Ad 2 Sign language – can be described as a sum of visual-motion signals that enable information transfer in intracultural and intercultural communication. It generally consists of definitive configurations of movements of one or both hands. The sign language, i.e. national sign language, does not fall within the AAC system, because it is considered a natural and full means of communication between deaf persons. The sign language is primarily considered a means of communication for the deaf that requires a visual feedback. Some adaptations (e.g.

tactile sign language) may also be used to facilitate communication between persons with dual sensory impairment (Souralová, 2000).

Ad 3 Finger alphabet – or finger speech is a system of signs based on various positions of the fingers and palms of one hand or both hands that represent various graphemes in space. Finger alphabet signs are not recognized internationally. In the Czech Republic, single handed finger alphabet is primarily used (Bendová, 2013).

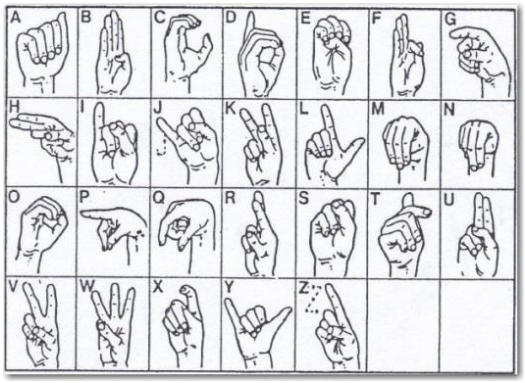

Figure 1 Finger alphabet single-handed
Source: Czech Republic Union of Deaf and Hard of Hearing, 2018

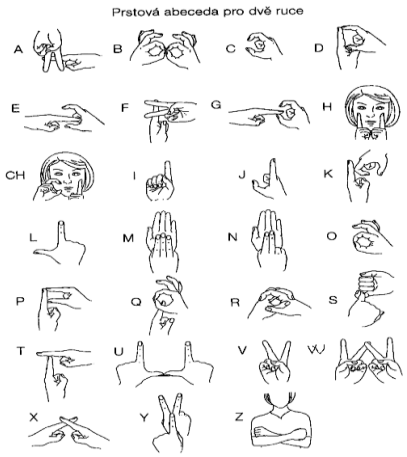

Figure 2 Finger alphabet double-handed
Source: Pinterest, 2018

Ad 4 The Lorm alphabet is commonly used to facilitate communication of persons with practical or total deafblindness. The Lorm alphabet is based on the fact that each letter in the alphabet corresponds with a spot or a group of spots on the palm. A prerequisite is the knowledge of the meaning of letters and words; therefore, it is not used among children.

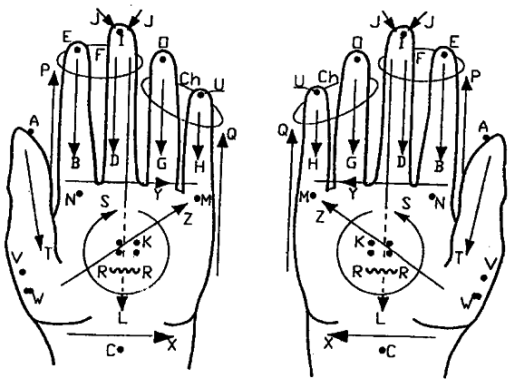

Figure 3 Finger alphabet double-handed
Source: LORM, 2018

Ad 5 Makaton – since 1970s the Makaton communication system has been one of the most frequently used AAC communication system in the UK as well as other Anglo-Saxon countries (Krahulcová, 2002). The system is based on 350 characters and symbols modified to be easy to present by movement and to be comprehensible. The signs are arranged in eight basic stages according to increasing abstraction and movement coordination; the ninth stage comprises an individual (additional) dictionary containing 35–40 words based on the individual needs of each individual (Janovcová, 2003).

In young children, the use of Makaton is frequently combined with pictures, photographs or pictograms (Krahulcová, 2002). Adult users usually learn the symbols and signs according to a Makaton handbook (Language Programme Manual).

The application of the Makaton system is based on communicating keywords in a sentence and is accompanied by rhythmed speech, face expressions, speech modulation, and demonstration of symbols (Kubová, 1996). At present, the Makaton system is used to communicate with deaf adults, persons with intellectual disability, small deaf children, autistic children, children with physical and multiple disability, adults after cerebral stroke, vascular accidents, children with specific learning disorders, etc. (Bandžuchová, 2002).

Ad 6 Signs in speech – visual-motor communication system. The basis of this approach is the application of gestures and facial expressions by an individual with disrupted communication ability. The current vocabulary of signs in speech as presented in the printed form (Tech-Market, 1999) consists of more than four hundred signs and includes signs adopted from the Danish version of signs in speech, Makaton, and the sign language (Bendová, 2013).

However, this is an open communication system based on natural signs that can be modified and complemented to suit the needs of a specific client. The gestures are very simple and illustrative, and respect the decreased level of motor, visual and cognitive functions of the users of the system (Kubová, Pavelová, Rádková, 1999).

(B) AAC resources with aids (aided communication) – individuals use physical assistance of another person or various types of aids. As far as practical application is concerned, this area is divided into technical and non-technical. However, foreign literature also includes "light-tech" or "low-tech" aids (i.e. those that are battery powered but are not as sophisticated as "high-tech" aids). In the Czech Republic, the classification into technical and non-technical aids is used. This issue is described below.

Non-technical aids (non-electronic assistive devices, also referred to as low-tech) include communication tables, letters of the alphabet, words, clauses, phrases, symbol diagrams (e.g. images, photographs, objects), frames, books, light pointers, tactile communication boards. This area also includes facilitated communication.

Technical aids (referred to as high-tech) are electronic aids and computers, for example computers with voice or printed outputs, devices with voice output (communicators), transcription of speech into a written form (e.g. JetVoice), word suggesting programmes, and many other types of hardware and software.

1) Non-technical aids – as has already been mentioned, this group includes a broad range of non-electric aids or programmes. These often include visual aids in the form of pictures. If this approach appears practicable in case of individuals with significantly disrupted communication ability, a diagnostic process must be used to identify the extent to which the individual is able to understand the picture. This must always be based on the individual's **current level of symbolization.** From the specific to the abstract.

a) The highest position in the hierarchy is represented by **three-dimensional projection – objects.** As suggested by Šarounová et al. (2014), this is the first communication possibility, which is often applied with small children (where other options are expected at a later age) or with persons with significantly disrupted communication ability as a result of severe intellectual disability. The subject – whether a toy, article of daily use, etc. – directly represent a "mediator" through which all communication takes place.

b) The next level includes the so-called **miniatures** – normally used as a replacement object for specific communication (information). These are three-dimensional symbols – miniatures, models of real objects that can be manipulated, have a tactile structure, and are easy to recognize (e.g. toy plastic plate as a replacement for “food” or “lunch”). The disadvantage of this type of communication is the fact that these replacements cannot represent abstract concepts and distort the object and relevant activity (e.g. a teaspoon might symbolize the teaspoon itself but also eating) (Krejčířová, 2011).

Figure 4 Reference object for a banana
Source: Jarolímová, 2018

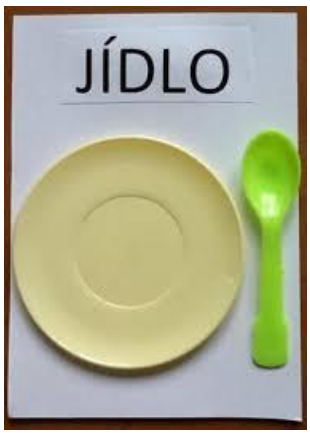

Figure 5 Reference objects for food
Source: Jarolímová, 2018

Figure 6 Reference objects
Source: Structured learning – alternative communication, 2012

c) A very frequent approach is the use of **photographs**. The advantage is their possible concretization – a specific object, person or activity can be shown. On the other hand, it is always necessary to fully individualize the process of communication through photographs and check whether the person understands what is shown on the picture – in other words, what sort of information the photograph represents. It is also important to respects certain principles when taking photographs – figure in the background, specific versus general concept, transparency, size, details, colour shades (for details see Šarounová et al., 2014, p. 18-19).

d) In the event that the individual achieves a higher level of symbolization, it is possible to use **pictograms.** These can generally be specified as picture communication symbols that are also frequently used in everyday life in the form of instructional and information signs and symbols (Kubová, 2002). Pictograms can be characterized as representations of objects, activities and properties, are simplified as much as possible and comprehensible to all categories of persons in terms of culture, impairment, nationality, and age (Krahulcová, 2002). The purpose of pictograms is to provide quick information in situations in which verbal expression would be too lengthy or could present a barrier to comprehension (Kubová, 2002).

   Pictograms are used particularly in communication with individuals with physical, intellectual or combined disability. They can also be used in communication with persons

with autism spectrum disorders or as an assistive communication means especially in persons/children with severe hearing impairment.

At present, a number of visual sets of pictograms are available, e.g.: **Speech of pictures**; **ALTÍK 2.0;** pictograms in the **PECS** system**; Boardmaker**; set of pictograms used in the **Makaton** system, etc.

These applications are also subject to an important rule: identify and verify whether the person understands what each pictogram represents. In other words, whether our understanding of the communication meets the understanding of the other person.

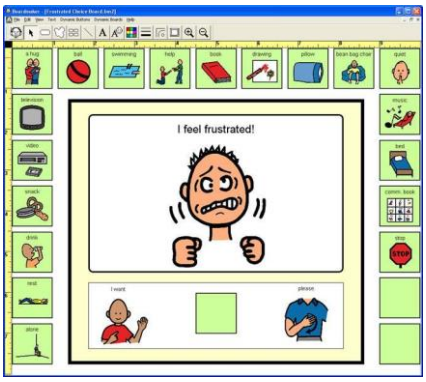

Figure 7 Set of Boardmaker pictograms
Source: Boardmaker, 2018

Figure 8 Set of coloured pictograms
Source: Pinterest, 2018

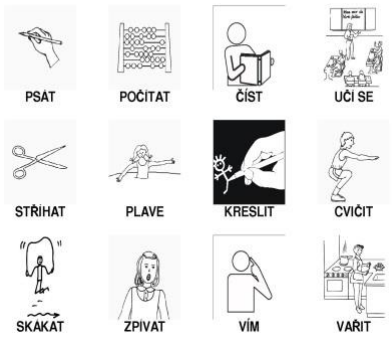

Figure 9 Pictograms – black and white
Source: Dařinová, 2017

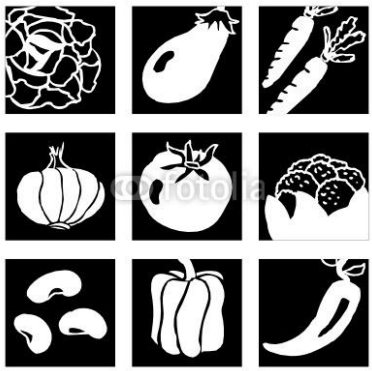

Figure 10 Pictograms – Speech of pictures
Source: Kubová, 2011

e) The **Bliss system** uses communication by means of specially designed abstract symbols. The symbols are arranged for individual users into distinctive communication tables. When showing a specific symbol the communicating person also tries to vocalize the symbol. The method can be used by persons with central motor skill impairment and disrupted communication ability, persons with autism spectrum disorders, etc. (Krejčířová, 2011). Regarding a higher abstract nature of the representations (compared with other systems mentioned above), the Bliss system cannot always be used for example with persons with severe intellectual disability.

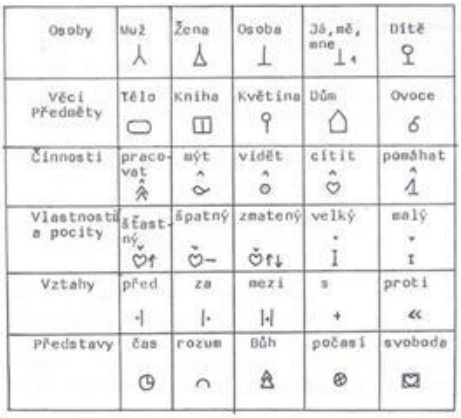

Figure 11 Bliss system
Source: Kašlíková, 2013

Selected systems of work and communication using non-technical AAC aids

The **PECS system** is an acronym for the **P**icture **E**xchange **C**ommunication **S**ystem. The purpose of this method is to develop functional communication skills. It is used with children who have significant problems with verbal communication (autism spectrum disorders, Down syndrome, cerebral palsy, aphasia, etc.) (Krejčířová, 2011).

This is a system that works with visual symbols, but as opposed to for example pictograms, children do not show pictures but bring them to the communication partner. During initial lessons they replace a picture with a favourite object – toy or favourite food. This enables them to understand the purpose of the system at the very beginning of learning – communication. This is a replacement with a certain purpose, which is at the same time very motivating, because during training the child receives what is desired. After that the child learns spontaneously to ask for a favourite thing in exchange for a picture, come independently to the storage of pictures and the communication partner, ask for “something” using a picture in various settings including various people; learns to choose a symbol from multiple pictures, make a simple sentence on a sentence strip and ask for “something”, and at the same time answer the question “What do you want?”; learns to develop the sentence strip by adding more parts of sentences in the form of pictures, and comment on various situations (Knapcová, 2003).

Figure 12 Communication using the PECS system
Source: Daneta, 2018

Social reading – the purpose is to teach an individual to analyse, interpret and adequately respond to symbols, pictograms, letters, words and groups of words, which are present in the individual's closest social environment and which are of a communication nature (Kubová, 1996).

The training of social reading is performed on the basis of three different categories using a set of pictures and texts, words related to pictograms, and groups of words related to pictograms (Klenková in Vítková (ed.), 2004). In terms of content, the choice of materials is subjected to the functional needs of practical life of persons with health disability (Krahulcová, 1998). Social reading is primarily used in the teaching of children with intellectual or multiple disability, where usual methods of teaching reading are not effective (Bandžuchová, 2002).

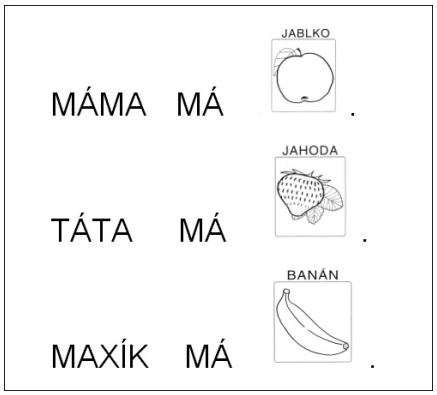

Figure 13 Social reading
Source: GlobálníČtení, 2018

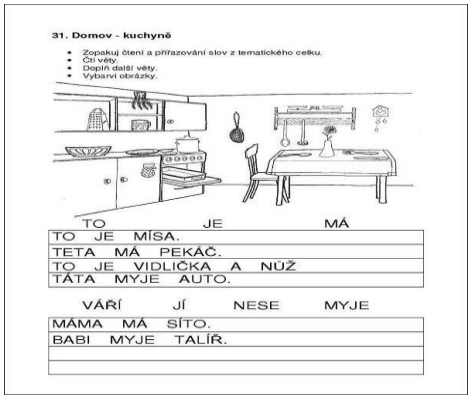

Figure 14 Social reading – word categories
Source: GlobálníČtení, 2018

Etran-N – the target group of this aid includes non-speaking persons, who are only able to indicate using their eyes. A prerequisite for using the aid is that these persons are able to hear. The aid is often a plexiglass board of different sizes depending on the possibilities of the individual who communicates. The board has an opening in the middle, often of a rectangular or square shape, occasionally of a circular shape. Around the opening there are letters, symbols or numbers in clusters. The arrangement must always be clear and comprehensible. It is also desirable to distinguish the signs by means of colours (Krejčířová, 2011).

Figure 15 Method of communication using Etran-N
Source: Pinterest, 2018

Control questions

1) List and briefly describe unaided AAC resources.
2) For which target group of potential users is the use of visual-motor communication systems beneficial and for which group it is not? Explain why.
3) Explain the issue of symbolization in the AAC system. List individual levels including illustrative examples.

4) Specify the principles of taking photographs in using AAC.
5) Explain the principle of using and communicating through the PECS system.

6 HI-TECH AND PROGRAMME SUPPORT IN AAC

As far as innovation and technical progress is concerned, this is surely the most dynamically developing segment of AAC. This is aptly expressed by Šarounová (2014, p. 34), who claims that: "For AAC, technical aids are required and very useful, but it needs to be borne in mind that they become obsolete very quickly and are replaced with others". This is quite obvious when a comparison is made between the world of modern technologies for example in 1980, at the beginning of the new millennium and today.

In the context of AAC, these are clearly revolutionary inventions. One of the examples is the recently deceased professor Stephen W. Hawking, a globally recognized scientist in the field of cosmology and quantum gravity. By communicating through a voice synthesiser, Stephen Hawking was able to continue his scientific work despite a severe motor limitation and despite using only the right part of his face for communication in the last years of his life (as a consequence of a severe neurodegenerative disease). And what is more, he managed to achieve one of the basic self-actualization needs because he became an equal communication partner despite his significantly disrupted communication ability.

An article describing the process of supporting S. Hawking's communication including his personal statement about how modern technologies helped him is available using the following link:

https://technet.idnes.cz/stephen-hawking-novy-hlas-synteza-intel-swiftkey-fvn-/veda.aspx?c=A141209_150652_veda_pka.

But even here, in the selection of appropriate resources, a number of factors must be considered including the age of the potential user of special HW, the user's mental capacity, the quality of visual and auditory perception, and partial motor skills such as muscular strength, range of motion, grasp quality, movement accuracy, perseverance, etc. (Zikl in Zikl et al., 2010).

The area of technical aids and software is very broad – it always depends on the personal preferences of each user. In general, the following components are included:

a) Non-dedicated electronic devices for AAC – desktop computer, tablet, notebook, all-in-one computer, mobile phone;

b) Dedicated electronic devices for AAC – single-button and multiple-button devices with voice output (communicators), including modern devices with a dynamic screen;

c) Control facilitating devices – modified keyboards, mouses, joysticks, sensors for "touch-free" control;

d) Switches and adapters;

e) Holders, pads and protective cases;

f) Special software designed to support AAC.

A. Non-dedicated electronic devices for AAC

It is not surprising that one of the basic electronic devices is the computer, although it was not primarily designed for the area of AAC. Throughout their existence, computers have undergone a radical transformation – from large devices requiring the space of a room to super-performance pocket-size devices. In this context, most people probable think of what is shown below – a desktop computer.

This device is used in the context of AAC, especially in a modified and completely individualized form. The basic component is fitted with additional devices, such as a specially modified keyboard/mouse/touchfree control, etc. The disadvantage of a desktop computer is obvious from its name. If a person uses this device as the primary AAC resource, there is a considerable limitation because it must be used in a room where the device is located (requirement for mobility in communication). This problem, which places an emphasis on portability, is currently resolved by notebooks and especially tablets. If used by an individual with physical disability, these devices can be attached to a wheelchair or bed by means of various holders and other fixtures.

Figure 16 Example of a desktop PC
Source: INSTE, s. r. o., 2018

Figure 17 Tablet attached to a child's wheelchair
Source: Meru 2015

Figure 18 Notebook attached to a child's wheelchair
Source: Amazon 2018

Figure 19 Desktop computers fitted with additional hardware
Source: Petit, 2009

B. Dedicated electronic devices for AAC

This is a very broad and internally structured system ranging from simple single-button or multiple-button components, but with a non-digital (static) display, powered by pencil batteries (in foreign countries sometimes referred to as light-tech) to technically complex electronic devices with a digital (dynamic) touchscreen (at first sight look like tablets) with a specific factory-installed communication programme. The difference is that all these devices, unlike tablets, mobile phones, etc., are designed exclusively to support the communication of individuals with significantly disrupted communication ability (Fonte, Boesch, 2018).

In a simplified way, these devices are sound buttons or communication tables with various numbers of keys (boxes). The information is conveyed by activating one or more buttons representing a specific piece of information (noun, verb..., one word, whole sentence, etc.) and at the same time the corresponding sound is played. The soundtrack can either be digital; assigned with a specific button and saved in the device internal memory (the same principle as the answering machine), or the device can use a synthetic voice. Today, this type of voice resembles human voice unlike the earlier “machine” voices. Alternatively, the types of sounds (digital/synthetic) can be combined in various ways.

As a result of their speech production feature, these devices are often referred to as **communicators**. However, this name is inaccurate and misleading. They are devices with a voice output. Intentionally, these devices are collectively referred to as “dedicated speech output devices”. For illustration purposes, below are several examples of dedicated AAC devices and demonstration videos.

Figure 20 Single-button communicator
Source: Petit, o.s., 2009

Figure 21 Single-button Go Talk communicator
Source: Liberator, 2018

Figure 22 Double-button iTalk2 communicator
Source: Inclusive Technology, 2018

Figure 23 Overview of multiple-button Go Talk communicators
Source: Inclusive Technology, 2018

Figure 24 Voice output device – dynamic screen (Indi manufactured by Tobii-Dynavox)
Source: LinkAssistive, 2018

Figure 25 Device with dynamic display – Grid Pad manufactured by SmartBox
Source: SmartBox, 2018

Short instructive videos showing dedicated AAC devices:

- https://www.youtube.com/watch?v=iWp18ajAEQ0
- https://www.youtube.com/watch?v=770xoaA-5xg
- https://www.youtube.com/watch?v=1_gBTGpBKqk
- https://www.youtube.com/watch?v=lIoAfacbvi0
- https://www.youtube.com/watch?v=tcIdnLGZ1Dw&t=1s
- https://www.youtube.com/watch?v=Gc8OIaVeT1Y
- https://www.youtube.com/watch?v=SyFiQoaE8qg

C. Control facilitating devices

This is a significant area involving various positioning devices (modified mouses, joysticks, control devices fitted with motion sensors, etc.), special keyboards, switches and adapters. They are used by individuals to use and control electronic equipment (desktop computer/notebook/all-in-one device/tablet/communicator, etc.) using commonly available interfaces (keyboard, mouse, joystick), who would otherwise be unable to do so.

The predominantly modern compensatory aids described below can be collectively referred to as assistive technology, because by means of technical aids they increase an individual's accessibility to and eliminate barriers in the use of AAC (cf. Fonte, Boesch, 2018; Šarounová et al., 2014).

1) Modified and configurable keyboards

This category includes keyboards with large keys; coloured or contrast keys; ergonomic keyboards, programmable keyboards with customized key settings (functions, numbers, arrangement); keyboards compatible with tablets designed for single-hand control or children, etc. There are also various special plastic or hardened covers to reduce unintended keystrokes or to ensure more precise finger movements or pointer movements.

Figure 26 Clevy keyboard
Source: Petit, o.s., 2009

Figure 27 Jumbo XL keyboard including an auxiliary plastic cover
Source: Petit, o.s., 2009

Figure 28 Maltron Ergonomic 3D Keyboard - designed for both hands
Source: School Health, 2018

Figure 29 Programmable keyboard IntelliKeys
Source: School Health, 2018

Instructional videos of selected special keyboards are available using the following links:

- https://www.youtube.com/watch?v=a2gT2CJP1Q0
- https://www.youtube.com/watch?v=93-va2vOnO8.
- https://www.schoolhealth.com/videogallery/gallery/single/product_id/31103/media_video_id/224/
- https://www.youtube.com/watch?v=Z_Ma4k9qBFs

2) Modified mouses and joysticks

Specially modified mouses or joysticks represent necessary components that make it possible to control computers or other devices by persons who are for various reasons unable to use a common positioning device. Special mouses (often referred to as “trackballs”) and joysticks – just as with keyboards – take different forms in order to adapt the user environment to a specific person and the person’s individual requirements. The basic requirement is to increase accessibility to those users who for various reasons (most frequently as a result of motor impairment) have difficulty controlling a conventional mouse or when controlling a computer by a traditional mouse is impossible (grasp, manipulation with buttons, range and accuracy of movement, increased fatigability, reduced sensitivity, etc.), where the use of an alternative mouse or/and joystick appears as a possible solution to these specific difficulties.

Figure 30 One of the possible ways of controlling the BigTrack mouse
Source: Život bez bariér – Nová Paka, 2015

Figure 31 Alternative KidTRAC mouse
Inclusive Technology, 2018

Figure 32 Ergonomic Evoluent mouse
Source: Nerd Techy, 2018

Figure 33 BJOY Chin device controlled by head movements
Source: School Health, 2018

Figure 34 Specially modified Optima Joystick
Source: School Health, 2018

Figure 35 Specially designed joystick controlled by the orofacial region
Source: School Health, 2018

Figure 36 IntegraMouse+ as a multifunctional control device
Source: Closing the Gap, 2018

Instructional videos focusing on the area of specially designed mouses and joysticks are available using the following links:

- https://www.youtube.com/watch?v=Qrff9lAGq4w&feature=youtu.be
- https://www.youtube.com/watch?v=9NmJ3NIQ2NA.
- https://www.youtube.com/watch?v=Ikzp22bNxOs.
- https://www.youtube.com/watch?v=tQdI9Lnn2_g
- https://www.youtube.com/watch?v=fFi5_ctNFl0
- https://www.youtube.com/watch?v=NNCxSRW9WVU

3) Movement detection by sensors

If, in the world of modern aids designed to support and develop communication abilities and competences in individuals with significantly disrupted communication ability, we were to choose only one area that has developed dynamically in recent years, it would definitely be the area of **AAC devices based on movement detection**. These are contactless devices that can fully replace the functions of a conventional mouse/touchpad/joystick.

Their purpose is to control special communication programmes and control the surroundings (television, internet, light and temperature setting, etc.) As a result of technological progress and innovations, current devices are replaced by modern ones – improved and more accurate sensors, faster response and better performance, elimination of additional equipment, etc. An integral part of the whole process of improvement (does not apply only to this case) is the experience and reflection of the users and people around them – informal support (family,

close persons, community members) and formal support (teacher, special education teacher, assistant, counsellor, social worker, physician, speech-language therapist, IT specialist, etc.)

Currently, there are devices that use the principle of **head position measuring**, or changes in **head position (kinesis)** – for example the *Quha* model range; in recent years there are devices working on a completely different principle:

- Using **reflective sensors**: *SmartNAV 4: EG;*
- Using **sensors of eye movements** (Eye gaze systems) of an individual who watches a display: *Tobii* (Eye Tracker, Eye Tracker 4C PCEye Mini, PCEye Plus) or the competitive product *myGaze*.

Figure 37 Head movement sensor – Quha Zono
Source: Boundless Assistive Technology, 2018

Figure 38 Head movement sensor (reflective point) – SmartNAV 4: EG
Source: Natural Point, 2018

Figure 39 Eye gaze system – PCEye Mini (size comparison)
Source: Senzory Guru, 2018

The applications of these modern devices in practice are available using the following links:

- https://www.youtube.com/watch?v=ubaUpdG3I9Y
- https://www.youtube.com/watch?v=TI7SO_xAx9c
- https://www.youtube.com/watch?v=euBDysPgRPQ
- https://www.youtube.com/watch?v=rr3FIWMCuto

D. Switches and adapters

Switches and adapters are simple, physically accessible and controllable devices. Switches – particularly of an oval shape made of hardened plastic – may be confused with single-button "communicators". Switches take various forms, materials, means of controlling (activation/ deactivation), and sizes. In the context of technical support of AAC, switches have various purposes and functions (Spektra, 2018; Petit, 2009 cf. Šarounová et al. 2014), for example they:

- Replace the function of buttons – mouse/joystick/touchpad;
- Replace specific keystrokes, e.g. Enter, Space; Delete;
- Replace specific keyboard shortcuts, e.g. Ctrl+C; Ctrl+Alt+Delete;
- Replace certain commands – hibernation mode, turning on the computer, running a specific programme or game, volume up, etc.;
- Are used for the purposes of scanning;
- Activate/deactivate a toy modified to be controlled by switches;
- Activate/deactivate or control a paired electric device – television, air-conditioning, MP3 player, blinds, calling an assistant, etc.;
- Can also be used to control an electric wheelchair;

Figure 40 Smoothie Switch in various colour modifications
Source: Micwil Group of Companies, 2018

Figure 41 “Big Buddy Button” switch in various colour modifications
Source: Micwil Group of Companies, 2018

Figure 42 Palm-activated Grasp Switch
Source: Talk To Me Technologies, 2018

Figure 43 Pole switch with a head
Source: Inclusive Technology, 2018

Figure 44 Inhale/exhale switch
Source: Key Technologies, 2018

Illustration videos of selected switches are available using the following links:

- https://www.youtube.com/watch?v=9i5JP5WNrzs
- https://www.youtube.com/watch?v=XecVa9HVE9k
- https://www.youtube.com/watch?v=Bhj5vs9P5cw.

For all switches described above to be functional, a connection to an **adapter** is required. The adapter mediates a specific action, which should take place after switch activation. The adapter is (usually) connected to the computer/tablet etc. via a USB interface, and is a certain "intermediary" between the switch and the device (switch – adapter – device). The function of the adapter is simple: the switch needs to be "programmed" so that the device receives information about what should happen after activation – which function should be activated/deactivated, etc.

Figure 45 Simple Box Switch Adapter – cannot be further programmed
Source: Assistive Technology – DTSL

Figure 46 Programmable adapter for 2 switches – BJ805
Source: BJlive!, 2018

Figure 47 Inclusive MultiSwitch 2 Adapter designed to programme up to 6 switches
Source: Assistive Technology – DTSL

Figure 48 Wireless adapter for one switch
Source: RJ Copper, 2018

An illustrative video of a selected switch is available by using the following link:

- https://www.youtube.com/watch?v=3BHibfIKx5Q

E. Holders, pads and protective cases

This is a very large group of products ranging from fixation pads for mouse, keyboard, joystick or switch; holders, brackets, stands, frames and panels to be attached to the table, bed frame, wall, ceiling, body part, and very often to the wheelchair of a specific user, etc. The holders may be mobile (for example with additional wheels), fitted with fast lock mechanisms, or firmly attached. Another criterion is the position of the person who controls the device (sitting position, lying position, standing position) and side preference.

An important aspect is the selection of appropriate case, protective frame or cover including specialized parts, e.g. with certified higher resistance, water resistance, light weight material, variability, etc. Obviously, this area provides numerous possibilities and variations to meet the requirements of the users of the compensatory aids in order to support them in the process of communication.

Figure 49 Flat pad for controlling a button communicator, switch, etc.
Source: Medical Engineering Resource Uni, 2018

Figure 50 Nylon pad – its angle allows tablet attachment
Source: Medical Engineering Resource Uni, 2018

Figure 51 Splatz pad – designed for button switch attachment
Source: Medical Engineering Resource Uni, 2018

Figure 52 Holder with a flexible bar – attached to the edge of a board
Source: SpaceKraft, 2016

Figure 53 Bar holder – fitted with multiple joints
Source: SpaceKraft, 2016

Figure 54 Bar holder – attachment for head control switch
Source: CJT Enterprises SpaceKraft, 2016

Figure 55 Mobile holder – attachment of a tablet/communicator
Source: Daessy, 2012

Figure 56 Switch attachment – side location
Source: CJT Enterprises, 2018

Instructional videos of holder applications and their attachment to a wheelchair or flexible bar holder attachments are available using the following links:

- https://www.youtube.com/watch?v=04D-AUsUYQU
- https://www.youtube.com/watch?v=3bmcnilNCG8

F. Special software designed to support AAC

According to Šaronová et al. (2014) the programmes used in the context of AAC can be classified into several categories (see below). In the context of the system of classification, these devices can be considered in isolation, but in practical applications, the configuration always depends on the specific individual (preference, purpose of use, motor and cognitive aspects, etc.) In other words, it happens that in the context of supporting communication

competences and accessibility, a single person uses multiple programmes at the same time (e.g. one of the Petit educational programmes to support communication skills + Grid 3 as a "communication programme" + ACKeyboard programme to control the device using the scanning principle, etc.) Other types of special software programmes can be used as well.

1. Software programmes designed to **support accessibility to the device or remote control of other devices** (alternative control/commands/management of the user environment, etc.), in order to use the potential of the device in the maximum possible way:
   - Programmes that simplify and individualize the user environment (this group also includes programmes primarily designed for persons with visual impairment, etc.) – **ZoomText**; **NVDA**; **Guide; KobaSpeech; Click-N-Type Keyboard; Dwell Clicker**, etc.;
   - Software designed to control remote devices (the so-called "smart home" control), mobile phones, etc., the **Servus** environment (part of Grid programme); **Remote Phone Call;**
   - Programmes that allow voice command control – **My Voice; Jet Voice; My Dictate;**
   - Programmes designed for switch configuration – **Switch Driver 6**; switches are often delivered with an installation programme (e.g. technical support for BJ LIVE! switches); Apple tablets have these programmes installed by default to make control easier;
   - Programmes that allow control by means of scanning – **ACKeyboard**; this option is also offered by **Grid 3**; tablets with iOS have the programme installed by default;
   - Programmes that can make available and redirect the content of an interactive board – **iAsistent**.

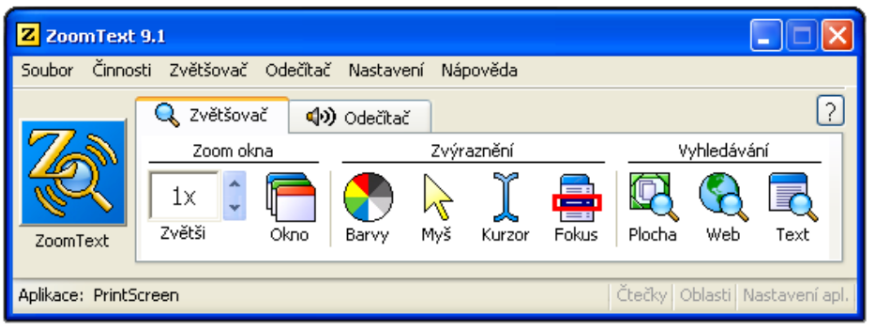

Figure 57 ZoomText v9 programme
Source: Západočeská univerzita (KVD), 2017

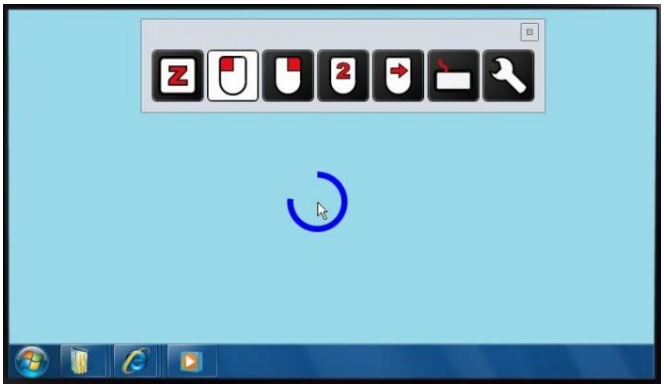

Figure 58 Dwell Clicker 2 programme
Source: School Health, 2018

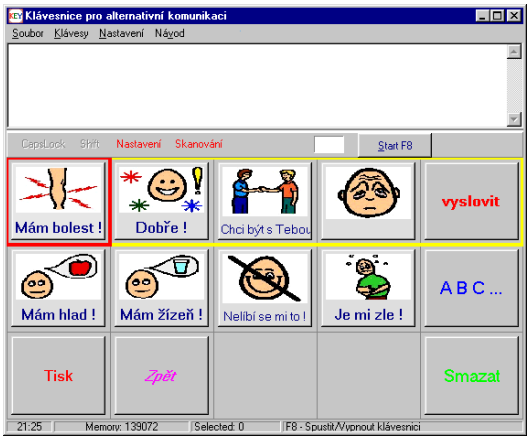

Figure 59 ACKeyboard programme
Source: Keyword for alternative communication, 2018

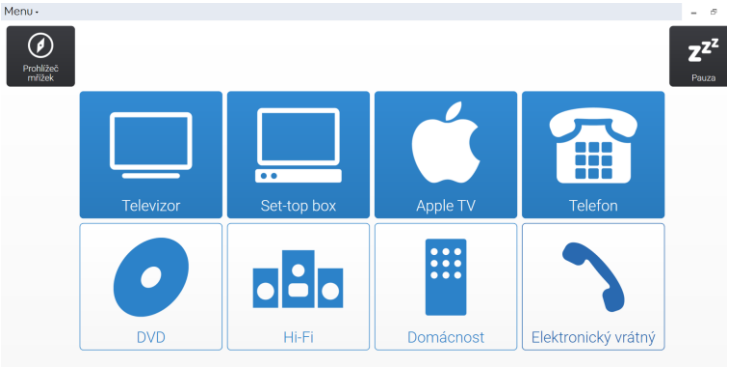

Figure 60 Sevus programme (part of Grid)
Source: Grid 3 by Smartbox, 2018

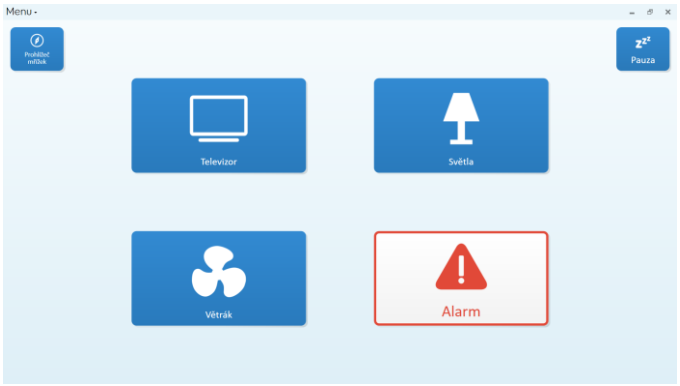

Figure 61 Sevus programme (part of Grid)
Source: Grid 3 by Smartbox, 2018

2. Software used for **diagnostic** purposes in the area of AAC – this especially includes the **DiagView** programme, which is primarily "designed as a diagnostic supplement to Tobii PCEye navigation system. Using another networked computer (desktop PC, notebook, tablet, smartphone) the programme is able to display and in real time monitor the place where the client is looking, how long the client is looking at a specific place, and to track eye movement on the screen. It also informs about how long and which objects the client is looking at" (Spektra, 2018).

   This non-invasive diagnostic tool is capable of providing a relatively accurate assessment of whether the Tobii PCEye device using the principle of visual contact is suitable for supporting communication and whether it is a suitable communication or navigation device for the client. This diagnostic programme can also be used to assess the level of an individual's perception including visual perception (Spektra, 2018).

   Another application with a diagnostic potential is **Look to Learn** – this is an educational programme aimed at training those skills that are required for future use of a computer/tablet – controlling/using a communication programme using eye navigation. Look to Learn offers several activities (games) controlled by means of visual navigation – in a playful way, the user accomplishes various tasks. Both DiagView and Look to Learn offer (upon activity completion) retroactive trajectory display – "heat track" of the user.

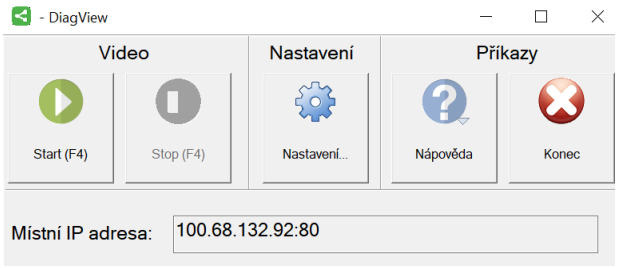

Figure 62 DiagView programme – initial screen
Source: DiagView, 2018

Figure 63 Look to Learn programme – trajectory analysis
Source: Look to Learn, 2018

3. **Training software** offers a wide range of applications. The content of these applications focuses on stimulation, training, support and development of various skills, e.g. supporting sensory or cognitive competences, motor or visual-motor skills, training of attention, or the development of communication and speech skills. Many of these programmes develop individuals' abilities to control various devices (computer/tablet, etc.) independently.

   A set of useful educational programmes fully located in the Czech environment (target group – children, persons with serious health disabilities) is offered by **Petit** (www.petit-os.cz). These are programmes with a range of different themes called **Teddy Bear** – these programmes offer a very user friendly environment including alternative control (Teddy Bear – Colours and Shapes / Teddy Bear and Pictures / Teddy Bear Counting / Teddy Bear Reading). Other programmes include **Passive Watching** (same manufacturer) and **Babbler**, **Global Primer –** to support communication and speech competences. Another educational programme is the above mentioned **Look to Learn**, which contains over 40 simple educational games including learning the ability to control the device by other means than a conventional mouse/keyboard. Games of an educational nature (cause and

effect/multiple choice/supporting attention, etc.) are also offered by the Grid programme (versions 2 and 3). In this context it is also important to mention the web-based platform www.i-sen.cz. This is a public group consisting of parents, teachers and professionals who focus on sharing of information and experiences in the context of using IT aids and software by persons with special educational needs, not only in the teaching process but also in supporting their communication skills.

4. The last category consists primarily of dedicated **"communication software"** – this includes programmes primarily designed for the production and printing of communication tables or simple "pictures" – for example the following programmes fully located into the Czech environment: **Boardmaker**, **AltiC**, **Symwriter** (vocabulary of approximately 4,000 – terms, nouns, verbs, etc. – by means of visual symbols).

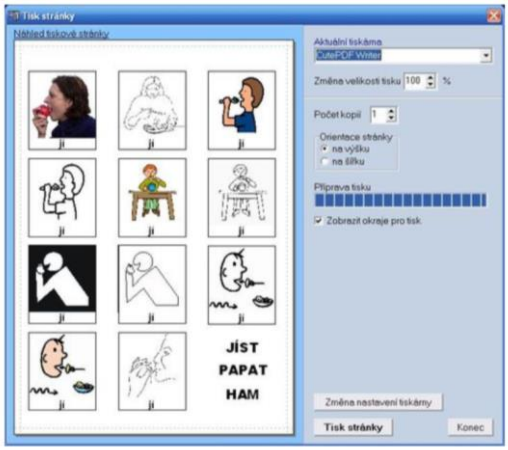

Figure 64 AltiC programme – visual expressions of the verb "to eat"
Source: Petit, 2009

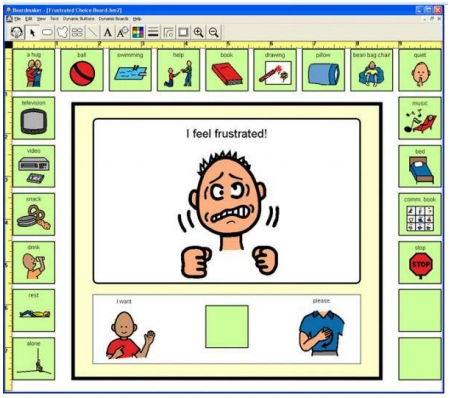

Figure 65 Boardmaker programme – preparation of a theme-oriented communication table
Source: ADROS, 2009

Very useful programmes in the area of supporting communication skills are those with immediate voice output, through which the users carry out their communication intent in real time. For this purpose the **Grid 3** software is used in the Czech Republic**.** This allows persons with significantly disrupted communication ability the following (Spektra, 2018):

- Communicate using ready-made tables (pictures, words, letters) – these can be changed or new tables can be made according to the user's needs;
- Control the PC and mobile phone, use the Internet, listen to music downloaded to the computer, etc.;
- Control household appliances and lighting.

Figure 66 Grid 3 programme – initial screen: selection of several applications
Source: Grid 3, 2018

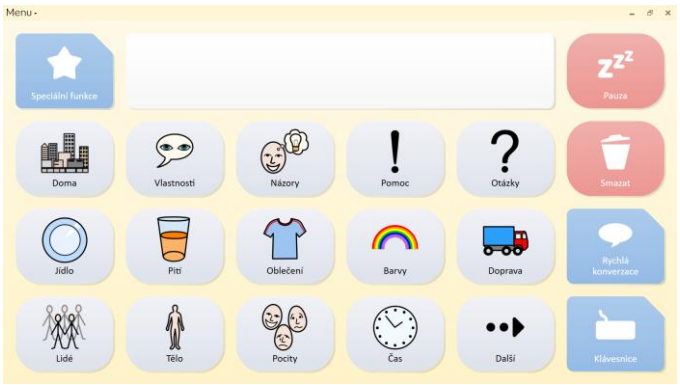

Figure 67 Grid 3 – initial screen (factory setting)
Source: Grid 3, 2018

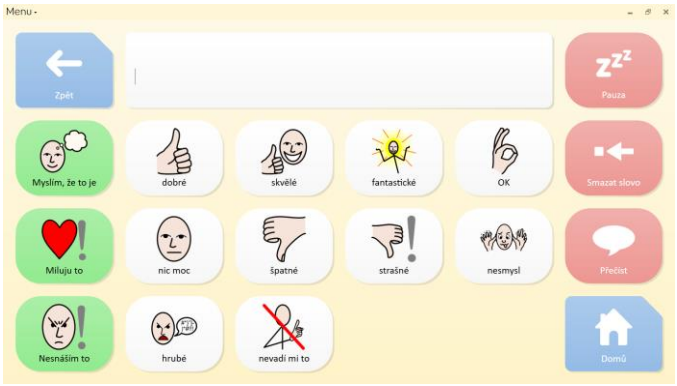

Figure 68 Grid 3 programme – thematic area of "Opinions" (factory setting)
Source: Grid 3, 2018

Another useful programme is **Go Talk Now.** The programmes mentioned above can be fully individualized – editing themes, inserting pictures, adding sounds, adjusting the size and the number of expressions (words), changing the colours of the "tiles", etc.

Figure 69 GoTalk Now programme – initial screen
Source: GoTalk Now, 2018

Finally, it should be mentioned that the programme itself will not communicate instead of the individual; it is only a tool that the person must gradually learn to control and use; the same applies to other people in the individual's surroundings.

Illustrative videos showing the use of selected communication programmes are available using the following links:

- https://www.youtube.com/watch?v=SWZ4Fw2-42Q
- https://www.youtube.com/watch?v=0DOor4PgU0k
- https://www.youtube.com/watch?v=tme1ljWlrGY

- https://www.youtube.com/watch?v=_gRoHaMYSMM&list=PL9jFik0qDiMItQCDWE0mfpCyH8BdMTMS4
- https://www.youtube.com/watch?v=muDJB3sSJEE

Control questions

1) Define the group of technical aids in AAC. Which components does the group contain?
2) Based on the study of the texts and videos describe the principle of communication using dedicated electronic AAC devices.
3) Define the basic differences between a commonly used keyboard and a keyboard with specially modified keys.
4) What is the trackball?
5) What is the principle of the Tobii device? Explain and specify a possible group of potential users.
6) What are switches used for?
7) List and briefly describe at least 5 special programmes used in the context of supporting communication competences.

Conclusion

The information presented above suggests that the system of alternative and augmentative communication includes instruments of great importance for the communication of persons with severely disrupted communication ability. AAC systems make it possible for individuals with severely impaired expressive and receptive speech components to become active participants in a communication and to engage in activities that require the ability to communicate with the narrower as well as broader social environment.

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