

Virtualization as a Factor of Development of Communicative Competencies in a Hard of Hearing Student with Special Needs

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ABSTRACT

The article describes possible virtualization resource as a phenomenon of substitutional commutation as part of the supporting training “mother – hard of hearing student with special needs” and analyzes the commutation reserves to ensure understanding of family support technologies. In this article we discuss a wide range of substitutional communication options and explain why commutation option is most suitable for a hard of hearing teenager with special needs. Today, thanks to modern technologies, children with special needs have a lot of new opportunities related to various types of substitutional communication. In this context, commutation technology can be used as a transitional form for development of communicative competencies of hard of hearing teenager with special needs.

Keywords: *hard of hearing student with special needs, virtualization, commutation, paralinguistic means, substitutional communication, family support*

1. INTRODUCTION

Full interpersonal communication in the process of socialization is an essential part of success in life and, generally, harmonious existence of each person. Thus, successful education is impossible without acquisition of communicative competencies, because nobody can socialize and realize his/her full potential without communication.

Each neurotypical child is intrinsically able to master speech (first, oral and then written speech). This ability is primarily implemented through his/her communication with his/her mother and other close relatives and secondarily through his/her involvement in communication with gradually extending range of people. Thus, natural evolution of a child and his/her transformation from a biological being into a social being occurs through communication in the process of mastering of oral speech. Studies by N.I. Zhinkin emphasize that speech and communicative development do not always come hand in hand: “There is a relationship between speech and communicative competencies, though the direct correlation between these parameters (speech production and communication) is missing: a child with even significant delay in speech development is able to rather actively interact with his/her age-mates or adults using paralinguistic means, while a child with well-developed speech skills may lack communicative skills [22]”.

However, not everyone may use common communication options and not everyone is able to master oral speech: many children with various psychophysiological disorders are not able to master oral and written speech at the level

required for full communication. If you do not give these children an opportunity to master and learn how to use paralinguistic means, they may not only lose a chance for socialization, but, which is much worse, their mentality will not be able to adequately develop, because according to the concept of inner thinking and speech consistency presented by L.S. Vygotsky social and inner speech are interrelated [14].

That is why it is necessary to provide these children with a wide range of substitutional communication options to prevent brain stagnation and launch the development of their thinking using “alternative path” during longer period as compared to neurotypical children, but according to the same principles and same stages of ontogenesis as envisaged by the L.S. Vygotsky’s concept of consistency of normal and abnormal child development principles [14]. Therefore, it should be emphasized that the more opportunities of using signs a child has, the more initiatives and reactions he/she may demonstrate and be understood, the more positive impact these initiatives and motivators have on the development of his/her cognitive capacities and personal development.

Therefore, the task before us was to find a type of substitutional communication which could suit the interests of each child. In this context, we offered a commutation option to a hard of hearing teenager with special needs. We will explain now how we understand the concept of commutation. Technically, commutation in terms of communicative network means a process of connection of subscri-

ers through “transit nodes”. In this context, a mother who, on the one hand, creates a “coverage zone”, i.e. continued access provided immediately upon the subscriber’s request, and a reserve where information can be “stored” until better days when her son can be “in the network”, i.e. when he develops his own “coverage zone” by signing up and taking advantage of her resource as an active user, on the other hand, shall act as a “transit node” and a “storage”. In this case, our considerations are similar to the theory offered by a famous linguist, J. Bruner. He thought that children’s speech could not develop without adult support [45]. Bruner placed a need for implementation of a “mother-child” communication and interaction structure (which he called “format”) in the center of his concept. Bruner abbreviated it as **LASS** (Language acquisition support system). Resource will be accumulated as part of the apparent virtualization phenomenon which is regarded by us as a set of computing resources or their logical consolidation separated from their hardware implementation and supporting logical differentiation of computing processes implemented on a single, physical resource. **Virtualization** can be regarded as a phenomenon related to the launch of several operation systems: in this case, each of such copies of guest operation systems will work with its own set of logical resources (processor resources, main memory, storage devices) the retrieval of which from a common pool available at the equipment level will be managed by a host operation system called “**hypervisor**” (“maternal support”). Data transmission and storage networks, as well as platform and application software can also be virtualized, i.e. for a hard of hearing adolescent with special needs: (impaired hearing + developmental delay), it can be a resource of storage, processing and translation of both academic and social information.

1.1 Methodology

In the process of communication, a child develops an attitude towards himself/herself, other people, and world around. M.I. Lisina underlined that communication played a critical role in the development of cognitive activity in childhood [6]. Though focus had always been on speech and communicative skills of children with hearing impairment, S.A. Zykov, T.S. Zykova, B.D. Korsunskaya, L.P. Noskova, R.M. Boskis, A.G. Zikeev, K.G. Korovin, N.D. Shmatko etc highlighted the need for development of communicative skills in deaf and hearing-impaired children, arrangement speech environment for them, active use of activity involving adults in the communication, which would give hearing-impaired children an opportunity to functionally participate in the communication process. However, there has been very little research both by Russian and western educationalists and psychologists on how hard of hearing adolescents with special needs develop their communicative competencies. Even fewer studies (in fact, there has not been any proper research at all) analyze the commutation in terms of a communicative network: storage, processing and translation of academic, social and other information from one subscriber to another.

According to T.V. Rozanova, primary developmental delay (DD) caused by impairment of central nervous system is observed in 25-30% of deaf and hearing-impaired children [13]. Children with DD were separated from a group of underachieving school students with deafness and hearing impairment in the course of clinical, psychological and pedagogical studies carried out in the 1970s (G.P. Bertyn, N.Y. Donskaya, L.S. Tamoshynene, L.I. Tigranova, T.V. Rozanova, N.V. Yashkova, M.N. Fishman). The authors underlined that in the majority of cases children had developmental delay of cerebral and organic origin, which manifested itself in the emotional and volitional immaturity, low level of attention randomness and other cognitive processes. Foreign researchers also note considerable difficulties in the school teaching of such children due to the attention deficit and low work capacity which are caused by mild organic brain damage (Meadow. K., 1984). These children proceed with their speech development slower than other deaf persons. That is why they should be initially offered with substitutional types of communication as a transitional arrangement.

It is worth to say that a child with hearing impairment and developmental delay cannot fully master sign language, because he/she learns only a small set of gestures used in the social interaction. A child cannot learn or use abstract and general terms. At the same time, it makes sense to use elements of Russian sign language (RSL) known to a child from an early childhood when talking to a child as one of the sign systems which substitutes oral speech at specific stage.

Which other types of substitutional communication can we use? Western educationalists from the 1960s started to develop the systems of the so-called augmentative and alternative communication, or AAC. PECS and Makaton are the most popular systems of alternative communication in our country. R.M. Frumkina describes the AAC as follows: “All these systems are based on the same concept. It can be summarized as follows: instead of attempts to develop speech skills in a child or liquidate individual speech defects, the undeveloped speech must be substituted with communication using images [20]”. It can be reasonable to use alternative communication in the absence of oral speech or if there is a disorder preventing to understand oral speech (M.L. Barbera, L. Frost, E. Bondy, S. von Techner, H. Martinsen, K. Haydt, O. Speck, M. Walker, L.M. Shipitsina etc.). Moreover, positive impact of alternative communication on the development of oral speech has been confirmed (M.L. Barbera, E. Bondy, L. Frost, B. Carr, J. Felce etc.).

Our commutation-based approach implies that we offer a child with special needs photographic and video materials on the Web instead of special cards with images or pictograms (like in the AAC), where the use of “maternal school” technology as “holding therapy” during the period of shared activity becomes the “hands” of an autistic child or where a mother (“transit node”) finds the information only upon the request of the boy (“subscriber”) (or where he search these images and video clips on the Web). Can we consider this a full **sign system** which can replace oral

speech? Very unlikely, but this option can be regarded as an original “bridge” which can in the future lead an adolescent with special needs to the awareness of using oral speech as a communication tool. It is possible if these images and videoclips for which a child (inventor) feels desperate need are combined with gradual introduction of actual units of oral and written speech.

1.2 Commutation technology in a specific context

Let’s consider the use of commutation technology in respect of a hearing-impaired student with special needs. The boy, Ilya T., was born in 2005 from the second pregnancy (elective caesarian section). The following neurological status was established: “perinatal affection of the CNS of mixed origin manifested as hypertension and hydrocephalic syndrome in the subcompensation stage, mild astheno-hyperkinetic syndrome, 1-2 grade general speech underdevelopment with dysarthric component with underlying 3-4 grade bilateral neurosensory loss of hearing; emotional and volitional immaturity”. The child received hearing aid at the age of 2. Around the same time, it was found out that the consequences of perinatal affection of the CNS of mixed origin manifested themselves not only as hearing, but also visual impairment in the form of moderately severe myopia complicated with astigmatism.

Under continuous monitoring by a child psychiatrist of the Moscow Children’s Surdology Center, the boy successfully passed all intelligence tests and was diagnosed with the following disease as per ICD: “P 06.68 Organic emotionally labile (asthenic) disorder caused by mixed diseases and accompanied by bilateral sensorineural hearing loss”. These disorders in the 1990s were successfully described and analyzed by Galina Petrovna Bertyn [3] as “harmonic universal infantilism accompanied with typical neurological and somatic symptoms” who also made the forecasts of their development [1].

Modern case follow-up shows that Ilya being a hearing-impaired adolescent relies to a considerable degree on his own sensory impressions of direct interaction with the world around, which he receives through unimpaired sensory organs. Vision is the main route of perception for a deaf boy. He states: “There are few words, but really many images in my head”. Ilya is an eighth grade student at Special Boarding School No. 52 for hearing-impaired children in Moscow. He leads rather active social life: he attends a railway simulation group, a motor racing group and basketball school. The closest friend of Ilya is Artyom: they exchange messages with each other (often using animated images) and use gestures during video calls. In winter they go together to the skating rink, in summer they ride their bicycles and scooters and walk around the town. It is understood that most of the time they spend time for online gaming. Expression “go pubg” most commonly used during their conversation must be translated to be understood by older persons. Word “go” means “let’s go”, and “pubg” means Player Unknown’s Battlegrounds (abbr. PUBG),

which is a multiplayer Battle Royale online game. In other words, “go pubg” means “let’s go playing PUBG”. All these features of communication between these adolescents must be taken into account during commutation-based communication.

Ilya often uses such form of self-expression as “mimic pantomime” which is not exactly sign language, but it is rather his own “mix”, i.e. a set of gestures which he transforms into his own linguistic system that helps to adequately support his contacts with Artyom and his mother. Despite that separate gestures may coincide with RSL, Ilya uses them in his own stylistics and according to his own “linguistic canons”. In other words, Ilya shows few gestures in the form of terms or letters in such case: all his movements describe the events or emotions and feelings experienced by the hero of the story he tells. It is clear that it is very difficult to adequately perceive such stories, because they lack universal voice units, and all that he wants to say is very specific and obscure. But Ilya doesn’t really care. He either does not realize that other people do not understand him or he does not care about it and simply wants to express himself. Or he just wants to believe that his mother will always understand what he wants to say. Probably, it also happens, because Ilya simply cannot say all he wants. On the one hand, like many other hard of hearing children, he suffers from impairment of all main functions of oral speech (communicative, generalizing, significative, control, regulating functions) and speech components (vocabulary size, grammatical system, phonetic system), and, on the other hand, he demonstrates the need for self-expression which is typical to a person with ASD. Ilya almost does not comprehend oral speech and understands only some words. He poorly lipreads and almost immediately gets tired. Both his receptive and expressive speech is poor and underdeveloped. The analysis of Ilya’s vocabulary size shows that he has small passive and active vocabulary. Most of the words he uses are characterized by original excessive diffusive ambiguity [4]. Ilya almost does not use word formation, but uses the same word for all cognate words (“race” replaces all cognate words: “racing”, “racer”, “racing car”). Generally speaking, Ilya has difficulty in understanding the relationship between cognate words which have common meaning: for example, “go” and “trip” are absolutely different and disconnected words. Moreover, Ilya in most cases is not aware of synonymic rows and use one word for all similar terms. For example, he uses “ship” for motorboat, yacht, steamboat and warship. Ilya uses very few adjectives and verbs. He does not use prepositions, conjunctions and rarely uses pronouns.

His written speech to a great extent reflects his mistakes in oral speech. He makes many mistakes when he tries to express himself, including in chat rooms and social media. Sometimes it is difficult to understand what he wants to say. His phrases are characterized by features typical to the written speech of a deaf child and resulting issues related to agrammatism, limited vocabulary, wrong use of words, ignorance or wrong use of most of inter phrase constructions. Here are the examples of such phrases: “And Monday I buy” which means: “I will buy something on Mon-

day”. Another example: “Walk, calm. I entrance restaurant” which means “I am on my way, take it easy. I am entering the restaurant”. The last example matches very well with sign translation. But it is an uncommon match.

1.3 Commutation in the process of videoclip watching

How does an adolescent who has such difficulties in perceiving verbal information gain knowledge, understand and process the material required for his development? A feeling of permanent connection and full contact with his mother, a storage of information, a hypervisor, plays a huge role in this context. Clearly, full contact with a mother plays an important role for any child, but for Ilya it is of primary importance.

The best way to promote speech communication in a deaf adolescent with special needs is to involve him/her in the activity which causes his/her interest and implies interaction with a significant adult [5] (for example, watching videoclips which cause his/her interest). For Ilya’s mother, the most important thing is to try to become a part of his world picture, to understand how he acquires information, how he accumulates and processes data and what he learns. For this purpose, Ilya’s mother sometimes sits down next to her son in the evenings and watches the videoclips he selects on Youtube. At least, Ilya is really interested in these video materials as compared to the activities offered by his mother. It turns out that in the process of watching a videoclip which is relevant for a child, his mother is able to give him even a small part of the required information: she is able to act as a “transit node” in the communicative network, when a “subscriber” spontaneously declares a request for communication and receipt of information. Because this information seems interesting to him and he needs it, he is ready to accept and process it as opposed to scholastic training sessions which seem boring to him.

The fact that he may manage the amount and quality of viewed material is also very important for Ilya when watching videoclips. For example, this is how Ilya watches movies: he takes a remote control and rewinds moments which seem boring to him (usually, those where people talk to each other or nothing happens). So, it turns out that he makes his own “video editing” and watches his own compiled movie consisting of fast moving, vivid, spectacular and interesting episodes. Ilya does not want to be a passive consumer of information. He wants to act as an interactive subscriber and control the content which he receives for storage and processing.

Ilya’s mother was surprised that he watched not only tutorials and streamings (computer game walkthroughs in real time), but also various informative cartoons. For example, he watched a cartoon about a legless pilot of British Royal Air Force, Douglas Bader, with great attention (his mother asked him whether he had ever heard of a Soviet legless aviator, and he showed her using sign language how Maresyev suffered wreck and lost his legs, but he did not

know his surname. His mother told him that). Then, he watched a cartoon about Nikola Tesla. Ilya lively reacted to the events shown in this cartoon and asked his mother questions. These cartoons are made in the form of animated comics: characters almost do not speak with each other, but make very many movements and perform many actions, and, which is more important, express a wide range of emotions. Then he watched a cartoon about the fall of the Berlin Wall, French Revolution and chess (the history and rules). His mother was surprised that her son watched cartoons on history until the end, though history and social science were his least favorite subjects at school. Ilya got a rough idea about what happened there, though he did not understand the entire text in the subtitles, because they contained many complicated words. He perceived more content from the video information: movements made by the characters and their emotions and actions.

Most often, Ilya views the so-called memes on the Internet. Earlier, meme was just a funny image on current topics. Now, mem is something you may call a “video anecdote”. It is a very short videoclip (lasting 5-10 seconds) on a funny or ridiculous topics. For example, a young man cannot throw a ball into a basketball hoop. The next moment he is carried to the hoop by an elephant and he can easily throw a ball where he wanted it to be thrown. Such memes represent a perfect source of video content for Ilya. They are short and wordless. They convey emotions understandable by the teenager. They usually have a clear and simple plot which is not overloaded with too much detail. Ilya watches such memes not only on Youtube, but also on Instagram and TikTok. Ilya is most interested in the following memes: cooking (ice-cream, pizza, desserts, i.e. everything he like to eat), various machinery, especially automotive equipment, sports (primarily, car racing).

It should be noted that development of various models of planes, tanks etc. takes up much of his free time. He improves these skills at the Palace of the Pioneers together with other normally developing age-mates and has an equal level of engineering skills. This is also true for chess game where he has achieved high level.

2. CONCLUSION

Today, thanks to modern technologies, special children have a lot of new opportunities related to various types of substitutional communication, including virtual communication. Even if a person does not have a command of oral or written speech, he/she can send smiles or, for example, animated images to his/her friends and acquaintances. He/she can create a chat room in messenger or WhatsApp and send messages this way, as well as send and receive photographs and videoclips. In the process of virtualization, he/she searches for substitutional and alternative types of information transmission which can be used as a transitional form until universal forms of communications, such as written and oral speech, become available to a teenager with complicated disorder structure.

It is also very important that a child has a need for communication, because special children do not always have such a need. Sometimes, a child shuts off himself/herself inside his/her own world where he/she feels comfortable, and he/she does not feel any special need in close interaction with other people. It does not always mean that there are signs of an autism spectrum disorder (ASD). It might be just a feature of a child's temperament and personality. Remember that there are no two alike children (as well as there are no two alike mothers or teachers); individual specifics of each child must be taken into account and considered instead of adjusting a child to a standard.

A child must be ready and willing to accept the information we can give to him/her. According to V.I. Lubovsky, the main depriving situation for children with developmental disorders is that they experience difficulties in receiving and processing of information: "there is a slower pace of all mental processes (than it should be), slowed and limited receipt, processing and use of information, drawbacks in verbalization, low work capacity etc." [23]. In most cases, a child with special needs demonstrates emotional and volitional immaturity, increased fatigability and nervous system exhaustibility, therefore, his/her receptivity of new information is very limited. Besides, a hearing-impaired school student with special needs has huge difficulties with word identification requiring significant efforts from him/her, which makes him/her even more tired.

All these multiple difficulties arising in the process of perception and reproduction of oral speech sometimes make a child to completely avoid oral communication. To avoid this, he/she must be given a chance to mature and overcome all difficulties associated with his/her development delay. In this context, commutation technology can be used as a transitional form, because it is based on a very careful and flexible approach to all specifics of development of an individual adolescent. Thus, dyad "mother-son" or "hypervisor-subscriber" is used to search for possible maneuvers which allow for generation of communicative competencies in a step-by-step manner, though not at a fast pace.

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