

THE EFFECT OF PHONEME DIFFERENTIATION OF THE BRAIN IN THE LEARNING PROCESS

³EVA ZEZULKOVÁ

University of Ostrava, Pedagogical Faculty, Department of Special Pedagogy, Varenská 40a, 701 03 Ostrava

email: ⁴eva.zezulkova@osu.cz

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Abstract: The article analyses the conditions for development of speech in children with mental disorder and the particularities of using speech in social context. It points out the mutual connections between thinking and speech and it puts the emphasis on the development of communication competence in the process of school integration. It gives reasons for the necessity of systematic affecting the development of speech in children with slight mental disorder focused on the phonemic differentiation. It gives information on the results of the research focused on finding and judging the level of phonemic differentiation in pupils in young school age from which the suggestions for special pedagogical theory and practise are derived.

Keywords: verbal communication, communication skills, school integration, social integration, pupils with slight mental disorder, the differentiating ability of the brain, phonemic differentiation, phonemic awareness

Human speech is determined socially, it develops only in social context. Verbal communication is privileged and the most developed means of communication among people. Via verbal communication it is possible to control the behaviour of the members of society according to the respected and recognized standards; it is the basic means in the process of learning. Communication through a spoken word depends not only on expressing abilities to express oneself and talkative readiness, on the way of passing information to speakers but also on the quality of accepting and processing by the listener. Corresponding level in speech and language skills is therefore a significant attribute in the process of social integration. Unfortunately, people with mental disorder often do not meet the demands expected in this sphere. As a result, social integration appears to be the most difficult for those with mental disorder, because the main symptom of mental disorder is more or less considerable deflection in communication, where the rule of proportion can be applied – the more developed stage of mental disorder, the more serious speech disorder. Due to mental disorder the ability to speak develops not only delayed but also in a different way because of different biological conditions. If we consider that the process of education is based on adequately developed speech abilities and skills – both speech spoken and written – different and eventually limited development of speech indicates not only school failure but also difficulties with career and in other spheres of social environment. To prevent secondary consequences of disabilities in case of children with mental disorder it is necessary to emphasize the development of speech from early age.

Pedagogical and psychological point of view, which is applied to outline the system of compulsory education for students with mental disorder, is based on searching procedures, methods and techniques to simplify the process of learning of these students, it is also based on the careful selection of the subject content essential and needed for the orientation in the world, in the area of human relations; eventually for the potential career performance and also the subject content that enables further development and continuation in education after the school attendance is finished. To develop communication skills it is needed to use both systematically and thoroughly all the possibilities given by the educational content as well as by the experience and pieces of knowledge of students with mental disorder. Speech is the product of higher cognitive processes that are retrospectively influenced by the speech, a process of mutual interaction exists here. If we want to support cognitive development of a child, it is important to observe and stimulate the progression of speech and language skills even during the preverbal phase which comes before the verbal communication

phase. We must not forget the influence of nonverbal communication, either. It can sometimes work more strongly and convincingly; through nonverbal communication it is possible to express communicative intention that words cannot express. However, the importance of nonverbal communication is often neglected in the case of children with mental disorder.

A healthy child is born to the world with inborn disposition to learn to speak and this disposition is naturally evolved in the contact with speaking people surrounding the child. As children bearing a risk we consider children with mental disorder being exposed to conditions not suitable for the development of speech even in the phase of brain development. Unsuitable conditions arise from both dominant handicap and influential outer surroundings.

By inconvenient internal conditions we consider organic damage of central nervous system that displays as a weakened cognitive activity. Brain cortex is the controlling system of our nervous system and a place of our consciousness. Thanks to it we can remember, realize things and communicate. As a consequence of its weakened functionality the connection between the analyzers is made with difficulties and the result is overall psychomotor delay. Here the negative role is played by the general disruption in dynamics of nerve processes. From the very beginning the speech is developed slowly and deformed. Inconvenient external conditions are often caused by inadequacy or lack of speech stimulation, improper speech model, negative educational approach etc. In the case of children with mental disorder, inconvenient internal preconditions often combine with not so positive external influence of the surroundings. Between the internal and external factors influencing the development of speech there are complicated mutual relations that are difficult even to specify when judging the development of speech of a specific child. At the same time perception disorders disable kids to gather enough ideas that would support their speech development. As a result of that they misunderstand the meaning of the verbal concepts and that limits their active participation in games, manipulation with objects, thus activities that backward support and influence the development of speech as a basic tool of thinking. Negative consequences of delayed development of speech caused by mental disorder start to appear even during the early period in other spheres of psyche. Generalized speech leads to generalized thinking. Thinking of children with mental disorder is too specific, inaccurate, and wrong in the analysis and synthesis, it is characterized by the weak leading function and considerable uncriticalness, the terms are formed carelessly and the judgements are imprecise. The insufficient development of speech is often considered the main cause of these. There is even a hypothesis to what extent the level of intellectual abilities is influenced by the organic damage of the brain and to what extent by the role of delayed speech development. Different conditions for speech development in children with mental disorder are reflected in all language levels and the development of speech is disrupted to the extent that it never reaches the standard and on the basis of course it is assessed as a limited development. Therefore the issue of speech development in children with mental disorder is much more complicated than it might seem to be at first sight mainly because of various causes influencing one another. The processes of the imitation and experimentation while acquiring speech are limited because of the mental disorder and for that reason it is necessary to pay higher attention to the stimulating programmes encouraging the development of speech. In the case of the symptomatic disorders of speech in children with mental disorder it is obvious that elimination of the influences of the dominant disability is not possible but the negative consequences can be compensated by timely support of the development of speech and language abilities with the stress on the usage of all the means of expression.

In children with slight mental disorder the delayed development of speech is usually the first signal of the developmental deflection from the standard. It is demonstrated mainly by so

called phonetic-phonemic disorders manifesting itself in low level of phonetic differentiation of sound close phonemes and difficult sound analysis of words. Differentiating ability of the brain mainly in the sphere of hearing and motoric skills stands in the shade of the mechanisms of perception and production of speech. It guarantees the ability to differentiate even the smallest sound differences during a continuous speech and at the same time to precisely grade the movements of convoluted components of the articulatory system in order to make the produced sound reach the shape of comprehensible speech. Phonologic processes are essential for acquiring the speech and also they are closely connected with higher cognitive processes. On that account we can predict their mutual interaction. The correct development of phonemic differentiation usually contributes to the correct pronunciation, to understanding of the meaning of words and on the contrary the proper pronunciation encourages phonemic realization. While with the pathologic cortical activity and slower formation of connections between analyzers in children with mental disorder the opposite tendency appears. As a result of a weakened brain cortex, which influences the quality of higher cognitive processes at the same time, the differential conditioned connections and dynamic stereotypes in the cortical areas of auditory analyzer form more slowly in children with mental disorder. By this the auditory and proprioceptive backward afferents are weakened which is reflected in the insufficient discrimination of phonemes. The Phonemic awareness as the most complicated level of phonologic processes and the highest quality indicator of the phonetic phonological abilities of a child is then differentiated more slowly and in worse quality. Children with mental disorder cannot distinguish the sounds of continuous human speech for a long time and as a consequence of the weak connections of the centres of fine motor skills we can expect frequent incompleteness in the articulation.

Insufficient phonemic differentiation slows down the improvement of pronunciation, it disturbs the understanding of word meaning and the improper pronunciation limits the improvement and makes understanding of phonemic awareness more difficult. In connection with the mental disorder it is necessary to respect the fact that the achieved level of phonemic differentiation that is achieved depends on the abilities of a child to perform thinking processes .

For that reason the development of speech in children with mental disorder falls behind the intact population and it also takes place differently in the particular language levels. When putting words into sentences they rely on simpler forms, the meaning of the words is more specific, it has less dominant role in conversation, the change from a concrete name to a term is long and inaccurate, different and incorrect usage of phonological rules leads to more frequent occurrence of different articulation.

From the above mentioned it is obvious that the perception of sounds of human speech is not a simple thing and it is not ensured by a sufficient auditory acuity only . It is the result of a complicated analysis and synthesis where those phonemic features are chosen from the complex of sound features that have signal importance for certain language. Thus it is not enough to hear, it is important to distinguish between the sounds which means to differentiate or discriminate words or verbal units according to the specific characteristics in their acoustic structure. Without the proper accuracy in understanding the whole word, mainly of similarly sounding phonemes, the child cannot separate slight differences in the connotations of many words. That slows down learning of vocabulary and grammatical structure of the language; it influences the pronunciation and makes the development of communication skills more difficult. To acquire a word it is not enough just to learn it, but it is necessary to be able to use it in the real conditions of communication context and for the specific communication purposes.

The risks of acquiring universal, effective and open communication with adequate language means in pupils with mental disorder follows from

- a long-time unfavourable internal conditions connected with a dominant disability

- a long-time unfavourable external conditions, e.g. in the form of absence of the early stimulation, late or surface diagnosis, the unawareness of specific unusualness of an ontogenetic development of speech, the application of ineffective methods in speech education etc.

It often happens that the period of preschool and young school age is not used to create basis for the mother tongue. Positive results of some researches in the area of the aimed stimulation of phonemic awareness in pupils with slight mental disorder, on the contrary shows the possibility of how to effectively affect the quality of orientation in sound structure of spoken speech that is the precondition of understanding . The emphasis on the development of phonologic processes supports the refinement of the meaning of words, vocabulary extension, acquiring grammatical rules of spoken word and the improvement in pronunciation. The attributes stated above improve the motivation to study and influence positively learning of reading and writing and the whole process of communication competence in children with slight mental disorder.

We focused the research on finding the level of chosen areas of phonemic differentiation in pupils of young school age.

We took up interest in the results of these representative samples:

- 1.intact pupils of major society
- 2.intact pupils of Romani ethnic group
- 3.pupils with slight mental disorder

The Interpretation of the results of the research

The results found by the empirical investigation confirm the theoretical basis about the irregular development of differentiation abilities of the brain. Phonemic differentiation is developed as a result of the coordinated activity of analyzers together with the development of higher cognitive functions. It is not sufficient just to distinguish the fundamental verbal sounds only by hearing, the child has to realise and understand the sound structure of a spoken unit. It is the ability to consciously handle the sound of human speech on the level of words, syllables and phonemes. Phonological processes come under a "schedule" of physiological development; they mingle with each other and are demonstrated by the level of phonemic awareness. Firstly, a child differentiates the basic sounds of a mother tongue, later more detailed sounds and then it learns to differentiate even the slightest differences between phonemes by hearing. The standard for reaching the appropriate phonemic level of differentiation is the age of seven or eight years as this age is logically connected with the beginning of school attendance. A child starts to understand that syllables and words are formed by the sounds of human speech that are represented by graphic characters. Phonemic awareness enables to distinguish between the elements of speech and to understand the content of the communication. It is the area of auditory perception that takes part in the determination of the vocal structure of words and the manipulation with phonemes in a word.

The results of the research prove the optimal development of phonemic differentiation only in the case of a group of intact pupils from the major population. In intact pupils from Romani ethnic group and the pupils with slight mental disorder the level reached in ability to break down human speech to words, syllables and phonemes is approximately the same but it, however, is located in the plain of good and low level which is a very alarming condition for learning graphic form of speech. (see the table)

Table: The overall evaluation of the results for chosen sample of empirical investigation

the level reached	the intact pupils of population	intact pupils from Romani ethnic group	pupils with slight mental disorder
0-49,9%		omission of phonemes	omission of phonemes
		omission of syllables	omission of syllables
		substitution of phonemes	substitution of phonemes
		production of rhymes	production of rhymes
		analysis of words into phonemes	analysis of words into phonemes
50-79,9%		isolation of first syllable	isolation of first syllable
		omission of phonemes	omission of phonemes
		omission of syllables	omission of syllables
		substitution of phonemes	substitution of phonemes
		production of rhymes	production of rhymes
80 – 100%		synthesis of phonemes	synthesis of phonemes
		analysis of words into syllables	analysis of words into syllables
		synthesis of phonemes	synthesis of phonemes
		analysis of words into phonemes	analysis of words into phonemes
		isolation of first phoneme	isolation of first phoneme
		isolation of first syllable	isolation of first syllable
		awareness of rhymes	awareness of rhymes

note: When judging the level of phonemic differentiation in observed tasks the criteria are used as following:

- low level 0 – 49,9%
- good level 50 – 79,9%
- high level 80 – 100%

The discussion of the results of the investigation

The study of observed development of certain areas of brain showed that children perceive information about the language and word from the early period of life. That influences their development and the process of learning at the same time. It depends both on the biological basis for learning speech, on the way of the mediation of sounds of human speech and on the environment the child is living in. The quality of differentiation of sounds of human speech is influenced by speech inputs intermediated by the contact with people. The precondition of successful learning in the early childhood is a social contact. Auditory and phonemic differentiation takes place even after the first year of life when new reflective connections in the brain are formed. In children, a refined phonemic perception appears at the beginning of the development of speech as the ability to accurately imitate even the slightest differences in sounds of human speech from own microenvironment. Later, with the development of intellect the child gives preference to the content of information rather than to the form and it often apprehends the segments of sounds incorrectly.

Around the third year of life the child starts to differentiate words in the sentence and divides two-syllable words and later more complex words into the syllables. The implemented research proved that all the observed pupils have the area of syllable analysis and synthesis differentiated on a high level. That area is affected by the activities accompanying early and preschool period of development in children that is naturally connected with movement, rhythm, recitation and singing. The amount of experience is then reflected in higher level of the area observed. The immediate perception is guaranteed by the sense perception and then perceptions are registered by the memorial fixation and consolidated by the activating of a commemorative trace. It should be noted that the immediate auditory perception is always selective, based on the individual experience. The ability of syllable analysis and synthesis is differentiated

between the fourth and fifth year of a child considering that the syllable synthesis is more difficult than the syllable analysis.

Before starting the school attendance the child should be able to separate the first syllable and the phonemes in a word and decide on whether the words are identical or not. The results of the research confirm that these areas (the isolation of first phoneme, the isolation of first syllable, the awareness of rhyme) are differentiated only in the case of intact pupils of the major society. In other pupils they are differentiated on a good (average) level, which is insufficient state of the phonemic differentiation mainly in children from Romani ethnical groups.

The development of auditory analysis and synthesis takes place during the first few years of school attendance. In close connection with learning of reading and writing the abilities are differentiated to discriminate more precisely the sounds of human speech (the length of syllables, the differentiation of soft and hard syllables) and to manipulate with phonemes in words (leaving out syllables, leaving out phonemes, substituting of phonemes), all these abilities are the precondition for learning the graphic form of speech. If pupils fail in these tasks we can expect problems with understanding of the content of spoken speech, with learning the vocabulary and grammatical rules in spoken speech, with realisation of phonemes more difficult for articulation. The imperfections listed affect the motivation to learn and the overall success of pupils. When reading and writing, the pupils are not able to state the phonemes that form the word or they are not able to create a word from the phonemes. They perceive the words inaccurately, the phonemes blend and that makes it difficult to understand the meaning so children often skip those words.

By the means of the research we found that the processes of phonemic differentiation focused on more difficult manipulation with the phonemes in a word (leaving out phonemes, leaving out syllables, substitution of phonemes) are developed at a good level in intact pupil of the major population and therefore we can assume that during the young school age they will reach a very good level through autocorrection together with learning the graphic form of speech. On the contrary, in pupils from Romani ethnic group and in pupils with slight mental disorder we can expect persistent problems that will certainly reflect in the level of graphic form of speech. These pupils can be considered as bearing a risk in terms of school success because their orientation in more difficult tasks of the phonemic differentiation is on a low level that predicts serious problems while learning to read and write.

Mutual immediate connection between phonemic awareness, the range of vocabulary and thinking is also proved by the results in the area of the production of rhymes. The precondition for the production of rhymes is the range of vocabulary which is dependent on the previous experiences of the child, on the level of the phonemic differentiation and on the higher cognitive function (understanding of situations and logical relationships). Firstly, the child has to understand a new word and its content and then it becomes a part of its passive and later active vocabulary. Vocabulary is a reflection of the development in thinking of every child and conversely learning of new words supports thinking.

The results of the investigation show different precondition for learning in different samples of pupils following from the level of the phonemic differentiation. As alarming we consider the traced differences in the observed areas of phonemic awareness in intact pupils of the major population and intact pupils from the Romani ethnic groups as those follow the uniform curriculum in form of the Frame Educational Program for Primary Education.

The results of the research also show that the pupils with slight mental disorder reach a higher level in those areas of the phonemic awareness that are stimulated more often and where concrete thinking is applied as there is no need to deduce general, essential feature (the analysis of a word to syllables, the synthesis of syllables, an isolation of the first syllable, an isolation of the first phoneme, a synthesis of phonemes).

However, they reach lower values in tasks, where the depreciated thinking processes appear more noticeable (a realisation of rhymes, a production of rhymes, an analysis of words into syllables, an omission of syllables, an omission of phonemes, a substitution of phonemes). These tasks expect the ability of more complicated thinking operations, accurate perception, and the division of phonemes in a word, the idea about the order of phonemes in a word.

Based on the analysis of the results of the investigation it was confirmed that in the area of phonemic differentiation there appear deficits in the case of pupils from the Romani ethnic groups and in pupils with slight mental disorder that were studied. The causes of these deficiencies vary and they result in various ratio of long-time unfavourable conditions for the speech development. For this reason the goals set for the development of phonemic differentiation and the means to reach them are different. On the contrary, the consequences of the deficiencies described are the same, mainly in the process of learning. Without the ability to discriminate the sounds of human speech the pupils have difficulties with understanding the slight differences in meaning of words which slows down learning vocabulary and grammatical structure of the language, it influences the pronunciation and makes it more difficult to acquire the speech and language skills. The pupils can differentiate words in the speech of someone else and can reproduce them quite precisely, but they cannot clarify their phonemic structure and the final word is read or written with a mistake. The necessity of a purposeful development of both auditory perception and phonemic differentiation appears as reasonable mainly at the beginning of a compulsory school attendance. The focus on better quality orientation in sound structure of the language can help the pupils from socio-cultural disadvantaged environment and also to the pupils with slight mental disorder to handle an adequate level of communicative competence, which is the necessary precondition for social integration. We must not forget the importance of simultaneous development of cognitive areas. We must conclude that the integrated program focused on the development of phonologic processes is not available in our country yet.

For that reason we recommend that teachers use activities supporting the development of phonemic differentiation in school curriculum that is based on curricular documents for the preschool education and for compulsory basic education. At the same time arises the demand for the improvement of preparations of pedagogues in the area of integration of pupils with special educational needs and their professional qualification particularly in the communicative and diagnostic area. The effort must be made to improve the cooperation of teachers with the institutions providing school consultancy and to enforce the justice of the demand for arrangement of the function of a special pedagogue in an advisory team at primary schools.

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