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Speech Therapy Work with Children Having Specific Language Impairment: Algorithms and Personalization

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Abstract

The concept of “personalization” is rather strengthened in pedagogy. At the same time, in Russia in the field of special pedagogy and, in particular, in speech therapy, there is an urgent need for personalized influence with specific language impairments. A review of Russian classical and modern data on the comorbidity of speech, language, motor skills, and other processes in children with specific language disorders is presented. The rationale for personifying speech therapy work in children with specific language impairments was justified. The scientific positions of the authors with respect to personalization in the field of differential evaluation, developmental effects, and prevention of systemic consequences of specific language impairments in children are indicated. The groups of personalized means and aids of influence of a speech therapist for specific language impairments in children are indicated. The directions of further development of the indicated problem of personalization of speech therapy work are determined.

Keywords: personalization, children of preschool age, personalized means and aids of speech therapy work, specific language impairment in children, personalized diagnostic profile, comorbidity of speech, language and motor disorders

1. Introduction

In world science, and in Russian speech therapy, in particular, the issues of differential evaluation and in-depth study of specific language disorders in children are dynamically developing [1–3]. The manifestations and symptoms revealed by the authors determine the understanding of the underlying mechanisms of such a state as “specific language impairment.” This allows to study in detail the structure of impaired development, to determine strategies and directions of developmental effects of speech therapy. Therefore, in Russian science, the search for further ways of a transdisciplinary study of the problem of helping children with SLI remains very relevant in special pedagogy in general, and speech therapy, in particular. It can be stated that in modern speech therapy, as a science, it is defined as a number of contradictions. On the one hand, there is a need to find new and improving

existing approaches to the speech therapy work with children with SLI. On the other hand methodological, substantive, organizational, and other aspects of new and modernized approaches to solving the designated problem are insufficiently developed. The resolution of the existing contradictions, of course, occurs, and will continue to take place in scientific research of several generations. However, today, we can say that a personalized approach in speech therapy work with SLI children meets the abovementioned social challenges and contributes to effectively overcoming pressing contradictions in general, inclusive, and special education.

In Russian pedagogy, interest in the development of a personalized approach can be traced in the writings of scientists starting last century [1]. There are different interpretations of personalization in education, which allows interpreting this phenomenon in different ways. Personalization can be explained as the process of gaining by a subject universal human, socially significant, individually unique properties and qualities that allow him to fulfill a certain social role in an original way, creatively build communication with other people, and actively influence their perception and assessment of their own personality and activities [2]. At the same time, the term “personalization in education” is often used in Russian scientific research, interpreted extremely variably as: a special form of organization of the educational process, taking into account the peculiarities of personal differences of students [3]; one of the directions of modernization of the system of continuous education; a process aimed at the development of students’ abilities and interests [4]; a factor of development of cognitive activity of trainees; and a means of building a personal educational route [5]. The personalization of education is also considered as a didactic principle, according to which the content and all other elements of the educational process should be determined and built on the basis of the interests, needs, and aspirations of persons involved in educational activities [6].

The variability of interpretations, however, reflects the general focus of educational processes in Russia on the dynamic development of such pedagogical paradigms that put the student’s personality and his multidirectional interests and needs at the center of pedagogical processes.

Moreover, the relevance of a personalized approach in the field of evaluation and development work of a speech therapist with SLI children seems logical.

2. Speech therapy impact at SLI in Russia: algorithms or personalization?

For many decades, Russia has developed stable algorithms for speech therapists: how to work with children with specific language impairments. Those algorithms are based on the classic Russian level approach to assessing the linguistic and speech status of such children [7]. For many decades (since the 60s of the last century), Russian speech therapy has developed an understanding of the essence of SLI as a developmental speech\language disorder that has signs of systemic underdevelopment of all language components and embraces all speech processes [8]. In this regard, in Russia, national models for evaluation of children with SLI have been identified and are successfully operating to date. These models bring together an interdisciplinary team of specialists, which conducts a comprehensive examination of children, evaluates the state of various functions, and formulates a conclusion and recommendations for working with a particular child (psychologist, pediatrician, neurologist, speech therapist, teacher-representative of the school, and if necessary, other specialists). The speech therapist as part of this team conducts his assessment. It can be variable in technology and didactic materials, but always includes: collecting data on the development of language and speech of the child and the speech environment in his

family, understanding of speech and language structures, the state of vocabulary, grammar, phonetics, dialogical and monologue utterances (in relation to the age indicators of normative development). The diagnostic program also includes examination of the state of operations of language analysis and synthesis (starting from 3 to 4 years of age), the state of the basics of literacy (from 6 years old), and later (from 7 to 8 years) an examination is added to the above writing, reading, counting operations, and other educational skills. For many decades, scientific research data, covering various regions of Russia, confirmed the idea of professor R.E. Levina, and, later, professor T.B. Filicheva that the speech-language status of children with SLI can be understood as very different, varying within different levels: from the first level (lowest) to the fourth level (somewhat close to the lower limits of the age norm) [7–9]. The national practice of speech therapy allows detecting a delay in the development of speech/language in children from 2 to 3 years of age with a normative state of intelligence and hearing, in order to subsequently consider these children as a risk group for detecting SLI in them, starting from 3 years. Accordingly, it is from this age in Russia that it is customary to designate a condition revealed in a child not as delayed, but as a disordered development of language and speech. The context of this approach is reflected in the national psycho-pedagogical classification of speech\ language disorders [9]. In Russian speech therapy, a hierarchy of short level characteristics has been established that testifies to the underdevelopment of the processes of language and speech in children with SLI, starting from the age of three:

- The *first level* characterizes practically nonspeaking children who understand the extremely limited volume of words. They use single simple words, amorphous root words, sound complexes, and parts of words, sounds associated with what is named, not combining them into a phrase. There are no word endings, understanding and use of prepositions is not observed. Word formation is not available. A child cannot compose a story on his own. Monological speech is practically absent. A dialogue with such a child shows his active use of non-verbal means of communication. The phonetic side of speech is significantly disturbed; sounds from different phonetic groups are not formed. Children do not understand the tasks aimed at distinguishing the verbal sounds.
- *The second level*—the beginning of the sentence development: children begin to combine two or three words into a simple sentence. However, these sentences are characterized by violations of structure and content. Understanding of speech lags significantly behind these normotypic children. Children skip or distort prepositions, as well as morphemic parts of words, which allow differentially denoting the number, size, gender of objects, objects actions and signs, and other categorical qualities. The initial attempts to form words with significant structural and substantive errors may manifest. Children enter into a dialogue, but do not initiate it, rather respond in one or two words. There is still a tendency to use nonverbal means of communication. Children cannot talk about events, retell the text, etc. Tasks related to distinguishing the verbal sounds are not feasible. The pronunciation of different groups of sounds is characterized by multiple violations.
- *The third level* characterizes using a simple sentence with multiple lexical and grammatical errors. For children at the third level, it becomes possible to draw up simple and even some types of complicated sentences. Nevertheless, in these sentences, there are obvious errors: omissions and rearrangement of the order of the sentence parts, replacement of the end of words, replacement of

prepositions, multiple lexical changes and errors (e.g., according to the genus-specific characteristics of words). Children can actively engage in dialogue, but there is a steady tendency toward a passive role. Self-compilation of the story, retelling of the text, becomes possible. At the same time, expressed errors are allowed in the transmission of the text, its composition, cause and effect, logical and temporal relationships. Word formation and change of words by grammatical categories is characterized by persistent, constant errors (choice of morpheme, choice of grammatical model, word design, etc.). The ability to distinguish some sounds of the native language appears. However, sounding phonemes do not differentiate as should be in accordance with the age of children. They found disturbed pronunciation of sounds from different phonetic groups.

- *The fourth level* characterizes residual manifestations of mildly expressed underdevelopment of vocabulary, grammar, phonetics, and storytelling. Single, but persistent manifestations of impaired development of language and speech are noted in almost all areas, but as minimal manifestations. Such micro-manifestations in the underdevelopment of speech and language, however, are systemic. They show the need for further continuation of the work of the speech therapist [8, 10].

These characteristics of the level assessment of the state of speech and language in children, on the one hand, represent an algorithmized understanding of the fact that underdevelopment of the studied processes of varying severity can be observed in SLI. However, on the other hand, this approach already determines personalization in assessing the language and speech of a child with SLI (if there are common characteristics of underdevelopment inherent in one or another level). The speech-language data of each child are compared with indicators of the age norm. At the same time, indicators of insufficient development of language and speech inherent in each specific child are revealed. In accordance with such a layered approach, confirmed by hundreds of scientific studies and many decades of scientific and practical work, speech therapists in Russia successfully perfect effective algorithms for optimal care for children with SLI. These algorithms are based on determining the level of development of language and speech capabilities that correspond to the current state of the child, and the level that is promising and achievable for him in the course of development work, taking into account the social needs of the child [8, 10, 11].

Currently, these speech therapist work algorithms are reflected in training programs for children with SLI (e.g., programs for overcoming SLI in preschool children) [12].

Such training programs for children offer speech therapists a simple and transparent algorithm of work. It includes a plan for working with a child (with first, second, third, or fourth level of underdevelopment of speech-language processes), the content of the work, the main guidelines for the formation of the lexical, grammatical, phonetic, and syntactic possibilities of children, as well as the potential results that the speech therapist seeks in his work.

So, in working with children whose level of speech and language capabilities is assessed as the minimum (*first level*), the speech therapy is aimed at:

- development of understanding of speech: to teach according to the instructions of a speech therapist to recognize and show objects, actions, signs, understand the generalizing meaning of a word, differentially perceive who and where, and understand appeal to one or more persons, grammatical categories of the

number of nouns, verbs, guess objects according to their description, determine elementary cause-effect relationships;

- the development of active speech activity: in any phonetic design, to name parents, close relatives, imitate the cries of animals and birds, sounds of the world, musical instruments; give orders—go, sit, give; make up the first sentences from amorphous root words (*mama pi*—mama, go to sleep), convert imperative verbs into singular verbs of the present tense, make sentences according to the model: (a) Who? what does? (b) Who? what does? what? (e.g., Katia (mom, dad) is sleeping; Anna drinks milk). Simultaneously, exercises are conducted to develop memory, attention, logical thinking (remembering 2–4 objects, guessing the removed or added object, remembering and selecting pictures of 2–4 parts).

As a result of speech therapy work at this stage of the formation of speech/language development, children learn to correlate objects and actions with their verbal designation, to understand the general meaning of words. An active and passive dictionary should consist of the names of objects that the child often sees; actions performed by himself or others, of some of his states (cold, warm). Children need to communicate with the help of elementary two-three-word sentences. Verbal activity can be manifested in any phrases without correction of their phonetic design.

Teaching children with a *second level* of speech/language development involves several areas:

- development of understanding of speech: includes the formation of the ability to listen to the converted speech, to highlight the names of objects, actions, and some signs; the formation of understanding the generalized meaning of words; and preparation for the perception of dialogical and monological speech.
- activation of speech activity and the development of lexical and grammatical means of the language: learn to name words made up of one to three syllables (cat, bed, coat, puppy), teach initial inflection skills, then derivation (number of nouns, mood and number of verbs, possessive pronouns “my—mine,” nouns with diminutive suffixes, categories of case of nouns).
- development of active phrase: construction and use models of simple sentences—noun plus a coordinated verb in the indicative mood of the singular present tense, noun plus a coordinated verb in the indicative mood of the singular present tense plus a noun in the indirect case (of type “Misha, sleep,” “Misha is sleeping,” “Lilia drinks milk”); assimilation of simple prepositions—on, at, in; combining simple sentences into short stories; strengthen the skills of drawing up proposals for demonstrating actions based on questions; memorization of short couplets and nursery rhymes. Moreover, any phonetic design of independent expressions available to the child is allowed, while attention is paid to the correct grammatically significant elements (endings, suffixes, etc.).
- development of the pronunciation: to learn to distinguish between speech and nonspeech sounds to determine the source, strength, and direction of sound; to clarify the correct pronunciation of the sounds available to the child; develop the sounds at the level of the syllables, of the sentence, words, form the correct sound-syllabic structure of the word; to learn to distinguish and

reproduce clearly syllabic combinations of sounds with different stresses, voice strength, and intonation; and play the syllables with a concourse of consonants.

As a result of speech therapy work by the end of this stage of education, children should have a simple phrase, learn to coordinate the main parts of a sentence, understand and use simple prepositions, categories of case, number, time, and gender. The ability to answer questions with a short sentence, to maintain dialogue, is supposed. The understanding of some grammatical forms of words, simple stories, short tales is expanded. Work on the syllabic structure of words ends with the assimilation of the rhythmic-syllable pattern of two-syllable and three-syllable words. Sound disturbances are permissible.

Education for children with a *third level* of speech/language development includes:

- the development of speech understanding, the ability to listen to the speech addressed to person, to differentially perceive the names of objects, the actions of signs; to develop an understanding of more subtle meanings of generalizing words, to prepare for mastering monologic and dialogical speech.

- the formation of the phonetic system of the language:

(a) the development of the ability to differentiate listening oppositional speech sounds: whistling-hissing, voiced-deaf, hard-soft, etc., then, working out these differentiations in pronunciation; (b) consolidation of the pronunciation of polysyllabic words with various variants of the concordance of consonants, the use of these words in speech; (c) strengthening the skills of sound analysis and synthesis (analysis and synthesis of a simple syllable without consonants, emphasis on the initial vowel/consonant in a word, analysis and synthesis of syllables with confluence of consonants, emphasis on the final consonant/vowel in a word, division of a word into syllables, analysis and synthesis of 2-compound words, etc.).

- literacy training: acquaintance with letters corresponding to correctly pronounced sounds; learning the elements of sound-alphanumeric analysis and synthesis when working with syllable and word schemes; read and write single syllables, words, and short sentences. Preparation for mastering elementary writing and reading skills includes consolidating the concepts of “sound,” “syllable,” “word,” “sentence,” “story,” analysis and synthesis of sound-syllabic and sound-alphabetic structures.
- the development of lexical and grammatical means of language. This section includes not only an increase in quantitative, but primarily qualitative indicators: the expansion of the meanings of words; the formation of the semantic structure of the word; the introduction of new words and phrases into speech of nouns with a diminutive and magnifying meaning, with the opposite meaning. The ability to explain the figurative meaning of words (golden hands, sharp tongue etc.). Select unambiguous nouns for adjectives (sharp—knife, sauce, razor, seasoning; dark—shawl, night, coat); form names of objects from the action names; explain logical connections (Nata escorted Sofia—who came?), to pick up synonyms (bold—brave).
- the development of detailed phrasal speech phonetically correctly formed; formation of dialogue skills; expanding the skills of composing a narrative story based on the events of a given sequence, drawing up sentences with different types of subordinate clauses, strengthening the ability to compose stories from

a picture, a series of paintings, by presentation, by demonstrating actions, transforming a deformed text; and the inclusion in the stories of the beginning and end of the plot, elements of fantasy.

As a result of speech therapy work children should master the skills of using simple and complex sentences, be able to take part in dialogue; be able to compose a story from a picture and a series of pictures, retell the text, have a grammatically correct spoken language in accordance with the basic norms of the language; it is phonetically correct to make statements, conveying the syllabic structure of words, to master some elements of literacy (reading and typing letters, syllables, and short words). However, they may have some lexical, grammatical, and phonetic inaccuracies, the elimination of which should be combined with teaching children complex forms of speech, which is proposed to be done at the next stage of training.

Teaching children with the *fourth level* of speech\language development provides areas of work related to their comprehensive preparation for school:

- Improvement of the lexical and grammatical means of the language: expansion of the lexical stock in the process of learning new words and lexical groups (shell, tusks, museum, theater, exhibition etc.), activation of word-formation processes (complex words, adjectives with different correlation values, prefixes with tinted values), exercise in the selection of synonyms, and antonyms, giving them explanations (mean—greedy, kind—merciful, funny—sad, etc.), explain the figurative expression of words and whole expressions (burn with shame, wide soul), transform the names of male professions' gender into feminine names (typical for Russian), and convert one grammatical category into another (read—reader).
- Development of phrasal speech: to consolidate the skill of using sentences in reference words, to expand the volume of sentences by introducing homogeneous members of sentences.
- Improve coherent statements, ability to build dialogue and monologue, reinforce storytelling skills, retelling with elements of fantasy and creative stories.
- Improvement of the pronunciation in speech: to consolidate the skills of clear pronunciation and distinguishing of delivered sounds, automate their correct pronunciation in polysyllabic words and statements, to bring up the rhythmic and melodic coloring of speech.
- Preparation for mastering elementary writing and reading skills: reinforce the concepts of “sound,” “syllable,” “word,” “sentence,” learn to analyze and synthesize reverse and direct syllables and monosyllables—two, three complex words, learn to make letters, split alphabet, syllables, words and read them, develop optical-spatial and motor-graphic skills, and prepare for a fluent sequential reading with awareness of the meaning of what was read.

As a result of speech therapy, preschool children should be as close as possible to age norms. This is manifested in the spontaneous, faultless possession of dialogical and monologue speech, namely: the ability to adequately formulate questions and answer the questions of others, to tell in detail and logically about the events of the real world, to retell literary texts close to the original, carry out creative storytelling, etc. Accordingly, the lexical and grammatical structure of the language is formed in children. So, children adequately understand and use the various parts of speech, simple and complex prepositions, possess the full knowledge of word formation and inflection for the full extent specified for the specified age. The phonetic design

of children's speech should fully comply with the norms of their native language. In addition, children have sufficiently formed operations of sound-syllabic analysis and synthesis and elementary literacy skills (reading and typing some letters, syllables, short words) [7].

3. Methodology

The material below is aimed at achieving the goal: to identify personalization opportunities in working with children with SLI. It is traditionally considered that algorithms of speech therapy with SLI take into account an individual approach to working with children. The individual approach is an important psychological and pedagogical principle, according to which the educational characteristics of children take into account the individual characteristics of the development of each child (psychological features, abilities, psychological characteristics, the child's perception of the impact on him, etc.) [13]. In the context of speech therapy work with SLI children, a personalized approach is an equally important principle according to which medical, psychological, pedagogical, and social markers and criteria for their impaired development are taken into account in working with each child from the standpoint of further prediction and implementation of optimally effective speech therapy. With this understanding of the problem, there is no equal sign between the individual and personalized approaches in speech therapy work with SLI children. The need for a holistic algorithm-based work with these children is determined to reasonably take into account the combination of individual and personalized approaches [10, 11, 14].

Russian studies in this area show the variable correlation of the speech-language capabilities of SLI children with emotional-volitional, communicative, motor, spatial-orienting, visual (as later acquired) disorders [10, 11, 14, 15]. For example, the data of recent years allow to speak about the multi-level comorbidity of symptoms and components (in the context of the codependence of impaired speech, language, motor, and other processes) in children with language disorders [16–18]. The levels of comorbidity states identified in preschool children with SLI were determined (based on the results of the analysis of data from a survey of language, speech, motor, optical-spatial, graphic processes). The level of micro-comorbidity is characterized by a slightly pronounced correlation of motor and speech/language disorders with the relative safety of spatial possibilities. The level of meso-comorbidity indicates a persistent, pronounced correlation of violations of speech-language processes (intonation, prosodic, pronunciation, phonological, lexical-grammatical) and motor sphere (myofunctional and motility of the fingers) along with partial violation of spatial possibilities. The level of macro-comorbidity characterizes stable, systemic combination and pronounced correlation of manifestations of speech/language disorders covering all speech processes and language components, and motor disorders covering differentiated myofunctional abilities and movements in the shoulder girdle, hands, and fingers with the accompanying pronounced impairment of spatial capabilities [16, 17]. Below is a summary data illustrating the phenomena of comorbidity in children with SLI (**Table 1**).

All of the above allow us to draw a number of conclusions that are fundamentally important for the personalization of speech therapist work with SLI children as part of an interdisciplinary team of specialists:

- in children with SLI, violations of the development of not only speech and language, but also other processes (motor, spatial and other) are detected;
- manifestations of the severity of these disturbed processes and their compatibility can be variable for each child;

Levels of comorbidity states	Presence of conjugate/codependent violations
Level of micro-comorbidity	Insignificant degree of correlation of violations of pronunciation and distinction of sounds, weak correlation of indicators of reduced understanding of the lexical and grammatical meanings of words and their use in self-expression mainly with indicators of violations of articulation, weak correlation between indicators of impaired speech, language processes and movements of fingers, wrists, shoulder girdle; spatial gnosis and praxis relatively preserved.
Level of meso-comorbidity	Pronounced correlation of speech language processes (intonation, prosodic, pronunciation, phonological, lexical and grammatical) correlating with the indices of motor sphere insufficiency (myofunctional and motility of fingers, wrists etc.) along with partial violation of spatial gnosis and praxis.
Level of macro-comorbidity	Systemic combination and confidently pronounced persistent correlation of manifestations of speech-language impairments, covering all speech processes and components of the language, and motor impairments, covering differentiated myofunctional abilities and movements in the shoulder girdle, hands, and fingers with associated pronounced disorders of spatial gnosis and praxis.

Table 1.
Characteristics of comorbidity levels of speech-language and motor-spatial capabilities of preschool children (5–6 years).

- in this regard, the identification of personal indicators and characteristics of processes disturbed in a child (linguistic, speech, motor, spatial and others) will determine the need for personalization in working with each SLI child, including not only a speech therapist, school teacher, psychologist in the multidisciplinary team, but also other potentially necessary specialists.

All of the above allows to determine the subject of study: the search for reasonable personalized directions, content, means, aids, technologies for working with SLI children.

Between 2010 and 2018 at Moscow State Pedagogical University (Russia, Moscow), the authors conducted a study that covered 460 children with SLI 5–6 years of age, attending educational institutions and receiving the help of a speech therapist using algorithmic educational programs adopted in Russia. These were children whose state of language and speech was assigned to the third level out of four possible levels (according to the national assessment model). At the same time, among the population of children selected for the experiment, half had visual impairment (myopia or strabismus). This led to the formation of two experimental groups—group 1 (230 children with SLI and with good vision) and group 2 (230 children with SLI and impaired vision). For both experimental groups, an examination that combined the following methods was applied:

- standardized examination of language and speech used by speech therapists in Russia (the scheme of this examination was indicated above, the results were recorded in individual protocols for each child);
- diagnosis of the state of movements of the shoulder girdle and fingers according to indicators of completeness, strength, coordination, etc. using Pablo System technology (the results were recorded in individual electronic protocols provided by the software);
- diagnostics of the state of mobility, balance, and coordination using Habilect technology according to the criteria of maintaining equilibrium, coordination

of movements of the upper and lower extremities, occupancy, stability of movement, etc. (the results were recorded in individual electronic protocols provided by the software).

For children of the second group (SLI and visual impairment), ophthalmologists were additionally involved in the examination, who for each child gave a professional opinion (on the presence of myopia or strabismus) and formulated recommendations for the teachers' work: what conditions, exercises, and aids are needed for each child, depending on state of his vision.

4. Results

A comparative analysis of the protocols for examining children in the areas outlined above made it possible to personally assess for each child with SLI the starting state of language, speech, motor, and spatial processes. For the second group (children with SLI and visual impairment), ophthalmologists added personal data on the state of visual functions. Thus, as a result, for each child with SLI, a database of linguistic, speech, motor, and visual (for the second group) processes was collected and analyzed. This information is reflected in personal diagnostic profiles, examples of which are given below (Figures 1–3).

Figure 1 illustrates a piece of data reflecting part of the overall assessment procedure: the assessment of the quality of statements and stories of a child with SLI and myopia (with\without using of personalized supports) in tasks: No. 1—making a simple sentence based on 1 picture, No. 2—making a simple sentence based on 2 pictures, No. 3—making a simple sentence based on verbal help, No. 4—compiling a story based on a picture, No. 5—composing a story based on a series of paintings, No. 6—composing a story based on verbal help, No. 7—composing a creative story based on a picture. Studies have confirmed that the use of personalized supports when working with a speech therapist with such children gives a pronounced positive effect already at the initial stages of training. The work of a speech therapist for a long time with a child with SLI is all the more effective, provided that in the general algorithm of work those personalized aids and technologies are used

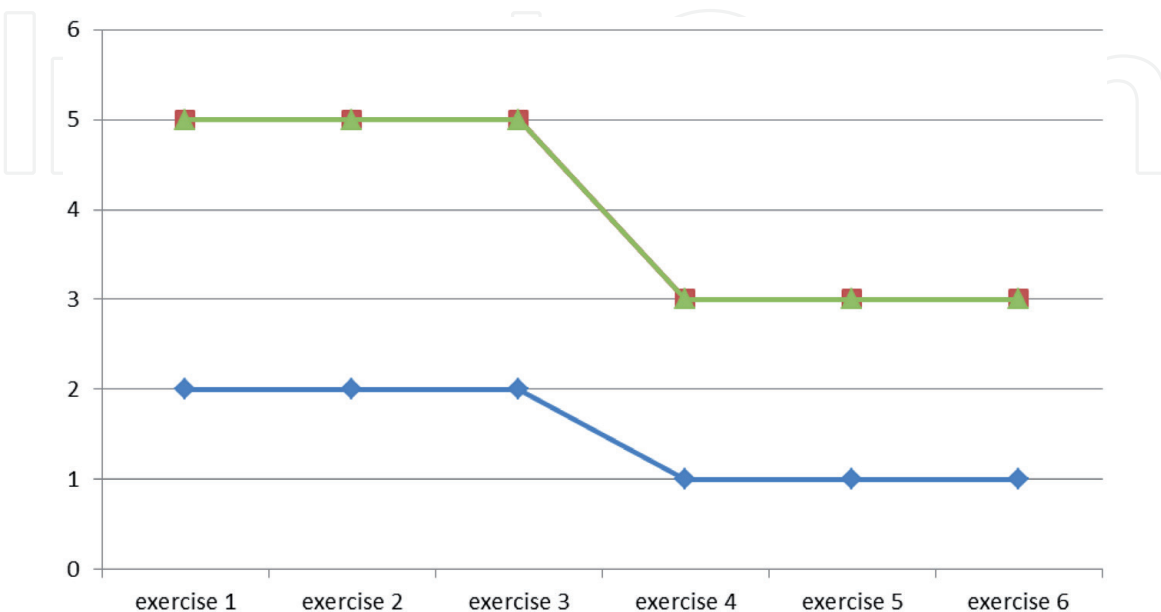


Figure 1. The profile of the state of connected statements of a child 1 (SLI and myopia) with\without the use of personalized support at the stage of primary linguistic diagnostic procedures.

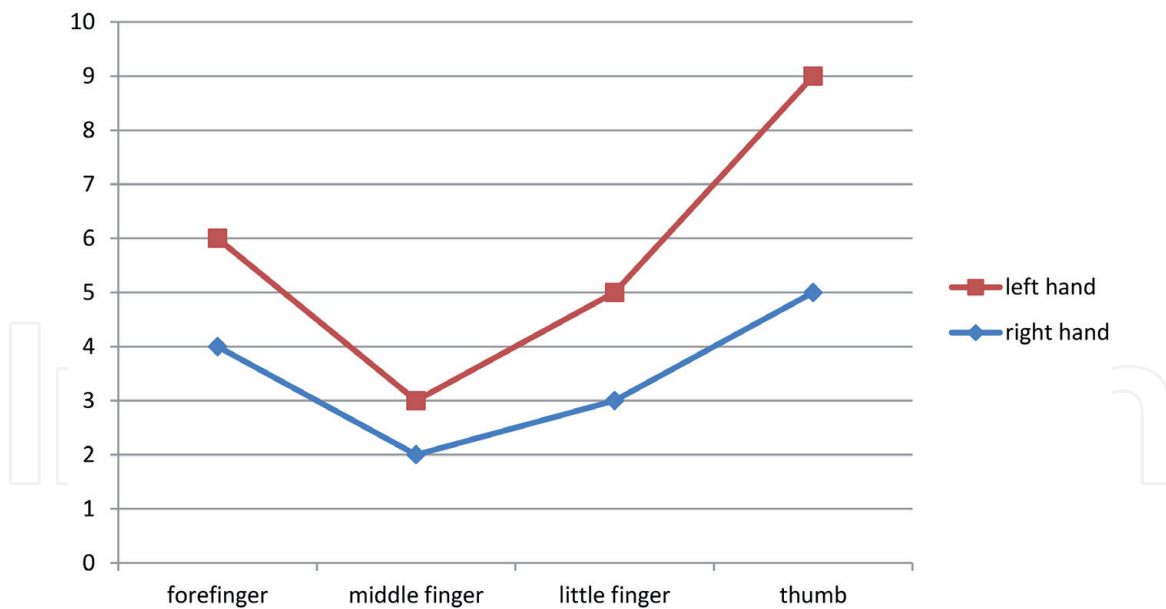


Figure 2.
Two-finger grip state indicators (right and left hand) of a child 1 (SLI and myopia).

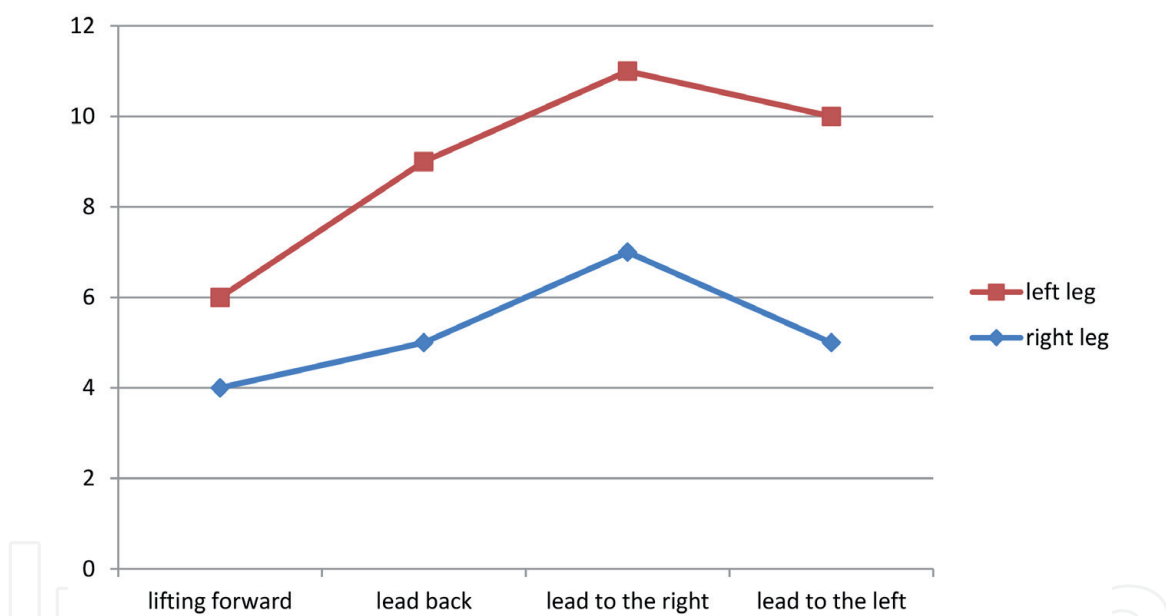


Figure 3.
Indicators of movements of the right/left leg of a child 1 (SLI and myopia).

that help the child with a particular comorbid state of impaired linguistic, motor, spatial, and other processes.

Figure 2 shows a piece of the personal data of child 1 according to the indicators of two-finger pinch capture (right and left hands), demonstrating how accurately and strongly the sensor is captured by different fingers.

Figure 3 shows a piece of the personal data of child 1 on the indicators of leg movements forward, backward, right, and left (right and left legs), showing how accurately and fully the movements are made.

A generalized analysis of the data for each child with SLI has become the basis for planning and implementing personalized exposure programs, designed for 1 year (divided by month and week), for a speech therapist as a member of an interdisciplinary team of specialists. The speech therapist compiled a work plan, based primarily on what starting indicators are recorded in the child in

No	Theme of the lesson	The purpose of the lesson
Week 1		
1	Singular and plural nouns	Learn to use singular and plural nouns
2	Singular and plural nouns	Continue to learn to use singular and plural nouns
3	Word and sentence	To teach to understand and use the concepts of “word,” “sentence”
4	Sounds of speech	To teach to understand and use the concept of “Speech Sounds,” to distinguish speech sounds from nonspeech
5	Simple sentences	To strengthen the skills of compiling and understanding simple common sentences
Week 2		
1	Verbs singular and plural	Learn to change verbs in the singular and plural categories
2	Verbs singular and plural	Continue learning to change verbs in the singular and plural categories
3	Simple sentences	To strengthen the skills of compiling and understanding simple common sentences
4	Vowels (A, U)	To strengthen the skills of distinguishing and pronunciation of sounds “A-U”
5	Vowels (O)	To strengthen the skills of distinguishing and pronunciation of sound “O”
Week 3		
1	Nouns with a diminutive meaning	To learn to form and use nouns with a diminutive meaning
2	The phrase “quality adjective + noun”	To learn to select and coordinate quality adjectives with nouns
3	Model sentence: Who? What doing?	To strengthen the skills of making sentences on the model of “Who? What doing?”
4	Preposition “on”	To strengthen the skills of distinguishing and pronunciation of preposition “on”
5	Consonant sounds	To strengthen the skills of distinguishing and consonant sounds (1-2 consonants, the most accessible for the child)
Week 4		
1	Nouns with a diminutive meaning	To learn to form and use nouns with a diminutive meaning
2	Model sentence: Who? What doing?	To strengthen the skills of making sentences on the model of: “Who? What doing?”
3	Model sentence: Who? What doing? Where?	To strengthen the skills of making sentences on the model of: “Who? What doing? Where?”
4	Preposition “in”	To strengthen the skills of distinguishing and pronunciation of preposition “in”
5	Consonant sounds (P-B)	Clarify the pronunciation and distinction of sounds “P-B”

Table 2.
A fragment of the sample work plan of a speech therapist with a child 1.

language, speech processes. An exemplary fragment of such planning is shown below (Table 2).

However, this plan included areas of work for the development shoulder girdle, finger movements, body movements, leg mobility, as well as those exercises that the ophthalmologist recommended for training the visual muscles. Accordingly, all these exercises were performed by the child either in the process of linguistic tasks,

or as independent trainings as a dynamic lesson fragment (using the technologies of Pablo System and Habilect, according to the plan designed by the program of these hardware-computer technologies). “Gymnastics for the eyes” took 2–3 minutes during each lesson and, according to the recommendations of the ophthalmologist, was an obligatory part of the lesson for those children who had visual impairments. Other teachers of the school (physical education teacher, music teacher, and drawing teacher) in their plan of work with each child made personal, substantive, and technological changes based on what were the personal capabilities and needs of each child. The clearly planned work allowed each specialist to carry out his functions, but this was done in mandatory coordination between all team members. In addition to personalizing the content and areas of work, personalized tools and technologies were identified that increase the effectiveness of the speech therapist working with SLI child.

Figure 4 shows the personal data of child 1 obtained when assessing linguistic, speech, motor, and spatial processes primarily (relative to age norm data), and reflects the constancy and stability of the mistakes made when performing language, speech, and motor-spatial tests. **Figure 4** demonstrates the improvement in the child’s performance under the condition of a single administration of personalized aids. After provided prolonged (14 weeks) personalized assistance from an interdisciplinary team of specialists, the improvement in the results of child 1 was clearly shown. After each prolonged period of personalized training, a team of specialists discussed the results, drafted amendments and changes to the content, technologies and auxiliary means of working with SLI child. Typically, in speech therapy for SLI, algorithmic exposure programs involve 2 years of training for children with a third level of speech and language development before they reach the next, fourth, level of language development.

At the end of the school year, the results of personalized work with children involved in experimental groups (E group 1—SLI, E group 2—SLI and visual impairment) were analyzed. Each child passed the final assessment according to the same parameters and criteria as before personalized learning. The linguistic and speech processes of all children in the experimental groups turned out to be much higher than at the beginning of the year in all assessment parameters. According to the national model for assessing language and speech status, almost

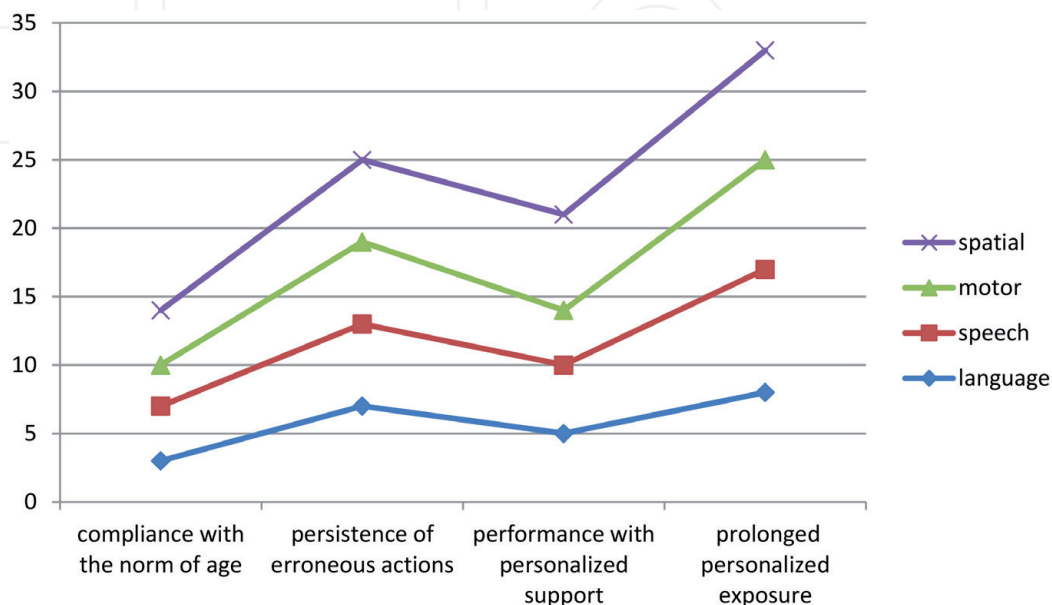


Figure 4.
Generalized indicators of process evaluation of a child 1 (SLI and myopia).

Language development level (according to the national model)	E group 1		E group 2		CA group 1		CA group 2	
	pre	post	pre	post	pre	post	pre	post
Level III	100	20	100	22	100	72	100	82
Level IV	0	80	0	87	0	28	0	18

Table 3.

Analysis of language development data for children with SLI involved in experimental and comparative groups (pre- and post-training) (%).

all children have been changed status from third to fourth level. At the same time, the comparative analysis groups (CA groups), which included children of a similar age who received the work of a speech therapist according to standard exposure algorithms (CA group 1—SLI, CA group 2—SLI and visual impairment) in most cases remained at the third level of speech\language development (**Table 3**).

Table 3 shows data that convincingly show that in the vast majority of cases, the dynamics of language development are higher in those children with ALS who were trained according to personalized programs.

Motor and spatial assessment data using Pablo System and Habilect technologies recorded a personal dynamics for each child, reflecting an improvement in the state of mobility, coordination, strength, motor control in the fingers, wrists, elbow, shoulder, as well as in the movements and coordination of the trunk and legs. The ophthalmologist's data for children with SLI and visual impairments showed varied dynamics (mainly from stabilization of indicators to their slight improvement—81%). The remaining 19% of cases were characterized by an ophthalmologist as a “progressive” course of visual impairment.

5. Discussion

Such data on the impact of personalized teaching aids, which have multiple reproducibility in the study of children with SLI in Russia, subsequently provide weighty reasons for substantial optimization of general, particular, and specific algorithms of speech therapy and developmental influence. At the same time, a personalized approach to it should be understood as a harmonious component of the general scientific and methodological support of the holistic process of psychological and pedagogical assistance for specific language impairment. The effectiveness of this approach seems to be optimal when the following conditions are met: reasonable integration with other approaches strengthened in science and practice, competent use of classical and modern scientific data from the field of speech therapy and related sciences, taking into account variable and combinatorial components in the structure of SLI, based on understanding personalized needs and capabilities of children, the relationship in the interdisciplinary team. The personalization of speech therapy is advisable on the planning and implementation of the content and directions of work, the choice of aids and technologies of influence, logical interaction with other members of the interdisciplinary team.

It is possible to clarify the interpretation of the concept of “personalized aids that ensure the effectiveness of speech therapy work in children with SLI” as a system of various ideal and material objects, including artificially created ones, in order to optimally form language and speech processes in children, as carriers of the necessary information and as instrument. They are integrated at the linguodidactic,

logical-semantic, optico-ophthalmological (as prescribed by the ophthalmologist), motor-spatial, and information-technological levels of the problem under study. It is logical to believe that personalization will be in demand in the work of a speech therapist as part of an interdisciplinary team.

Let us consider, for example, the personalization of the content and means of speech therapy work with schoolchildren with SLI and visual impairment (squint and myopia) in the direction associated with the improvement of their coherent expressions. The content of this speech therapy area is traditionally algorithm-driven, based on the appropriate techniques adopted in speech therapy. In parallel, in the context of the joint work of a speech therapist, parents, teachers of physical culture, music, drawing, an ophthalmologist, personalized exercise programs were developed and implemented for such children (depending on the states of comorbidity of speech-language, spatial, optical and motor processes identified for each child) as well as personal plans to perform special visual exercises and workouts. These directions of speech therapy may be changed in content due to child visual impairment. So, in Russian speech therapy, usually a story-description of an object is one of the first forms of work in teaching SLI child storytelling. However, for a child with SLI and visual impairment, we can build a different algorithm that combines analysis and construction: a simple sentence—a fragmentary/holistic dialogue—a narrative story—a descriptive story—a creative story (all types of work are based on a special interactive touch panel with elements of feedback

Groups of personalized aids	Characteristics of aids
Lingvodidactic	Aids that are designed to teach children who have SLI (means to ensure optimal motivation to express, generate intention, plan, select speech means, implement and control speech). These means are personalized depending on what type of statements is “starting” for each child (simple or complex sentence, fragmentary or holistic dialogue, etc.), what are the personal indicators of language capabilities (in terms of diagnostic parameters) and preferences of the child on the subject of statements (“Game,” “Animal Care,” “Sport,” “TV,” etc.), what are the personal indicators of each child when performing diagnostic tests (reflected in the appropriate personal diagnostic profile). On this basis, for each child, separate models of statements are selected, objects that motivate the statement, graphic images and problematic communicative situations, individually take into account the variable set of words denoting objects, signs, actions, phenomena; solved range of grammatical and phonetic problems.
Optical-spatial	Means that allow optimizing the training of schoolchildren with SLI and visual impairment, taking into account the peculiarities of the optical-spatial capabilities of these children. These tools provide a linear organization of the stimulus material, its location in space, the possibility of correlating eye movements with hand movements (with tactile and visual row tracking), a fixed increased image size, its contour, detail, etc. These aids are personalized, for example, depending on the recommendations of the ophthalmologist. So children with squint (depending on the squinting eye) are invited to have visual rows on the left (or right); for children with one type of squint, verticalization of images is suggested, and with another type, horizontal position of images. Children in the process of occlusion are given the location of the stimulus material from the “better seeing” eye. Children who are in the process of pleoptic and orthoptic treatment (associated with correcting squint and restoring the ability to fusion-merging two images together) can be offered optical-spatial conditions that are close to those that are suitable for children with myopia (e.g., the increased size of images and their spatial image). The angle of visual stimulus material for children with squint and amblyopia—90 degrees, for children with myopia—40 degrees. When teaching children with myopia, you should monitor the wearing of glasses during class, set a timer that regulates visual loads in time, use “visual pauses” and visual exercises, determine the optimal distance between the eyes of the child and the stimulus material, spatial arrangement of cards relative to each other, etc.

Groups of personalized aids	Characteristics of aids
Light-chrome	Means that take into account the presence of visual impairment in children with SLI. These means provide additional illumination, illumination orientation, and color indication of various actions in the context of holistic activities (e.g., speech-language and subject-practical). These means cause the realization of sufficient illumination of the room, the location of an additional light source for children with squint in the side of the space in which the doctor recommends (e.g., in the state of occlusion), light indicator lights that signal the eye movements horizontally (from left to right) for children with myopia and variably—horizontally or vertically—depending on the type of squint; compliance with the rules of color contrast, the introduction of the contour of the image (e.g., for children with amblyopia—high, medium, or low degree of image contour), its small saturation with small details—for children with myopia and so on. It is necessary to use “anti-glare” materials for graphic presentation—for children with a high degree of amblyopia.
Logical-semantic	Analytical-synthetic tools that help optimize the formation of coherent expressions in children with SLI, taking into account their language and cognitive abilities. These are tools that help analyze, plan, and implement the meaning, content, storyline of statements. These aids are personalized depending on what the indicators of each child are according to the results of the diagnostic profile, what are the difficulties in analyzing and planning speech utterances (difficulties in identifying text composition, transmitting cause-and-effect, temporal, spatial relationships; personal relationships between actors, retelling, creative narration, etc.), what is the nature of difficulties in exercising control over statements (intermediate or final character). Accordingly, for some children it is crucially important to use (as a means) a detailed orated plot analysis, with a consistent analysis of its compositional structure, the introduction of appropriate graphic symbols; for others, it is important to learn to interpret (explain) certain words and expressions, marking difficult to understand and explain words; for the third, strengthening the work on the logic and verbal designation of grammatical relations, and for the fourth, the unification of all these logical and semantic means in the framework of chains and consecutive occupations.
Information technology	Means that with the help of appropriate information technology solutions ensure the formation of coherent statements in SLI children with visual impairment. It can be audio, video, multimedia, telecommunication technology, and so on. Personalization of these funds is determined in accordance with the existing visual impairments, relevant recommendations, and prohibitions from the ophthalmologist.

Table 4. *Personalized aids of forming coherent utterances in children with SLI and visual impairment.*

communication). These directions were carried out with the support of conditionally selected groups of personalized teaching aids for children, depending on their content, materialized, technological, visualized, audio, motor saturation.

The identified groups of personalized aids used in the formation of coherent statements in preschool children with SLI with visual impairment are presented in **Table 4**.

The effectiveness of speech therapy work, combining algorithmic, individual, and personalized approaches is much higher than with standard work. These combined approaches are being extremely significant in the light of the accomplishment of tasks to improve the quality of life of children with language impairment and their families.

6. Conclusion

At present, the idea of applying a personalized approach along with algorithmic and individual approaches is very popular and dynamically developing in the

context of improving speech therapy in Russia. In particular, aspects of personalized care for children with SLI are being developed. Given the diverse comorbidity of the state of disturbed verbal and nonverbal processes in these children, the personalization of the content, means, and technologies of the speech therapist working with such children will vary significantly, including depending on the scientific, technological, informational, and social resources of society.

The use of a personalized approach in speech therapy seems optimal when there are real conditions for rational integration with other approaches strengthened in science and practice. It depends under competent use of classical and modern scientific data from the field of speech therapy and related sciences, accounting for variable and combinatorial components in the structure of a systemic speech and language impairment understanding of the personalized needs and opportunities of children (social, activity, educational, etc.), the relationship in the work interdisciplinary team of specialists, attracting justified technological solutions, etc.

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