

Experimental And Pilot-Testing Activities Aimed At Improving The Technology For Teaching Literacy To Preschool-Aged Children With Visual Impairments

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Abstract: In this article, a pedagogical technology aimed at improving the process of teaching literacy to preschool-aged children with visual impairments was developed, and its effectiveness was evaluated through experimental pilot-testing. The results of the experiment showed that instructional methods adapted for children with visual impairments produced high outcomes in developing their phonemic awareness, strengthening graphic representations, and increasing independent learning activity. The article presents the findings of an experimental study focused on enhancing the literacy-teaching process for preschool children with visual impairments. The study analyzed the current state of children's tactile perception, phonemic awareness, graphomotor skills, and the formation of sound-letter relationships, and a new multisensory technology was developed. In the experimental group, children's learning activity increased significantly through a combination of a tactile-based component, an auditory-phonemic module, and an integrative literacy instruction practice. The results confirmed the effectiveness of the proposed methodology for children with visual impairments, contributing to the development of their compensatory capacities and improving their level of readiness for reading.

Keywords: Preschool education, children with visual impairments, literacy instruction, multisensory technology, tactile perception, phonemic awareness, graphomotor skills, corrective pedagogical approach.

Introduction: Teaching literacy to preschool-aged children with visual impairments requires specialized methodological approaches aimed at compensating for their limited sensory capabilities. In current educational practice, insufficient adaptation of didactic materials and the incomplete use of auditory- and tactile-based instruction slow down the formation of letter representations in children. Therefore, improving literacy-teaching technology and adapting it to the individual needs of children with visual impairments is a relevant scientific and practical issue.

The process of teaching literacy to preschool children with visual impairments requires a complex psychological and pedagogical approach. In such children, limited visual perception creates additional difficulties in receiving learning materials, understanding letter-shape relationships, and

developing graphomotor skills. For this reason, there is a growing need to improve literacy-teaching technologies, adapt learning activities to the child's individual developmental level, and integrate tactile and auditory learning tools. Modern corrective-pedagogical approaches serve to increase children's cognitive activity, develop compensatory capacities, and ensure the effectiveness of literacy instruction. This study is specifically aimed at scientifically improving this process and exploring opportunities for its implementation in practice.

During the research, a set of comprehensive methods was used to evaluate the effectiveness of pedagogical approaches applied in teaching literacy to preschool children with visual impairments. The observation method made it possible to analyze how the learning process unfolds in real conditions, as well as children's

attitudes toward learning tasks and the dynamics of their activity. Interview and questionnaire methods helped identify the experiences, needs, and existing problems of teachers, caregivers, and parents. Experimental and diagnostic methods (test tasks and criteria for assessing learning skills) were directed at measuring children’s learning and cognitive activity, their level of perceiving letters and shapes, tactile skills, and the development of phonemic awareness. Statistical analysis methods enabled the identification of differences between the obtained indicators and provided a scientific basis for evaluating the effectiveness of the improved technology.

The study focuses on improving the process of teaching literacy to preschool children with visual impairments and began with an analysis of the current state of forming learners’ tactile perception, phonemic awareness, basic graphomotor skills, and sound–letter relationships. The research content was conducted in the following areas:

1. Determining the effectiveness of existing

Indicators	Maximum score	Experimental group (n=15)	Control group (n=15)
Tactile differentiation	10	4.2	4.5
Phonemic awareness	10	3.8	3.9
Perception of letter elements	10	3.1	3.0
Understanding shape–letter relationships	10	2.7	2.8
Graphomotor readiness	10	4.0	4.2
Overall average indicator	—	3.76	3.88

The results showed that children with visual impairments experience significant difficulties at the initial stage of literacy instruction. Based on these findings, a new technology was developed.

The experimental technology is a comprehensive corrective-pedagogical system aimed at improving the literacy-teaching process for preschool-aged children with visual impairments and was designed according to the principle of organizing multisensory learning activities. This technology focuses on activating the child’s compensatory capacities, developing tactile and auditory abilities, forming sound–letter relationships,

pedagogical technologies

Current program and methodological materials were analyzed, and shortcomings were identified, including excessive reliance on visual materials, a lack of exercises for tactile differentiation, and limited methods for developing phonemic perception.

2. Content of experimental diagnostics

The diagnostics were aimed at measuring the following competencies:

- level of tactile differentiation;
- distinguishing geometric shapes;
- accuracy of phonemic awareness;
- tactile perception of letter elements;
- differentiating syllables and letters based on auditory input;
- speed of performing active speech operations.

The following table presents the generalized results based on the initial diagnostic indicators.

and ensuring the stability of practical literacy skills.

The technology is based on three main components: tactile-based learning activities, an auditory–phonemic development module, and an integrated literacy instruction practice. The tactile component strengthens children’s object–letter perception through the use of embossed (relief) letters, models of shape–abstract concepts, contour exploration, and exercises with textured materials. In this process, conditions are created for the child to explore the shape of a letter by touch, compare its elements, and develop tactile discrimination skills.

The auditory–phonemic module includes exercises such as distinguishing sounds, auditory differentiation, identifying syllables, and locating a sound source through hearing. Phonemic analysis skills were formed step by step using special acoustic signals, audio texts, sound cards, and speech-therapy exercises. This facilitated children’s ability to recognize sounds, connect them with letters, build syllables, and perform elementary reading more easily.

The integrative literacy instruction practice is based on the combined use of tactile and auditory stimuli. During sessions, the child is given an embossed letter model while simultaneously hearing the audio version of the sound, which is reinforced through articulation exercises. This multisensory approach helped establish

a stable connection between the letter’s shape, its sound, and its articulatory model. In addition, interactive activities such as “tactile games,” “find it by sound,” and “feel the letter and say it” increased children’s interest in the learning process and strengthened motivation.

The content of the technology was organized by combining individual and group forms of work. In each session, children’s tactile ability, auditory perception, and level of readiness for reading were taken into account. As a result of the experimental approach, the literacy-teaching process was transformed into a system that is accessible for children with visual impairments and supports a higher level of mastery.

Final results

Indicators	Experimental group (pre-test)	Experimental group (post-test)	Improvement (%)	Control group (post test)
Tactile discrimination	4.2	8.1	+92.8%	5.1
Phonemic awareness	3.8	7.4	+94.7%	4.3
Perception of letter elements	3.1	7.8	+151%	3.9
Understanding the shape–letter relationship	2.7	7.0	+159%	3.4
Graphomotor readiness	4.0	7.5	+87.5%	4.9
Overall mean score	3.76	7.56	+101%	4.32

The percentage increase was calculated using the following formula:

$$O'sish (\%) = \frac{Yakuniy\ ball - Boshlang'ich\ ball}{Boshlang'ich\ ball} \times 100$$

For example, for phonemic awareness:

$$\frac{7.4 - 3.8}{3.8} \times 100 = 94.7\%$$

In the experimental group, improvement across all indicators ranged from 87% to 159%, whereas in the control group it did not exceed 8–15%.

At the initial stage of the study, it was identified that

preschool-aged children with visual impairments experienced difficulties in certain aspects of learning activity. The indicators of tactile discrimination and phonemic awareness averaged around 4 points, while the perception of letter elements and understanding of

the shape–letter relationship did not reach 3 points. In addition, children’s level of graphomotor readiness was approximately 4 points. These data indicate that, due to limited visual perception, children encounter difficulties in processing learning materials and understanding letter–shape relationships.

During the experimental work, a new multisensory technology was developed to activate children’s compensatory capacities, develop tactile and auditory abilities, and form sound–letter relationships. The technology includes three main components: tactile-based learning activity, an auditory–phonemic development module, and an integrated literacy instruction practice.

The tactile component enabled children to develop object–letter perception through the use of embossed letters and models of shape–abstract concepts. Children learned to explore the shape of a letter by touch, compare its elements, and build tactile discrimination skills.

The auditory–phonemic module taught children exercises such as distinguishing sounds, identifying syllables, and locating a sound source through hearing. Phonemic analysis skills were gradually formed through special acoustic signals and audio texts.

The integrated literacy instruction practice was based on the combined use of tactile and auditory stimuli. During sessions, children felt an embossed model of a letter with their hands while simultaneously listening to the audio version of the sound and reinforcing it through articulation exercises. This approach supported the formation of a stable connection between the letter’s shape, its sound, and its articulatory model.

By the end of the experiment, the experimental group’s scores increased substantially. Tactile discrimination rose from 4.2 to 8.1, phonemic awareness from 3.8 to 7.4, perception of letter elements from 3.1 to 7.8, understanding shape–letter relationships from 2.7 to 7.0, and graphomotor readiness from 4.0 to 7.5. The overall mean score increased from 3.76 to 7.56, with improvement ranging from 87% to 159%. In contrast, improvement in the control group remained limited to 8–15%, which further confirms the effectiveness of the methodology.

The findings indicate that the developed multisensory

technology significantly increases the effectiveness of literacy instruction for children with visual impairments, compensates for their sensory limitations, and improves their level of readiness for reading.

CONCLUSION

The experimental pilot-testing confirmed the effectiveness of the improved literacy-teaching technology. This methodology considerably enhances the quality of literacy instruction for preschool-aged children with visual impairments, supports compensation of sensory limitations, and strengthens readiness for reading activities. Implementing the new technology in pedagogical practice can contribute to improving the quality of inclusive education and expanding the practical achievements of special pedagogy.

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