Psycholinguistic Preconditions of Speech Formation of Children with General Speech Retardation

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Abstract: *The article addresses psycholinguistic preconditions for development of the communicative component of speech activity in 5-year-olds with general speech retardation (GSR). The development of speech activity is analyzed through the lens of psycholinguistic motivation for the emergence of speech units. The authors for the first time identified psychological mechanisms that underlie disorders in the development of the communication component of speech activity in 5-year-olds with GSR and suggested effective interventions.*

The research involved a study of probability prediction within the structure of the communicative component of speech activity of 5-year-olds with GSR. The author-developed classification of non-verbal and verbal probability prediction formed the basis for a theory-based diagnostic tool to assess the communicative component of speech activity in 5-year-olds with GSR. The research demonstrated the importance of probability prediction as a dynamic process and indicator of practical realization of utterance and holistically developed coherent speech.

The analysis of disorders in cognitive and speech operations and functions identified in the study points to the dominant role of weak probability prediction function at non-verbal and verbal levels. Weak probability prediction was defined as the cause of poorly developed communication component of speech activity in 5-year-olds with GSR.

Keywords: *communicative interaction, 5-year-old children, research, probability prediction, diagnostic complex, psychotechnology.*

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Introduction

Current research in speech and language therapy is driven by activity-based, child-centered, neuropsychological, psycholinguistic and synergetic approaches. The psycholinguistic approach considers speech activity as an integrated unity of linguistic and communication components, and, therefore, enables the most holistic and comprehensive diagnosis of speech disorders and related speech interventions. The specific nature of the development of speech activity in preschoolers has been described by numerous scholars (Behas et al., 2019; Kalmykova, 2009; Leontyev, 1990; Melnyk et al., 2019; Melnyk et al., 2021; Sheremet et al., 2019; Sobotovych, 1997; Vyhotsky, 1983; Zhynkin, 1958; Zimnyaya et al., 1977 and others) who highlight its complex function, polystructuralism, mobility and the relationship between speech activity and all other mental functions. Meanwhile, both Ukrainian (Akhutina et al., 2017; Kalmykova, 2009) and international (Mandak & Light, 2018; Mathisen et al., 2016; Rao, 2011; Wakita, 1976) academics are predominantly guided by linguo-didactic views, which tend to overlook psycholinguistic motivation for the development of speech units that arises from the child's need to communicate.

Research studies into speech development in preschoolers in the context of ontogenesis and dysontogenesis mostly refer to 6-year-olds and focus on the linguistic component, whereas the communicative component of speech activity that underlies verbal interaction has received only cursory attention.

At the same time, potential maturity of key linguistic and communicative paradigms has been recorded already for children of 5 years of age. Their need for communicative interactions reaches its maximum, which stimulates intensive development of elements of the communication component of speech activity. However, in the case of children with speech development disorders within this age group, speech activity is exposed to deformative influence of adverse factors leading to secondary communication challenges. The relevance of the selected research topic is explained by this contradiction between the need for strategies to develop the communicative component as early as in 5-year-olds, and particularly those with speech development disorders, on the one hand, and the lack of such strategies, on the other.

Modern trends of research into speech delays of 5-year-olds are enabled by the integration of psychological, psycholinguistic and neuropsychological approaches to defining pathological mechanisms and

structure of this form of speech dysontogenesis. To create a comprehensive psychotechnological method to support the development of speech activity in children with general speech retardation (GSR), it is necessary to move away from studying linguistic phenomenology of weaknesses and to finding deficient and preserved links and levels of mental activity, identifying the proportions of speech and non-speech components in the structure of speech-and-mental activity; and designing psychological and linguistic mechanisms for propaedeutical intervention. Since the probability prediction function related to the development of psycholinguistic structure of speech activity in children with GSR, and specifically its communication component, has not been sufficiently studied (Ribtsun, 2011, 2017; Romanenko, 2011, 2015; Tyschenko, 2012), the authors believe it is important to analyze and explore it in this work. Therefore, the purpose of this paper is to look at psycholinquistic preconditions for the development of communication component of speech activity in 5-year-olds with GSR.

Literature review

In line with the current psycholinguistic theory, the mechanisms leading to general speech retardation may be understood and related methods to address it may be found only based on a clear understanding of the essence of speech activity, its structure, and the specific nature of its development in ontogenesis.

Speech is one of the most complex forms of higher mental functions (Akhutina, 2003; Leontyev, 1990; Vyhotsky, 1983; Werner & Keller, 1994 and others). According to a number of well-known academics (Leontyev, 1990; Zhynkin, 1958; Zimnyaya et al., 1977) and others), it should be considered from the point of its linguistic functioning.

Scholars in the area of special education (Ribtsun 2011, 2017; Sobotovych, 1997; Tyschenko, 2012) study speech in terms of its multi-aspect nature, i.e. as combining linguistic, psychological and psycholinguistic aspects.

The design of the psycholinguistic model of development in ontogenesis and dysontogenesis mainly has been led by Sobotovych. She suggested a holistic framework of systemic speech development disorders, their analysis and differentiation, and a theory of intervention work based on the structure of speech activity and its psychological mechanisms (Sobotovych, 1997, p. 23).

According to her framework, the linguistic component of speech activity is about mastering a language, whereas the communication component is responsible for using it in communicative acts. The scholar notes, that the linguistic component of speech activity may be seen as a certain body of language knowledge, language competence, which emerges in the process of learning a language and the lack of which renders language mastery impossible. According to Sobotovych's theory (1997), the linguistic component of speech activity supports child's language learning and includes language comprehension, phonetic-phonematic and lexical-grammatical elements, and coherent speech.

However, even complete acquisition of the linguistic component of speech activity is insufficient to enable a full use of language features. Therefore, Sobotovych (1997) identifies a second component of speech activity which is required for communication, i.e. the communication component. It refers to the process of maintaining a complex and multi-operational structure of speech acts that include the operations of probability prediction, forward synthesis, analysis and control (self-control) at different levels.

Zimnyaya et al. (1977) argues that a key to speech activity of 5-year-olds with GSR is a two-dimensional mechanism of forward mapping, which operates differently in perception and production. Zhynkin (1958) points out that in perception forward mapping takes the form of probability prediction, while in production it is exhibited as forward synthesis.

Anticipation of the next action combines the processes of speech reception and realization. In a way, the forward synthesis mechanism regulates the specific aspects of building structural components of speech units. It covers all communication elements, such as syllable, word, phrase, sentence, and thus influences on how they are combined. In his research, Zhynkin (1958) indicates that this mechanism leads to an integral formation "where the next link should be anticipated by the preceding impulse in order to form the next link". He highlights the inter-connectedness, inter-dependence and complementarity of forward synthesis and probability prediction. This is demonstrated in the unity of two elementary links of any speech chain as "the following links in this chain influence the preceding ones in the same way as the preceding links influence the next ones" (Zhynkin, 1958, p. 81).

The concept of probability prediction (anticipation) has been considered by scholars and practitioners in multiple fields (philosophy,

psychology, biology, pedagogy, linguistics, etc.). Anticipation (from Latin *anticipatio* – I foresee) refers to a notion about an object, phenomenon, or consequences of an action before they are really perceived or carried out (Tyschenko, 2012).

The ideas for using anticipation in different areas of life were covered in the concepts of Akhmetzyanova (2013, 2014), Gardner (2006), Goodman (1992), Schroder et al. (2001) and other international authors. Multiple aspects of anticipation were explored by Russian and Ukrainian researchers (Bernshtein, 1990; Brushlinskyi, 1979; Nichiporenko & Mendelevich, 2006, Regush, 2003; Sergienko, 1997; Tyschenko, 2012). It was established that the processes of foresight and prediction that underpin anticipation are fundamental to the development of child's psyche. In other words, the developmental level of probability prediction is an indicator of the developmental level of perception as a whole.

In speech activity, the probability prediction mechanism means anticipating a grammatically, lexically and syntactically correct future utterance. Such anticipation draws on the probabilistic structure of prior experience. It is known to serve as a means to intensify the processes of production and comprehension of speech utterances, which enables anticipating individual elements of speech chain based on its preceding elements and individual's experience (Chabanna & Kubrychenko, 2010; Tyschenko, 2012). Probability prediction is evident at all speech levels, i.e. from syllable to text; and the broader the context and the more complex the structure of the whole message, the more dependent is perception from probability evaluation of the entire message.

Probability prediction has a two-tier structure: (1) the level of content hypotheses, i.e. anticipating how the communicative message will unfold, development of content links; and (2) the level of verbal hypotheses, i.e. anticipating specific realization (verbalization) of such content links (Zimnyaya et al., 1977).

Thus, as the communicative message is unfolding, its content and verbal form are being predicted simultaneously. Given the lack of systemic analysis of probability prediction, apart from identification of its structural, linguistic and content types, we designed our own classification of probability prediction in speech activity:

- non-verbal: visual, auditory, motor, grammatical, syllabic, lexical, morphological, syntactical;

- verbal: phonological, phonetic, syllabic, lexical, morphological, grammatical, syntactical.

In view of the important role of the communicative component in multi-faceted formation of speech activity, based on its psychological structure, considering current academic knowledge about multi-dimensional interaction between cognitive and speech functions and operations, drawing on the review of the existing strategies to support cognitive and speech development of preschoolers, and taking into account the structure of speech defect in general speech retardation, we rationalized, developed and piloted a diagnostic toolkit to assess the communicative component of speech activity in 5-year-olds with GSR (Brushnevska, 2018; Ribtsun, 2017). It focuses on diagnosing variations of probability prediction in different types of compensatory and developmental interventions.

The toolkit relies on communicative-cognitive, emotional-behavioural criteria and the criterion of cognitive independence, and utilizes indicators and scales for assessing the performance on diagnostic tasks to differentiate the developmental levels − high, sufficient and low − of the main elements of the communicative component of speech activity in 5-year-olds with GSR, determine the nature of speech disorders, and identify the underlying psychological mechanisms.

The key to our research was understanding that speech activity is enabled by complex speech mechanisms, such as speech utterance programming; mechanisms related to transition from the program plan to grammatical structure of the sentence; mechanisms for finding the right word by its semantic and auditory characteristics; phonemic choice mechanisms; mechanisms that enable actual vocalization of speech, but are formed differently in children with typical and atypical speech development.

Psychological Approaches to Analysis and Compensation of Preschoolers' Speech Development Disorders

The study was based on the psycholinguistic approach to analysis and compensation of speech development disorders in preschoolers (Leontiev, 1990; Ribtsun, 2011; Sobotovych, 1997; Tyschenko, 2012 and others), and activity-based approach to systemic research (Akhutina et al., 2017; Kalmykova, 2009; Regush, 2003; Vyhotsky, 1983 and others). A review of psychological and pedagogical literature was performed to determine theoretical positions and key concepts of the study to enable scientific analysis, synthesis, comparison, interpretation and systematization

of data from relevant academic sources and to outline a conceptual framework for designing diagnostic and compensatory strategies. Logical and analytical (deductive and inductive) methods were used to verify the research assumptions and predictive conclusions.

The authors utilized bibliography methods to identify developmental levels of the communication component of speech activity, including collection of anamnestic data and review of medical, psychological and pedagogical assessment records; psycholinguistic analysis within activity-based paradigm; psycholinguistic method of indirect psycho-semantic assessment; qualitative and quantitative data analysis followed by their discussion; psycholinguistic modeling of speech production. Further, a teaching study was conducted to determine how the communicative component of speech activity is formed in 5-year-olds with general speech retardation. The authors used Kolmogorov-Smirnov λ-test to evaluate the validity of changes observed in the developmental levels of individual indicators and the communication component of speech activity in 5-year-olds with GSR.

To develop a rationale for and design a diagnostic toolkit to assess the communication component of speech activity in 5-year-olds with GSR, the authors reviewed the methodological foundations of psychodiagnostic strategies used to evaluate child's cognitive activity (Nemov, 2002; Paliy, 2010; Zabramnaya, 1995 and others) and special strategies used to assess speech development in preschoolers in the context of ontogenesis and dysontogenesis (Ribtsun, 2017; Sobotovych, 1997; Somova, 2002 and others).

The study was carried out starting from 2015 through 2017 at kindergartens No. 5, 9, 28, and 39 operated by Lutsk municipal council, combined nursery and kindergarten No. 611 in Kyiv, combined kindergarten and school 'Harmonia' operated by Kamyanske municipal council, Dnipropetrovsk region, and Denyshy education and rehabilitation centre under Zhytomyr regional council. Group I included 158 subjects, i.e. 5-year-olds with general speech retardation of 3rd degree, who were educated at those settings.

For the purposes of comparative analysis, similar diagnostic assessments were conducted with 107 5-year-olds with typical speech development at kindergarten No. 5 of Lutsk municipal council (Group II).

The study of the developmental level of the communication component of speech activity in 5-year-olds with GSR used two diagnostic

blocks: (1) assessment of cognitive development; and (2) assessment of speech development. Each of the assessment blocks comprised original diagnostic tasks to determine the level of probability prediction in verbal and non-verbal communication based on the author-designed classification. The study followed a number of stages, i.e. diagnostic-preventive, communication- and activity-based, and communication and analysis. Each stage had a differentiated aim, objectives, methods and techniques, while also including common dominant activities to develop probability prediction as the most 'sensitive' and indicative element of the communication component of speech activity.

Diagnostic Outcomes

Based on the diagnostic assessment, it was determined that 5-year-olds with GSR (Group I) had complex variable combinations of disorders related to cognitive and speech development, unlike typically developing preschoolers (Group II). Differences in cognitive development may be accounted by specific features that are characteristic of children with organic central nervous deficiency. Specifically, we recorded insufficiently developed prediction skills on phonological level (I −12.6%, II − 60.9%); impaired operations of non-verbal and verbal elements of probability prediction (I – 3.4%, II – 52.2%); poorly developed lexical (I – 0.5%, II – 61.5%), grammatical (I – 0.3%, II – 72.1%), morphological (I – 0%, II – 55.3%), and syntactic types of probability prediction (I – 0.2%, II – 54.3%). It was established that the totality of these factors negatively affects the development of the communication component of speech activity in 5-year olds with GSR.

The analysis of disorders in cognitive and speech operations and functions observed in our research demonstrated the prevailing role of a low developmental level of probability prediction at non-verbal and verbal levels. Furthermore, the authors define lacking probability prediction as the main cause of the poorly developed communicative component of speech activity in 5-year olds with GSR.

In view of these factors, we designed a psychotechnological approach to nurture the communication component in 5-year-olds with GSR. It builds on key criteria and indicators of well-developed communication component of speech activity. In practical terms, the main elements of this approach are planned and implemented to help 5-year-olds with GSR acquire a robust system of cognitive skills, speech knowledge,

communication experience, improve their skills of using probability prediction operations at non-verbal and verbal levels. Another vital element in this process is broadening the range of communicative interactions, which include the ability to analyze own actions and those of others and to transfer earlier acquired skills to similar situations.

The distinctive nature of the suggested approach is explained by the fact that its content, methods and strategies of compensatory interventions are tailored to work on specific weaknesses in the elements of the communication component, i.e. probability prediction processes. Among the current programmes for compensatory interventions with children with GSR, only the package "Teaching and learning interventions to develop speech in younger preschoolers with general speech delay" by Ribtsun (2011) highlights the development of specific prediction skills at different levels of child's speech activity. Thus, this is the first psychotechnological approach to develop the communication component, as a determinant of speech activity in 5-year-olds with GSR.

In our research we suggested an algorithm to develop probability prediction as a vital element of the communication component of speech activity in 5-year-olds with GSR. It involves strengthening cognitive functions and encouraging intentional communication based on acquired speech experience. Following the formative stage of the study, the control assessment of visual and auditory perception indicated an increase in the number of group subjects who demonstrated a high level of performance on the suggested tasks – from 10.2% to 25.9%. The developmental level of attention processes also notably improved: 12.5% of children demonstrated high performance at the start of the first six months, whereas at the end of the second 6-month period 29.9% of them did. Quantitative indicators of the development of memory processes grew from 10.5% to 29.3%. The overwhelming majority of children in the experimental group demonstrated improvements in visual logical reasoning: at the start high performance was demonstrated by 6.4% of subjects, whereas towards the end of the study this number grew to 28.0%.

Sizeable positive changes were also recorded for speech development indicators. The developmental level of phonematic processes continue to be a challenge in the speech of 5-year olds with GSR, despite positive dynamics indicating a growth from 7.3% to 28.9%. More extensive communication experiences encouraged a diverse use of suggested words in their different grammatical forms.

However, correct agreement between nouns, adjectives and verbs in gender, number and case remained fragmental, which points to an incomplete process of understanding grammar categories: the respective indicators increased from 0% to 20.9%.

In our research we prioritized the assessment of the resulting skills of 5-year-olds with GSR to produce phonetically, lexically and grammatically correct coherent speech. It was determined that communicative utterances were richer in content, indicated a broader range of cognitive interests and diverse use of lexical units, had better grammatical and syntactical structure and were oriented at communicative interaction with peers and adults. The evidence demonstrated growth of the relevant indicators from 0% to 17.6%.

The benefits of the developmental psychotechnological approach used in the study was proved by an analysis of the resulting probability prediction operation in its different modalities as an indicative element of the communication component of speech activity, i.e. significant growth was achieved at high and sufficient levels – from 3.3% to 24.1% (see Figure 1).
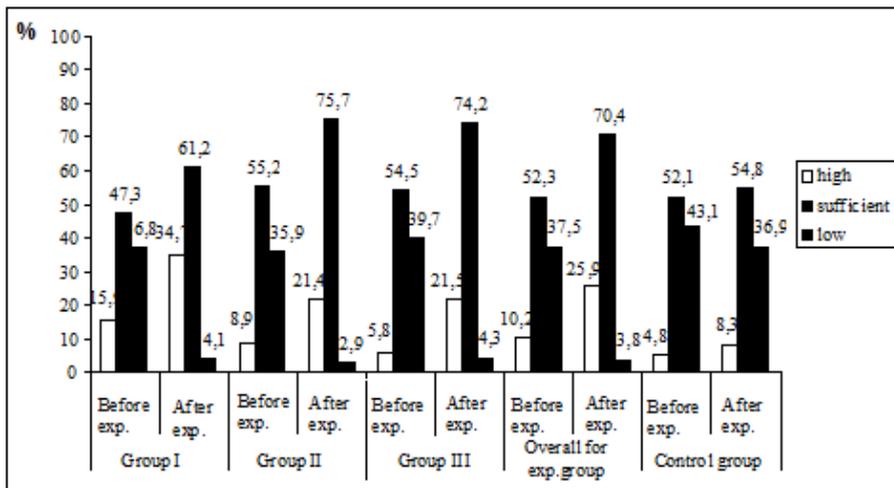

Fig. 1. *Developmental levels of probability prediction skills of 5-year-olds with general speech retardation (%).*

A comparative analysis of resulting developmental levels of the communication component of speech activity in all sub-groups (numbers of children who performed on the high level grew from 6.1% to 25.5%) points to the effectiveness of the proposed psychotechnological approach designed

to strengthen the communication component of speech activity in 5-year-olds with GSR.

Conclusions

Based on an inter-disciplinary theoretical review of research and theoretical literature (psycho-pedagogical, linguistic, psycholinguistic, speech therapy) and modern traditional approaches to interventions with 5-year-olds with general speech retardation, it may be argued that efforts to enhance the development of the communication component of speech activity in this group call for designing new meaningful approaches to increase the effectiveness of interventions intended to overcome disorders in the development of the communication component of speech activity, thereby improving the developmental indicators of speech activity of 5-year-olds with GSR.

Drawing on psycholinguistic analysis, the authors identified for the first time psychological mechanisms (visual functions and operations, mnestic processes, different modalities of attention) that make up the core of a disorder in the communicative component of speech activity in 5-year-olds with GSR. A theoretical and methodological rationale was provided for a structural-and-psycholinguistic model designed to support the development of this component closely linked with other components of speech activity.

This research demonstrates the importance of probability prediction as a dynamic process, indicator of practical realization of the utterance and holistically formed coherent speech. It also points to the need for structural analysis of psycholinguistic preconditions to design an effective psychotechnological approach to enhance the communicative component of speech activity in 5-year-olds with GSR. Finally, it details the main areas for team-based psycholinguistic interventions delivered by different professionals to meet educational needs of this group of children.

The promising avenues for future research may include designing special methods to assess and develop other elements of the communication component of speech activity in older preschoolers with general speech retardation.

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