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Developing the Speech of Intellectually Disabled Students Based on Innovative Technologies in Uzbekistan

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Abstract

In today's educational landscape, the integration of innovative technologies in specialized institutions for children with intellectual disabilities has become a vital component in enhancing education, communication, and social adaptation. This study investigates the effectiveness of modern pedagogical and logopedic (speech therapy) technologies in developing the lexical-grammatical components of speech in intellectually disabled primary school students. Drawing on national and international research across medicine, psychology, pedagogy, and psycholinguistics, the paper explores the deep interconnection between cognitive functions and speech development. The research identifies common speech disorders in children with intellectual disabilities, outlines the role of innovative, game-based, and individualized technologies, and proposes a structured model for correctional-speech therapy. Empirical results from diagnostic and educational experiments conducted in three specialized schools in Uzbekistan demonstrate a statistically significant improvement in students' speech development using these technologies. The study concludes that personalized, engaging, and methodologically grounded approaches are essential in supporting the comprehensive linguistic and cognitive development of children with intellectual disabilities.

Keywords: *Intellectual disability, speech development, inclusive education, innovative technologies, psycholinguistics, cognitive development, lexical-grammatical components.*

Introduction

In the world today, innovative technologies are being implemented in specialized educational institutions for children with special educational needs to provide education, upbringing, and social adaptation. According to the World Report on Disability, over one billion people with various disabilities live worldwide. This accounts for 15% of the global population, making them “the world’s largest minority.” As a result, systematic work is being carried out in the fields of medicine, psychology, genetics, sociology, and pedagogy to implement projects aimed at developing the volitional activity, perception, and emotional recognition processes of intellectually disabled children.

International educational and scientific research organizations are conducting studies on the physical and somatic conditions of intellectually disabled children, analyzing their intellectual abilities, deficiencies in passive and active attention, and the laws of their psychological development. Scientific

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research is also being conducted on educating intellectually disabled students in special schools and identifying psycholinguistic opportunities for developing their speech.

Special attention is being given to the development of the lexical, phonetic-phonemic, and grammatical components of speech in intellectually disabled students. Research focuses on the ability to correctly plan speech in communicative situations, select appropriate means to convey meaning, and use speech effectively as a tool for communication to express their thoughts to others. Additionally, efforts are being made to improve their integration into society.

In recent years, in our republic, the normative foundations for improving the methods of speech development for intellectually disabled students and enhancing logopedic (speech therapy) correctional practices have been developed. These efforts consider the specifics of the native language and aim to refine innovative technologies that support students' speech development.

The Action Strategy for the Further Development of Our Country emphasizes important objectives such as: "Educating physically healthy, mentally and intellectually developed youth who are independent thinkers, loyal to the homeland, and possess a firm life stance, deepening democratic reforms, and increasing their social activity in the process of developing civil society." As a result, the pedagogical potential for developing the speech of intellectually disabled students through innovative technologies is expanding.

Literature Review

The education and developmental issues of intellectually disabled children have been studied in the fields of medicine, psychology, genetics, sociology, and pedagogy. Based on the analysis of scientific research conducted in these areas, the concepts of "Intellectual Disability" and "Education and Upbringing of Intellectually Disabled Children" have been explained from a scientific-theoretical perspective (by researchers such as J.E.D. Esquirol, E. Séguin, S.F. Galton, Alfred Binet, E.W.M. Georg Kraepelin, and J.M. Cattell).

Researchers who have studied intellectually disabled children from pedagogical and psychological standpoints—such as L.S. Vygotsky (2003), G.I. Rossolimo, M.S. Morozov, and L.V. Zankov(1969)—associate the educational difficulties faced by this group of children with delayed speech development caused by intellectual disability.

Speech is considered a complex psychophysiological system. Its linguistic foundation is language, which encompasses all of its components as a system. Linguistics deals with language as a whole system and aims to study its phonetic-phonemic and lexical-grammatical components.

Education and upbringing are formed on the basis of speech. Therefore, the development of speech plays a crucial role in the comprehensive and full development of a child. The problems of speech development and addressing the practical issues of teaching, developing, and educating children have always been a central focus of methodological sciences. Speech development involves the study of the various systems that make up language, as well as their expression and planning. Today, the methodology of speech development involves not only utilizing knowledge from linguistics and psychology but also incorporating insights from psycholinguistics, a modern interdisciplinary science.

The ontogenetic principle developed by R.E. Levina(2000) holds special importance in correctional pedagogy. This principle is a key tool for understanding the types, degrees, and diagnostics of speech disorders, as well as the methodology of correctional work. Any correctional effort must be based on the laws of speech development during the general ontogenetic period (i.e., the natural development stages of the child).

It is well known that children with intellectual disabilities exhibit various types of speech disorders. Researchers have extensively studied the speech development of this group of children. Psycholinguists such as A.A. Leontiev(1999), L.S. Vygotsky (2003), and S.L. Rubinstein(1989) have emphasized that in order to engage in effective communication, an individual must possess a set of essential skills. These include:

Quickly and accurately orienting to the conditions of communication;

Properly planning one's speech;

Selecting appropriate means to convey the intended message.

These processes are often impaired in children with intellectual disabilities, which limits their ability to engage in full-fledged communication. The main reason for the incomprehensibility of their speech is the underdevelopment of these essential communicative skills. As a result, their speech typically consists of disjointed words that fail to convey clear meaning or information. This reflects their difficulties in planning speech, directing it appropriately, and selecting the necessary tools to communicate meaning.

Primary developmental impairments, especially in cognitive functions, often form the basis for speech disorders in these children, leading to a unique pattern of speech development that is characteristic of intellectual disability.

Many researchers in the fields of pedagogy and psychology have studied the unique aspects of intellectually disabled students' speech development. They have emphasized the close relationship between speech and cognitive functions, especially thinking. In the scientific works of L.S. Vygotsky(2003) and A.G. Spirkin (1972), the connection between thought, language, and speech is clearly evidenced.

The development of speech and its dependence on cognitive deficits is also discussed in the works of S.L. Rubinstein (1989) and D.B. Elkonin(1991), who focus particularly on the content aspects of speech and its role in children's intellectual activities and behavior.

The development of vocabulary in intellectually disabled children is noticeably delayed. Their speech tends to be poor and difficult to understand. According to L.V. Zankov (2014) and M.S. Pevzner (2014), while speech normally begins to develop around 1–1.5 years of age, in children with intellectual disabilities it often doesn't begin until around 3 years of age.

Foreign scholars such as Kassel, I.M. Schlesinger (1971), and I.M. Zeeman(2023) report that over 40% of intellectually disabled children experience delayed speech development. According to G.A. Kashe (1985), 65% of first-grade and 60% of second-grade students in special (auxiliary) schools exhibit one or more speech deficiencies. This figure increases to 80% in children with profound intellectual disabilities, and up to 95% in children with Down syndrome.

Researchers such as A.K. Aksenova, S.D. Zabramnaya, V.I. Lubovsky, V.G. Petrova, I.V. Belyakova, B.F. Sobotovich, M.S. Zeeman, K.K. Karlep, R.I. Lalayeva, D.I. Orlova, A.A. Popova, M.A. Savchenko, D.A. Nurkeldieva, V.S. Rakhmonova, P.M. Polatova, M.P. Khamidova, and N.S. Musaeva (Mamatkulova, 2023) argue that speech problems in intellectually disabled students are directly linked to insufficient cognitive development. According to their findings, underdeveloped mental processes hinder the communicative, significative (meaning-related), and informational functions of speech in these children.

As a result, they are often unable to use speech as a tool for thinking, communication, or for exchanging ideas with others — a conclusion that has been scientifically substantiated.

Discussions

According to R.I. Lalayeva (1983), children with intellectual disabilities, much like their typically developing peers, experience various forms of speech disorders. Experimental studies have proven that within systemic speech disorders, the primary issue lies in semantic impairments.

Currently, research is being conducted in specialized institutions working with intellectually disabled students to improve the planning of speech therapy sessions, modernize speech therapy rooms, and reform scientific-methodological literature, didactic materials, and guides. A survey was conducted among speech therapists working in these institutions to clarify the pedagogical potential of the students and determine current needs. The survey results showed a clear need for innovative technologies aimed at improving the speech and cognitive development of this student group.

Innovative technologies are valuable because they allow for a more effective and comprehensive understanding of the causes and nature of speech disorders and help in the development of individualized correctional and rehabilitation programs. These technologies support speech therapists in achieving better results more quickly and efficiently. The advantages of using innovative technologies in speech therapy include:

Interactivity and attractiveness (engagement);

Personalization and adaptability;

Visualization and audio enhancement;

Progress monitoring and analysis;

Improved motivation and satisfaction.

Innovative technologies are defined as:

New and engaging methods, techniques, or their elements that take into account the individual characteristics of the learner and are aimed at achieving specified didactic and corrective goals. These do not reject classical methods, but rather complement and enhance them.

Within the scope of the research, it was found that innovative pedagogical technologies act as drivers of modernization and reform in education. They aim to address urgent educational challenges and improve the quality of the learning process by meeting the individual and differentiated needs of intellectually disabled learners, particularly in the area of speech development.

The analysis of previous research and the conducted survey confirmed the relevance and necessity of using innovative technologies to develop the lexical-grammatical components of speech in intellectually disabled students.

And the use of innovative technologies in speech therapy practice enables speech therapists to work more effectively, personalize educational programs, enhance visual and auditory perception, track individual development, and increase the learner's motivation.

Educational technologies are widely used in the teaching of intellectually disabled students. These technologies are selected based on the students' abilities and levels of comprehension. Among the most effective and appropriate technologies for this group are game-based technologies, information technologies, and health-promoting technologies. These technologies, aligned with modern educational requirements, take into account the specific characteristics of intellectually disabled students and promote individual approaches, game-based learning, the use of various instructional tools, the creation of a supportive environment, and collaboration with parents to support speech development.

To ensure effective speech development in intellectually disabled students, it is essential to correctly choose pedagogical technologies, general didactic and special principles, teaching. Correctional and speech therapy work should be carried out systematically and in stages, and the learning process should be tailored to the students' capabilities and made engaging, all of which contribute to improved educational outcomes.

Since most speech disorders on these students are complex, the correctional-speech therapy system was improved to develop this specific aspect of speech using innovative methods, there is a need for an optimized model of correctional-speech therapy work for developing the lexical-grammatical component of oral speech in intellectually disabled students, based on innovative technologies.

The model is based on key components: goal setting, process organization, and evaluation of outcomes. The model consists of three main blocks with consideration of the factors that cause speech impairments on these students:

1. Goal-Oriented and Organizational Block
2. Programmatic and Correctional Block
3. Result-Oriented and Evaluative Block

The model proposes using special techniques, tools, and technologies to eliminate speech disorders while also focusing on nurturing the individual characteristics of the students. In selecting these methods, the age and personal traits of intellectually disabled learners were considered.

The model is aligned with the legal and normative documents regulating educational reforms in the country. It also integrates educational tasks, pedagogical principles, didactic support, and interaction between educational actors (teachers, students, parents). Key components include improved and author-developed game-based innovative technologies, teaching methods, and criteria for assessing the level of speech development.

Speech therapy practices are implemented based on general didactic and specialized principles, which are critical for accurately diagnosing and addressing speech deficiencies. These principles guide the effective organization of the correctional education process and help achieve optimal results. They

are interconnected, forming a continuous chain that ensures the successful implementation of correctional education.

The model includes educational-methodological and technical support and is organized to reflect interactions in the forms of:

- subject-to-object (e.g., teacher-student), and
- object-to-object (e.g., student-student).

The main participants in this system are the speech therapist (defectologist), educator, parents, and the intellectually disabled student, with all attention focused on the student's individual development.

The content of the model is designed to increase the effectiveness of education by organizing teaching through play-based approaches tailored to the abilities of intellectually disabled students. Instruction is delivered in individual, small-group, and whole-class formats.

The criteria for assessing students' speech development include:

- Passive vocabulary,
- Understanding grammatical forms of words,
- Active vocabulary,
- Skills in modifying word forms,
- Ability to express spatial relationships between persons or objects,
- Sentence construction skills, and
- Development of coherent speech.

Based on these indicators, students' speech levels are categorized as high, moderate, or low.

The model introduces author-developed and improved innovative technologies that consider the unique characteristics and cognitive limitations of intellectually disabled learners, requiring a sensory integration approach. Integrating innovative pedagogical technologies into the educational process leads to positive qualitative changes in the learners. These proposed technologies aim to comprehensively develop all components of speech.

We present improved innovative tools such as: "Drudli", "Krossens", "Landscape Table", "Froebel Gifts", "Lithotherapy" (Marbles) have been used to support vocabulary development, thinking, curiosity, and exploratory behavior in intellectually disabled students.

Additionally, custom-designed technologies like: "Broken TV", "Pyramid", "Grandma's Yarn", "Kimmatoy's Candy Box", "Talking Table", "Think, Find, Say!" and "Video Riddles" were developed with learners' specific characteristics in mind, focusing on the lexical and grammatical development of their speech. These technologies not only enhance speech skills but also help improve learning capacity, emotional regulation, and clear expression of thoughts.

As a result of research and analysis, an algorithm was developed for using innovative technologies to improve the lexical-grammatical component of oral speech on intellectually disabled students. This algorithm ensures a systematic organization of activities and guides positive developmental dynamics.

The innovative technologies aimed at speech development were conditionally divided into three groups based on their application:

1. **First group** – technologies that transform forms of speech activity: These include plot-based didactic games and communication-simulation tools that reshape the learning environment and foster active, interactive communication.

2. **Second group** – technologies targeting the psychophysiological foundations of speech activity:
These are designed to strengthen the underlying cognitive and sensory systems involved in speech.

3. **Third group** – technologies that focus on developing speech skills and competencies: These methods assist in structuring, modeling, and correcting students' speech based on imitation and reinforcement.

The proposed innovative game-based technologies and exercises during speech therapy sessions not only helped develop the vocabulary and grammatical structure of students with intellectual disabilities but also supported their cognitive activities, particularly the development of thinking processes.

Taking into account the unique characteristics and capabilities of each student, emphasis was placed on: expanding vocabulary, correcting grammatical deficiencies in speech, enhancing engagement in game activities.

These tasks complement each other during the games and ensure the effective acquisition of essential knowledge.

The sessions aimed at developing the lexical-grammatical side of speech included exercises such as: matching words to their meanings, choosing antonyms, word modification and word formation using affixes.

Key components addressed through innovative technologies consisted of integration of sensory skills, imitative speech modeling, development of speech skills, vocabulary expansion, development of grammatical structure of speech, improvement of passive vocabulary, understanding grammatical forms of words, development of active vocabulary, skills in changing word forms, ability to express spatial relations between persons and objects, sentence construction skills and development of connected speech.

Factors influencing the effectiveness of innovative technologies includes systematic organization of sessions, increasing task complexity according to the age and abilities of the students, relevance of tasks to the given topic, variability and diversity of tasks.

Furthermore, additional outcomes were identified from the use of these technologies, including the activation of vocabulary through game-based situations, clearer explanation of rules, development of students' sensory abilities, improvement in speech imitation and modeling skills, increased motivation for cognitive activity, and the fostering of positive attitudes toward learning.

The study confirmed that properly selected pedagogical technologies, methods, and tools support the socialization of students with intellectual disabilities through speech development. The use of innovative technologies plays a positive role in the development of the lexical-grammatical components of their speech.

Introducing innovative technologies into correctional-logopedic work complemented and enhanced traditional methods, adapting them to students' abilities.

Factors contributing to the effective impact of the proposed technologies were identified, and based on these, improved lesson plans and technological maps for developing speech in students with intellectual disabilities were created.

Researchers have developed numerous methodologies and techniques for assessing and diagnosing speech development, each addressing specific directions and various developmental challenges.

Currently, there are no specific assessment tools designed exclusively for evaluating the oral and written speech of students with intellectual disabilities. Therefore, before organizing the experimental work, the research team studied the scientific works of leading national special education scholars such as L.R. Mo'minova, R.Sh. Shomaxmudova, N.X. Raxmankulova, M.Yu. Ayupova, D.A. Nurkeldiyeva, N.V. Sosedova (2023), and reviewed the speech assessment methodologies developed based on their studies.

Taking into account the strengths of each assessment method, the age and specific characteristics of the target group, and the features of the native language, the research team developed a modified methodology for assessing the lexical-grammatical aspects of speech in students with intellectual disabilities.

Methodology and Result

The study included both diagnostic and educational experiments. The experiments were conducted at specialized educational institutions for children with special needs: School-boarding school No. 4 in Kukon city, Fergana region, specialized school No. 36 in Olmazor district, Tashkent city and Specialized school-boarding school No. 79 in Piskent district, Tashkent region.

A total of 103 students with intellectual disabilities (grades 1–2) participated:32 from Ko'kon, 20 from Tashkent,51 from Piskent.

The purpose of the diagnostic experiment was to study the development level of the lexical-grammatical aspects of speech on students with intellectual disabilities.

The experiment was conducted in three stages:

1. Preparatory stage consisted of determining the methodologies to be used, analyzing medical documents, collecting anamnesis data, forming the research group.

2. Main stage consisted of studying vocabulary and grammatical components of speech in students with intellectual disabilities.

3. Final stage consisted of analyzing the obtained results.

Table 1: Comparative Analysis of the Results Before and after Experimental Training

	Experimental- testing stage	Groups	Quantity	Tobservation (χ^2)	Tkr	Average value	Average scores of the experimental group	Acquisition efficiency	Criterion summary
Checking the level of development of passive vocabulary									
1	At the beginning of the experiment	EG	52	0,898	5,991	3,29		-	N0
		CG	51			3,2			
2	At the end of the experiment	EG	52	6,173	5,991	4,1	1,093	9,3%	N1
		CG	51			3,75			
Checking the level of understanding of grammatical forms of words									
1	At the beginning of the experiment	EG	52	0,293	5,991	3,23	-	-	N0
		CG	51			3,18			
2	At the end of the experiment	EG	52	6,29	5,991	4,1	1,099	9,9%	N1
		CG	51			3,73			
Checking the level of development of active vocabulary									
1	At the beginning of the experiment	EG	52	2,002	5,991	3,21	-	-	N0
		CG	51			3,14			
2	At the end of the experiment	EG	52	6,302	5,991	4,02	1,107	10,7%	N1
		CG	51			3,63			
Checking the level of development of word form changing skills									
1	At the beginning of the experiment	EG	52	1,82	5,991	3,13	-	-	N0
		CG	51			3,12			
2	At the end of the experiment	EG	52	5,998	5,991	4	1,102	10,2%	N1
		CG	51			3,63			

Checking the level of development of skills in representing spatial relationships between individuals or objects									
1	At the beginning of the experiment	EG	52	2,001	5,991	3,17	-	-	N0
		CG	51			3,1			
2	At the end of the experiment	EG	52	6,123	5,991	4,08	1,1	10%	N1
		CG	51			3,71			
Checking the level of development of sentence construction skills									
1	At the beginning of the experiment	EG	52	0,081	5,991	3,15	-	-	N0
		CG	51			3,14			
2	At the end of the experiment	EG	52	6,443	5,991	4	1,102	10,2%	N1
		CG	51			3,63			
Checking the level of development of connected speech									
1	At the beginning of the experiment	EG	52	1,112	5,991	3,13	-	-	N0
		CG	51			3,08			
2	At the end of the experiment	EG	52	6,133	5,991	3,94	1,104	10,4%	N1
		CG	51			3,57			
Total average values									
1	At the beginning of the experiment	EG	52	0,43	5,991	3,19	-	-	N0
		CG	51			3,13			
2	At the end of the experiment	EG	52	6,05	5,991	4,033	1,102	10,2%	N1
		CG	51			3,661			

EG (Experimental group)

CG (Control group)

Based on the analyses and the diagnostic experiment results, logopedic directions for speech development on students with intellectual disabilities were identified.

The following speech components were evaluated through the results of the diagnostic experiment:

Passive vocabulary,

Understanding of grammatical word forms,

Active vocabulary,

Sentence construction skills,

Skills in changing word forms,

Ability to express spatial relations between persons or objects,

Connected speech.

The results (expressed in percentages) showed:

Speech Aspect	High Level	Medium Level	Low Level
Passive vocabulary	31.1%	30.1%	38.8%

Understanding grammatical forms	27.2%	26.2%	46.6%
Active vocabulary	14.5%	20.4%	65.1%
Word form modification skills	21.4%	26.2%	52.4%
Expression of spatial relations	19.4%	26.2%	54.4%
Sentence construction skills	21.4%	29.1%	49.5%
Connected speech	18.4%	28.2%	53.4%

The results revealed distinctive impairments in lexical-grammatical categories of speech among students with intellectual disabilities. The findings supported researchers' observations of:

Pathological disruptions between passive and active speech,

Severe disturbances in grammatical structure,

Numerous cases of agrammatism.

The study confirmed the necessity of innovative technologies and specialized educational programs for developing speech in this group.

Based on the diagnostic experiment results and theoretical, methodological, and practical materials on lexical-grammatical speech development, an educational experimental study was conducted.

The educational experiment was carried out at the same institutions as the diagnostic experiment, involving the same group of 103 students with intellectual disabilities in grades 1–2.

The control experiment was conducted at the final stage of the educational experiment.

Results of participants before and after the educational experiment were compared.

Statistical analysis of pedagogical experiment results was performed using K. Pearson's Chi-square (χ^2) test to evaluate the significance of differences.

Statistical analysis showed that the average performance of the experimental group was higher than the control group in all evaluated components of lexical-grammatical speech development.

Improvement ratios of the experimental group compared to the control group were as follows:

Speech Component	**Improvement Factor (times higher)**
Passive vocabulary development	1.093
Understanding grammatical word forms	1.099
Active vocabulary development	1.107
Skills in changing word forms	1.102
Ability to express spatial relations	1.100
Sentence construction skills	1.102
Connected speech development	1.104

The Pearson chi-square test confirmed that the differences were statistically significant (test statistic exceeded the critical value).

The experiment showed the following percentage improvements in speech development for the experimental group relative to the control group:

Indicator	**Improvement (%)**
Passive vocabulary development	9.3%
Understanding grammatical forms of words	9.9%
Active vocabulary development	10.7%
Skills in changing word forms	10.2%
Expression of spatial relationships	10.0%
Sentence construction skills	10.2%
Connected speech development	10.4%

Overall average effectiveness	10.2%

The control experiment demonstrated that the innovative teaching methods used in the experimental group significantly improved the lexical-grammatical speech components in students with intellectual disabilities, confirming the effectiveness of the developed pedagogical approaches.

The speech level of intellectually disabled students was found to be lower than that of their typically developing peers, highlighting the need for special education environments to support their speech development.

Analysis of surveys among speech therapists working in specialized schools revealed the need to create and implement innovative technologies that simultaneously engage speech and cognitive activities, tailored to the unique needs of these students.

Also, Individual, group, and collective forms of education were applied, along with interactive, differentiated, and personalized teaching approaches. Special author-developed games were used to enhance lexical-grammatical skills.

Innovative technologies based on sensory integration and speech imitation modeling allowed for step-by-step speech development—from passive to independent speech—adapted to each student's degree of speech impairment and intellectual abilities.

Mathematical and statistical analysis confirmed the scientific hypotheses. The average effectiveness of speech development using innovative technologies was about 10.2%. Comparative analysis of experimental results validated the effectiveness of the developed correctional and developmental technologies.

Conclusion

Speech development is complex and multi-phased, requiring new methods, techniques, and technologies that consider the characteristics of the native language to improve speech effectively. The study confirms the crucial role of innovative pedagogical technologies in the speech development of students with intellectual disabilities, particularly in improving the lexical-grammatical components of oral language. Through the integration of game-based, sensory, and individualized learning tools, speech therapy practices have been significantly enhanced, leading to measurable improvements in students' vocabulary, sentence construction, and communicative competence.

Diagnostic and educational experiments conducted in specialized schools demonstrated that the use of structured, technology-driven methods resulted in statistically significant gains across key speech indicators, including active and passive vocabulary, understanding of grammatical forms, and the development of connected speech. The research also highlighted the importance of aligning correctional-speech therapy with students' cognitive, emotional, and sensory characteristics to foster deeper engagement and sustained motivation.

Moreover, the proposed speech development model—comprising goal-setting, correctional programming, and outcome evaluation—proved effective in guiding speech therapists and educators in planning and implementing targeted interventions. The use of author-developed tools and interactive technologies such as "Think, Find, Say!" and "Talking Table" not only facilitated linguistic growth but also enhanced cognitive and emotional regulation in students.

Overall, this research supports the integration of innovative, personalized educational technologies as a transformative approach in special education. It underscores the need for ongoing methodological development, teacher training, and collaboration with families to ensure holistic support for the speech and social development of intellectually disabled learners.

Authors' Contributions

Dilnoza Kurbonova worked on conceptualization, methodology, writing – Original draft of the paper. Doniyor Ergashev and **Kazakova Dilora** worked on data collection, formal Analysis. Lobar Yusupova worked on investigation, validation, editing. Mirsardor Alimov worked on statistical analysis. Medetova Raushan worked on resources, project administration. Dildora Mavlanova worked on literature review, methodology. Shoira Xaydarova worked on literature review, methodology. Rustam Abdurasulov worked on formal analysis, Writing – Review & Editing. Umida Elova worked on editing.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Statement

This study was conducted in full compliance with ethical standards governing research involving human participants, particularly vulnerable groups such as children with intellectual disabilities. Prior to the commencement of the research, approval was obtained from the relevant institutional and educational authorities overseeing the specialized schools involved in the study.

Informed consent was obtained from the parents or legal guardians of all participating students. They were fully briefed on the purpose, procedures, potential benefits, and confidentiality measures related to the research. Participation was entirely voluntary, and all individuals retained the right to withdraw at any stage without any consequences.

All data collected were anonymized to ensure the privacy and confidentiality of participants. The research activities, including diagnostic and educational experiments, were designed to align with the students' developmental needs and carried out with utmost care to avoid any physical or psychological harm.

This study adhered to national and international ethical guidelines for research in education and special needs settings, including the principles outlined in the Declaration of Helsinki and the ethical codes provided by relevant educational and psychological associations.

Data Availability Statement

The datasets analyzed in this study are not publicly available, but can be obtained from the corresponding author upon reasonable request

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