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Theoretical Basis of PECS (Picture Exchange Communication System)

SUMMARY

The article deals with the theoretical foundations of PECS (Picture Exchange Communication System). It is an example of supporting and alternative methods of communication – AAC (Augmentative and Alternative Communication). It can be both a supportive and alternative communication system. The strategy of acting for PECS is based on the principles of applied behaviour analysis – ABA (Applied Behaviour Analysis), the verbal behaviour approach and the assumptions of the Pyramid Approach to Education. Theoretical consolidation of PECS is supported by the results of scientific research conducted in the field of applied behaviour analysis. Verification of the theoretical concept through empiricism is the strength of the PECS method.

Key words: AAC, PECS, applied behaviour analysis

TERMINOLOGY

The assisting terminology and alternative communication methods are all the ways to provide exchange and receiving messages. They consist of supplementary processes (supporting communication) and/or replacing (alternative communication) the natural speech and/or letter to maximize communication skills, necessary for communication and social functionality in social life. “AAC is a set of tools and strategies from which AAC is used to meet the daily communication challenges” (Grycman, Kaczmarek, 2014, p. 348).

Speech is the best way of communication, through the language it becomes possible to participate in the social life and allow to exchange the knowledge

about another world (Grabias, 2000; 2001). On rare occasions this kind of understanding of the speech is not a way of implementing communication intentions. Man has a communication intention, it does not get lost in the absence or loss of voice. It still has its desires and needs, but it lacks the tool, which could make it possible to express it. Patients having difficulties in expressing communication in natural speech are the people with complex communication needs. This may be both adults and the children who have permanent or temporary difficulty in communicating, but also in fulfilling their social and life function. The people who have difficulty using the speech may use support in all communication forms, in any environment and with different communication partners. The problems of those patients may be the result of developmental or acquired disability, as a result of illness or injury, which causes interference in the speech and language and the cognitive skills (Grycman, Kaczmarek, 2014).

Taking into account the speech therapy typology of speech disorders, proposed by S. Grabias (2000; 2008; 2012; 2015) those should be divided into three groups of speech disorders. The first includes speech disorders related to non-developed perceptual skills, and the therapy procedure assumes building language, communication and cognitive skills. The second one includes speech disorders related to the lack or insufficient education of performance (with acquired competences), and the procedure for therapeutic treatment in these situations is to improve the implementation of various levels of communication systems. The third group includes disorders related to the disintegration of language and communication skills, and the therapeutic procedure is to stabilize decay, and in some cases to rebuild all types of competencies and improvement of implementation. In each of these groups there may be patients with complex communication needs who will not be able to take classical speech-based therapy that uses natural speech. In these cases, supportive and alternative ones are irreplaceable communication methods.

ASSUMPTIONS OF PECS

The Picture Exchange Communication System is an alternative communication system developed in 1985 by Andy Bondy and Lori Frost. It is a visual system which is based on exchanging pictures. In the light of the failure of the traditional approach to improve speech and communication in people with Autism Spectrum Disorders (ASD), the system creators were looking for a way that would allow those people to communicate (Kaczmarek, 2014). The authors' task was to develop a method that: 1) enables effective development of learning how to communicate with children who have no way to communicate their intentions through speech, gesture or facial expressions, 2) enables to discontinue verbal prompt,

3) allows the child to understand the rules regarding communication, 4) will be easy to use in everyday life (Kawa, 2015).

The Picture Exchange Communication System uses simple pictures to get through the visual channel to explain to people with ASD what social communication is. Along with the development and improvement of PECS methods, it was recognized that it can be successfully used to build communication also in people with speech disabilities other than ASD. Currently, PECS is being introduced into therapy for children and adults who experience various disorders and deficits in speech, language, communication (Kaczmarek, 2014).

When introducing the PECS therapy, a person learns to express his needs using a symbol (image) that represents a particular thing, activity, feature, etc. The start of the PECS program does not assume the patient's pre-existing skills, such as: making eye contact to respond to commands or imitation. The authors of the system are expecting that the person who masters the next phase of PECS should express their needs, comment on events, answer questions and make a dialogue using complex phrases (Kawa, 2015).

PECS IN THE LIGHT OF THE APPLIED BEHAVIOUR ANALYSIS

In 1913, John B. Watson has published a manifest titled *Psychology as the Behaviorist Views It*. This date is considered to be the beginning of the classical behaviourism. Watson put forward the postulate of psychology as an objective and experimental field of natural sciences. It may be because of the study of what is observed, or behaviour and stimuli that accompany it (Bąbel et al., 2016).

Behaviourism is based on experiments conducted by Ivan P. Pavlov and Edward L. Thorndike. Pavlov is the discoverer of classical conditioning "in which initially indifferent stimulus, after prior association with a stimulus triggering a specific reaction, has the ability to a similar reaction" (Bąbel et al., 2016, p. 22). Thorndike is the creator of the law, which is the basis for the instrumental condition. This law assumes that "if after certain behaviour appears the feeling of satisfaction, then the probability of this behaviour occurrence in similar conditions increases in the future. If, however, the consequence of the behaviour is a feeling of dissatisfaction, the chance for repeating this behaviour in similar circumstances in the future decreases" (Bąbel et al., 2016, p. 22).

Watson is considered the one who created the foundations of behaviourism, but the greatest influence on this trend of psychology was exerted by Burrhus F. Skinner. The beginning of the behaviour analysis is 1938, in which Skinner published the book *Behaviour of Organisms* in which he made a description of the new behaviour that he called the "causative". The researcher believed that causa-

tive factors differ from unconditional reactions. He took the view that causative behaviours are not innate reflexes, but learned behaviours during the body's interaction with the environment. In addition, they are not caused by preceding stimuli, but depend on the consequences they face (Bąbel et al., 2016).

The Picture Exchange Communication System is based on: firstly, the assumptions of the Applied Behaviour Analysis (ABA); secondly, the approach of verbal behaviour developed by Skinner; thirdly, it is taught according to the Pyramid Approach to Education (Frost, Bondy, 2013; Kaczmarek, 2014; Kawa, 2015).

Behaviour analysis "is a science about behaviour and changing environment (prior events and consequences) which affect them" (Bear et al., 1968; Cooper et al., 2007, after: Suchowierska, 2008, p. 240). It is divided into the applied behaviour analysis, theoretical behaviour analysis and experimental behaviour analysis. Two types of variables are important. The first of these are events that occurred so far in the environment, being the consequences of a particular behaviour and the prevailing environmental conditions then and now which are the background of behaviour and appearing under its influence environmental changes. Consequences of behaviour are divided dichotomously into strengthening and punishment. Among the strengthens and penalties are:

- 1) Positive reinforcement – "the type of dependency that brings growth of frequency of occurrence of the causative reaction. This relationship depends on the fact that the performance of a particular causative reaction results in an appearance of a specific stimulus in the environment. If in the wake of such experience, the severity of this causative reaction increases, we can observe positive reinforcement" (Bąbel et al., 2016, p. 179).
- 2) Negative reinforcement – "the type of dependency that brings the occurrence of the causative reaction. This dependency is based on the fact that execution of a specific causative reaction results in the termination of the action specified in stimulus, or that the performance of a specific reaction prevents the stimulus from working" (Bąbel et al., 2016, p. 178).
- 3) Positive punishment – "the type of dependency that results in a decrease in the occurrence of efficient behaviour. It is based on the fact that an unspecified causative reaction results in an appearance in the environment specific stimulus. If, as a consequence, such an experience decreases intensification of the causative reaction, positive punishment takes place" (Bąbel et al., 2016, p. 112).
- 4) Negative punishment – "the type of dependency that results in reduction of the occurrence of efficient behaviour. It is that the execution of a certain reaction causes receiving a certain stimulus or not allowing the stimulus to be shared" (Bąbel et al., 2016, p. 112).

The second type of environmental variables that are examined by the behaviour analysis are environmental conditions, understood as control stimuli (stimu-

lus preceding). They are divided into: differentiating stimuli – the frequency of behaviours increases with them, and extinguishing stimuli – the frequency of behaviour decreases with them (Bąbel et al., 2016).

Research conducted in the field of behavioural analysis is based on scientific assumptions of determinism, empiricism, simplicity of explanations, scientific manipulation and intellectual scepticism. The assumptions of determinism explain that events are connected with each other and have an impact on each other. Human behaviour is the result of events taking place in the environment, but it also affects what will happen in the future. The assumptions of empiricism convey view that taking therapeutic measures should be based on information, not speculation. The simplicity of explanations is a condition which accepts the complicated translation of the phenomenon only after rejecting the simpler one. Scientific manipulation should be understood in accordance with the relationship between the variable and the behaviour that this relationship has to be proven during scientific research, in which the variable will be controlled by the experimenter. Scientific scepticism is understood as a critical approach to scientific theories, especially when new discoveries cannot be described on the basis of these theories (Suchowierska et al., 2012; Bąbel et al., 2016).

Applied behaviour analysis as a subdiscipline of behavioural analysis is “using the procedures derived from the laws governing behaviour to improve socially relevant behaviours and proving in the experiments carried out that the procedures used were responsible for the changes that have occurred” (Bąbel et al., 2016, p. 19). The term “applied” means that the behaviour is selected for the purpose of the study due to its high social significance. The term “analysis” means that the effect of the therapy is responsible for the change of behaviour (Bear et al., 1968, after: McClannahan, Krantz, 2016). The term “behaviour” refers to reliable measurements that allow you to determine changes in it (McClannahan, Krantz, 2016).

To sum up, a specialist dealing with the applied behaviour analysis is, first of all, interested in its causes and consequences. Secondly, he focuses his attention and actions on the behaviours manifested by the subject and then accurately describes them, in order to use appropriate techniques to change them. Thirdly, he solves the problem at a given moment, when it occurs (Kořakowski, Pisula, 2013).

FUNCTIONAL LANGUAGE CLASSIFICATION, VERBAL BEHAVIOUR

Skinner in the book *Verbal Behaviour* (1957) described the perspective of language, which is based on a functional analysis of basic units. In the concept of verbal causative behaviour, the researcher presented the view that language is

a learned behaviour similarly to other areas of human life, therefore, is subjected to the same law of learning. Behaviours whose purpose it is to communicate, just like other behaviours, can be reinforced and shaped (Suchowierska et al., 2012). Strengthening the appropriate verbal behaviours results in an increase in their frequency occurrence. The above view on speech development is focused on language functions and the consequences that maintain the communication behaviour. This definition of verbal behaviour treats it as behaviour maintained thanks to the mediation of the other person. The effect of the broadcaster on the recipient is very important. The sender, wanting to implement the intention, engages in the behaviour, thanks to which he achieves the communication goal, thus, acting on the listener's reactions (Kawa, 2015).

According to Skinner, the key processes in acquiring communication skills are differential amplification and shaping (Barbera, 2017). The essence of differential amplification is that in a specific situation, like under certain environmental conditions, only certain behaviours are strengthened, while others in which the person is involved are extinguished, they do not have access to amplification (Cooper et al., 2007, after: Kawa, 2015). A second of relevant processes for acquiring communication is shaping, understood as a systematic, diverse enhancement of behaviours that are next levels to the target behaviour (Kawa, 2015).

Skinner argued that the language is a learned behaviour. He considered that the rights of behaviour analysis could also be used in the case of verbal behaviour. The researcher stated that people learn the ability to speak and understand the language, similarly to learning another behaviour. Skinner has introduced the concept of verbal behaviour, understood as any form of communication like sign language, picture, written and any other forms that a verbal response can take (Sundberg, 2015).

Skinner in his concept of efficient verbal behaviour introduced the classification of verbal operators. These are different behaviour types of speakers and listeners. They are:

- 1) Mand behaviour, as a request for what is needed. Mand is a very important language operator due to the fact that it starts with motivation, and ends by giving the person what s/he needed.
- 2) Tact behaviour (tact), i.e. naming or identifying objects, actions, events. This is communication through labelling, so naming or describing a given object when you interact with it through the senses: sight, hearing, touch, smell, taste.
- 3) Intraverbal behaviour, means answering the questions or conducting the conversation in which the words of one person are controlled by the words of the other.

- 4) Listeners' behaviour, i.e. executing commands or subordination to the mands of another person.
- 5) Echo behaviour, which is repeating of what was heard.
- 6) Imitation behaviour, or imitation of motor movements, gestures of the other person.
- 7) Textual behaviour, or reading the stored words.
- 8) Copy text, i.e. copying.
- 9) Transcription, i.e. spelling out the heard words (Sundberg, 2015; Barbera, 2017).

The introduction of PECS gives the opportunity to develop verbal behaviours. The person using PECS is learning the ability of using images in different functions. The first taught function is mand, which is the request. With the image, the patient can ask for something that he cares about or needs. The use of PECS also allows one to learn facts, i.e. labelling. The communication partner asks: "What do you see?" The patient using PECS replies. Thanks to PECS, the patient will also learn intraverbal reactions, when communication partner starts saying "Old bear is tough...", the patient will be provoked to finish, by putting "asleep" on the task strip. Thanks to such a wide approach people using PECS can learn to respond to the different situations.

PYRAMID APPROACH TO TEACHING

The Picture Exchange Communication System gradually teaches verbal causative behaviour in accordance to methodological steps, planned in the subsequent phases of the protocol and uses the Pyramid Approach to Education (Kaczmarek, 2014).

The Pyramid Approach to Education is a comprehensive model of factors which describes the elements necessary to create an effective educational environment (Bondy, 1994; Bondy, Sulzer-Azaroff, 2001, after: Kaczmarek, 2014). The three-dimensional pyramid contains a foundation and pillars. The base included there are four elements that are relevant to learning and which are focused around two key issues: *what* to learn and *why* students learn.

The first element of the pyramid's foundation is functional skills. The goal for teaching people with complex communication needs should be the same as in the case of others, so you must develop the skills that will allow you in the future to obtain the maximum for a given unit (according to its capabilities) level of independence, independence in everyday life situations. The second element of the base is the reinforcement system. The basic issue is granting a man the right to choose what is attractive to him, which does not always have to be in accordance with the expectations of therapists.

The specialist working with the patient will be trying to develop a repertoire of his motivation, but it is important to realize that it takes time. Until the moment that new reinforcement is effective, it is necessary to use these, which are immediately available. You must be able to minimize the situation to provide reinforcement in the most natural way. The strengthening should be delivered very quickly, within half a second. This receiving speed explains its strength. The third element of the pyramid is a functional communication which is “defined in the form of the social group directed to another person, which in response provides social rewards or specific” (Frost, Bondy, 2013, p. 8). The definition puts on the interface between the sender and the recipient and it does not matter whether the speech was used. In the event that there is no recipient, and behaviour includes vocalization, it will not be considered as communicative. At this point, the following functions of communication should be distinguished: a) this consequence of receiving directly strengthening, when speaker wants something or demands something and receives it as a result; b) as a consequence of receiving a social strengthening, i.e. when the speaker is complementing someone, and receives gratitude as a result. The fourth element of the pyramid base is preventing conservative behaviours and to counteract their escalation. These behaviours occur in the wrong place, at the wrong time, they continue for too long, are too weak or too strong. The most important is to find a function which triggered this behaviour and not only the form it took. There are three behaviour functions. The first is to access strengthening (i.e. speech, thing, activity, sensor stimulation). The second function leads to avoid certain events (e.g. social contacts, performing certain activities). The third is caused by a certain event (e.g. removal or reduction of potential rewards, occurrence of pain or similar stimuli, or introducing very significant prizes). Effective strategies for preventing inadequate behaviours are related to the modification of conditions that occur just before the behaviour. Such entire interventions also include direct response at the time of inadequate behaviour.

The basic of the pyramid approach to education is composed of: functional activities, efficient enhancement, functional communication and inadequate behaviours. The other parts of the model are pyramid pillars.

The first is generalization – the process aimed at gradual introduction of small changes that are leading to the result that will be concrete and improvement of the behaviour will be noticeable. There are the following changes: changes of the stimulus which contains factors like, a) injectors covering the issues relating to other people, b) injectors covering places, c) injectors covering the material and injectors covering patients’ relations, i.e. quantity, tempo, length, complexity, precision, permanence and smooth responses.

The second pillar is an effective lesson. When planning to teach certain skills, we need to take into consideration the factors related to the development of effective lessons. The following approach to teaching has three types of lessons: 1) extracted trial method, which is based on a direct task initiated by the therapist and simple answers; 2) sequence lesson, in which the skill requires a series of different short reactions put in one whole, according to the specified order; 3) incident lesson, implemented as the action initiated by the student, which reaches the naturally occurring stimuli, flowing from the physical or social environment.

The third pillar of the pyramid is a strategy of education. The help, delivered by the therapist, is by diverse hints. Those can be verbal, gesture, modelling and physical. The purpose of teaching is the independence of the patient, so it is important to gradually eliminate the hints. There are strategies of gradual hints' elimination while calling actions as a result of natural control of the stimuli. Among them are distinguished: withdrawing of hints, hints hierarchy, binding deferred (both solid and progressive) and use the behavioural strategy of the behaviour chain from the end and from the beginning. Learning the behaviour chain from the end is that the therapist performs with the student all elements of the behaviour chain beyond the last, which comprises the hints, strengthens the execution of the reaction and gradually withdraws the hints (Bąbel et al., 2016). Learning the behaviour chain from the beginning is that the therapist teaches only the first chain element, that is systematically applied hints to this reaction, strengthens it and withdraws the hints (Bąbel et al., 2016). The significant technique of learning is to shape with no prompts to be used. The gradual change of criteria is introduced, which is due to the acquisition of the strengthening.

The fourth pyramid pillar is minimizing errors and their correction. The essence is an introduction of the small series of the various changes. They are aimed at reducing mistakes, so that the patient has a greater chance to receive strengthening. The introduction of the remedy in the situation of an error depends on what type of lesson was run. The different way of adjustment will require an error in the extracted trial method lesson than an error made during the sequence lesson. Correcting mistakes is to quickly acquire skills, not just to delete or correct the error. In the situation of the error occurring during extracted trial method lesson there is a four-step procedure to correct an error – 1) to demonstrate the correct answer, 2) to help patient to execute the task correctly, 3) to change the task for a different one, the patient knows how to finish, 4) to repeat the first part of the task. Mistakes made during the sequence lessons requires using different procedure called “step back”. This procedure requires giving hints how to finish the task correctly at the right sequence.

PECS PROTOCOL

The introduction of PECS is carried out in accordance to the protocol through the next phases. During the introduction of the first phase, the patient learns “how” to communicate. The goals in this phase include the patient taking the image, reaching out to the communication partner and giving him a picture. In the second phase, the patient learns to overcome the distance and how to be persistent to draw the attention of the communication partner. Perseverance, which a man learns while pursuing this phase, is understood as not giving up and not getting discouraged in communicating a picture to the communication partner when he is, for example, busy and turned back. This phase also teaches to locate a communication book and to look after it, because images placed in it are a tool for communication. Objectives implemented in this phase is the patient’s approach to the communication book, taking a picture from it, approaching a communication partner, and giving him a picture. During the third phase, the patient learns to differentiate pictures. The goal pursued at this stage is a request for reinforcement. Request will be fulfilled if the patient selects the appropriate picture from the book to communicate, approaches the communication partner and gives him a picture. During the fourth phase, the patient learns the sentence structure. The goal in this phase involves asking for things that are in or out of sight. To finish the task, the patient will use the sentence strip exchange. At this stage, the patient begins to use sentences. The patient approaches the book, selects the picture “I want”, puts it on the sentence strip, selects the picture of the thing/activity which he wants, puts it on the sentence strip (next to the picture “I want”), detaches the Velcro with the sentence strip from the communication book, approaches the communication partner, gives him a sentence strip, indicates the turn of images on the strip and the communication partner reads them out loud. In the fifth phase, the patient learns to answer the communication partner’s question, which is, for example, “What do you want?”, “What do you need?”. It is important not to constantly ask the same question. The aim of this stage is, on the one hand, to spontaneously approach the communication partner asking for different subjects/activities, and on the other, to master the ability to answer the question. After moving to the sixth phase, the patient learns to comment. The goal is to spontaneously express requests and comments, as well as to answer the questions: “What do you want?”, “What do you see?”, “What do you have?”, “What do you hear?”, “What is this?” (Frost, Bondy, 2013).

CONCLUSIONS

The theoretical model of PECS was presented, being one of the following supporting strategies and alternative methods of communication. It is a system based on scientifically well-established and repeatedly verified knowledge derived from the applied behaviour analysis. Thanks to PECS, the patient develops further skills in expressive and receptive communication. The creators of PECS used the behavioural classification of verbal operants and the approach to the education pyramid. This is a specific method of methodical behaviour in the implementation of AAC. PECS is used to teach communication, its course is consistent with the rules of speech development, it begins with the introduction of communication exchanges using one character, to move on to building several statements using the sentence bar. The research results indicate that the introduction of PECS lowers the threshold of difficulty in acquiring speech and, at the same time, has a positive impact on its development (Każmierczak, 2016). PECS is effective in patients with complex communication needs, it can be both a supportive and alternative system. Patients gain a communication tool and initiate contact with another human being. PECS gives people with complex communication needs the opportunity to express their intentions. People using PECS learn functional communication, that is, one that is directed to another person and has a socially acceptable code in the form of a picture. The introduction of PECS contributes to the reduction of contextually inconsistent behaviours caused by the frustration of not being able to communicate. Thanks to the introduction of AAC, in particular PECS, patients can participate more fully in society and decide for themselves.

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