

DIGITAL TOOLS FOR SOCIALIZATION OF CHILDREN WITH GENERAL SPEECH UNDERDEVELOPMENT

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Summary

This article examines the application and impact of digital technologies on the social integration of children with general speech underdevelopment. The authors have conducted a comprehensive analysis of the current state of digital tools implementation in correctional work and identified the main challenges of this process. The research provides a structured classification of digital tools, which includes various systems: from communicative support to advanced solutions using artificial intelligence and virtual reality.

The article highlights practical experience in implementing specialized software both in the Ukrainian context and international practice, focusing on the interaction between speech therapists and parents. The authors examine in detail the effectiveness of various digital tools regarding their impact on the development of communication skills and social adaptation of children.

The study emphasizes the necessity of an individualized approach in implementing digital technologies, stressing the importance of combining traditional correctional methods with innovative digital solutions. The presented results demonstrate the significant potential of digital technologies in creating an effective inclusive educational environment and overcoming communication barriers. Prospective directions for future research are outlined, particularly studying the long-term impact of digital technologies on the socialization of children with special educational needs.

Key words: digital technologies, social integration, general speech underdevelopment, correctional work.

DOI <https://doi.org/10.23856/6713>

1. Introduction

In the modern world, digital technologies are playing an increasingly significant role in various aspects of social life, particularly in education and social integration. For children with General Speech Underdevelopment (GSU), digital technologies open new opportunities for effective social integration, enhancing their access to inclusive education and expanding the boundaries of their interaction with the environment. However, despite the significant potential of digital technologies, there are numerous challenges that hinder their effective use for social integration of children with GSU.

We consider the main challenge to be the dynamics and rapid changes in the scientific and technical sphere and the adaptation of the educational system (particularly in special education) to these changes. On the other hand, there are certain difficulties in implementing digital tools in educational practice for children with special educational needs. Although there are many programs and applications designed to facilitate learning and communication with children with GSU, their effectiveness and accessibility remain poorly researched. Additionally, there is a need to adapt digital solutions to each child's individual needs, which requires a comprehensive approach considering special educational requirements and social contexts.

Thus, the topic of using digital technologies as a tool for social integration of children with GSU is extremely relevant for research. Studying this issue allows not only to improve the possibilities and limitations of modern digital solutions but also to develop new approaches that will promote more effective integration of children into society, providing them with equal opportunities for learning, development, and social interaction. Through this scientific investigation, we aim to highlight the current state of digital technology integration in working with GSU children in Ukraine and abroad, outline innovations and new solutions, and identify important directions for further research.

2. Analysis of recent research and publications

The theoretical and methodological analysis of scientific literature demonstrates active research into the communicative development of children with special educational needs, particularly those with speech disorders, and the implementation of innovative technologies in correctional work.

Fundamental research on the communicative development of children with special educational needs is presented in the works of Yu. Bondarenko, V. Bondar, Yu. Bystrova, V. Syniov, E. Syniova, M. Chaika, and others. The scientists have detailed the specific features of communicative sphere formation in children with various psychophysical development disorders and outlined the main directions of correctional work.

Significant contributions to the research on implementing innovative technologies in work with children with special educational needs were made by V. Avilova, V. Bondar, I. Demchenko, V. Zaretsky, A. Kolupaieva, V. Liashenko, O. Martynchuk, and others. Their works reveal theoretical foundations and practical aspects of applying modern technologies in the correctional-developmental process. In particular, O. Chekan investigates the role of digitalization in supporting inclusive education and proposes an original educational-pedagogical tool "Movlianka" for developing the speech sphere of children with General Speech Underdevelopment (GSU).

The educational process features for children with speech disorders are thoroughly covered in the works of O. Boriak, N. Kabelnikova, I. Martynenko, A. Odyntsova, L. Trofymenko, M. Sheremet, and others. In this context, it is worth noting A. Kurienkova's research, who developed a methodology for using visualization in working with children with severe speech disorders and proposed innovative technologies for speech development in children with GSU.

Analysis of international experience, particularly the research of R. Osoreo and co-authors, demonstrates the effectiveness of information and communication technologies in inclusive education. O. Denysiuk, I. Zalutskyi, I. Kryvoruchko, T. Chechko, and others investigate the possibilities of using ICT and web services in working with children with special needs and their parents.

Despite the large number of scientific works devoted to the use of digital technologies in special education in general, insufficient attention has been paid to systematizing current information and the role of ICT in the social integration of children with special educational needs, which determined the choice of research topic.

Purpose of the article: To theoretically substantiate the current state and prospects of implementing digital technologies in the practice of social adaptation of children with special educational needs.

3. Presenting main material

Digital technologies have long become an integral part of the modern world, and their role in assistive technologies for people with GSU is remarkably significant. They not only help overcome physical barriers and ensure access to information but also have considerable potential for promoting the socialization of these individuals. Virtual reality (VR) technologies are particularly promising as they create a fully immersive digital environment where children with GSU can safely practice social skills, as well as augmented reality (AR), which overlays digital elements onto the real world, helping with learning and communication. Artificial Intelligence (AI) plays a key role in personalizing the learning experience by adapting task complexity and approaches to each child's individual needs.

For children with GSU, digital technologies open new opportunities for communication, learning, and development, which is crucial in their integration into society. The socialization of such children through digital tools allows them to feel part of the community, actively participate in social life, and develop their communication skills. AI assistants can help with speech recognition and response generation, facilitating communication, while VR environments create a safe space for practicing social interactions.

Digital technologies used in working with children with special educational needs (SEN) can be conditionally divided into two main categories: hardware and software. Hardware includes specialized devices and equipment that can be expensive and often difficult to access due to high costs. These include, for example, touch screens with adapted interfaces, alternative and augmentative communication (AAC) devices such as communication boards with speech synthesis, eye-tracking systems for gaze control, communicators with programmable buttons and voice output, as well as specialized tablets with pictograms and symbols. Unlike digital AAC tools that can be implemented as software applications, physical AAC devices often have additional tactile feedback functions, increased structural durability, and specially designed interfaces for people with motor impairments. Such devices may also include modular systems that allow gradually expanding the child's vocabulary and communication capabilities according to their development. VR headsets and AR glasses, as well as other assistive technologies that facilitate physical access to learning and communication, complement the arsenal of material means of communication and learning support (*Chekan, 2024*).

Software solutions, on the contrary, are more accessible and can be used on various platforms, including computers or laptops, tablets, smartphones, etc. These programs are often aimed at developing cognitive skills, facilitating communication, and supporting the educational process. The importance of such programs lies in their flexibility and ability to adapt to the individual needs of the child, making them extremely effective in the context of social integration (*Kurienkova, 2023*). Modern software solutions increasingly use AI technologies to analyze child progress and automatically adjust task difficulty, and include AR elements to create an interactive learning environment. Let's present the main types and ways of using software

for social integration of children with GSU in Table 1, which provides a detailed analysis of different software categories, their functional characteristics, specific implementation examples, and specific benefits for working with children with GSU. Special attention in the table is paid to the educational impact of each type of software, allowing better understanding of their role in the process of social integration and communication skills development (Table 1).

Table 1

Analysis of Digital Technologies for Social Integration of Children with GSU

System Type	Functional Characteristics	Examples	Educational Impact	Benefits for Children with SLI
Communication Support Systems	<ul style="list-style-type: none"> – AAC systems – Multimodal interaction interfaces – Adaptive communication protocols 	<ul style="list-style-type: none"> – Proloquo2Go: symbol-based communication – C-board: customizable visual schedules – Integration with speech synthesis 	<ul style="list-style-type: none"> – Improvement of verbal and non-verbal communication – Development of social interaction skills – Formation of autonomous communication skills 	<ul style="list-style-type: none"> – Visual communication support – Step-by-step speech skills formation – Reduction of communication barriers – Increased motivation for communication
Social Learning Environments	<ul style="list-style-type: none"> – Controlled interaction spaces – Educational server infrastructure – Pedagogical supervision tools 	<ul style="list-style-type: none"> – Minecraft Education– Autcraft – Integrated communication tools 	<ul style="list-style-type: none"> – Development of social competencies – Improved peer interaction – Enhanced collaboration skills 	<ul style="list-style-type: none"> – Safe environment for communication practice – Structured social interaction – Development of dialogic speech
Sensorimotor Development Applications	<ul style="list-style-type: none"> – Fine motor skills development – Gross motor coordination – Sensory integration protocols 	<ul style="list-style-type: none"> – Dexteria – "Development Games 1,2,3" 	<ul style="list-style-type: none"> – Improved motor control – Enhanced coordination – Improved sensory processing 	<ul style="list-style-type: none"> – Development of articulatory motor skills – Speech and movement coordination – Formation of motor bases for speech
Emotional Intelligence Development	<ul style="list-style-type: none"> – Emotion recognition algorithms – Behavioral response modeling – Mood tracking functionality 	<ul style="list-style-type: none"> – Headspace – Moodmeter – Interactive social stories 	<ul style="list-style-type: none"> – Improved emotion recognition – Enhanced self-regulation – Better social understanding 	<ul style="list-style-type: none"> – Development of emotional speech components – Enrichment of emotional vocabulary – Formation of prosodic aspects of speech
VR/AR Systems	<ul style="list-style-type: none"> – Immersive environments – Interaction modeling – Spatial awareness development 	<ul style="list-style-type: none"> – AutoSpark – AR-learning – Virtual social scenarios 	<ul style="list-style-type: none"> – Improved situational awareness – Enhanced social adaptation – Reduced anxiety 	<ul style="list-style-type: none"> – Immersion in speech environment – Controlled speech practice – Modeling of communicative situations

Continuation of table 1

AI-Supported Systems	<ul style="list-style-type: none"> – Adaptive content generation – Personalized learning – Performance analysis 	<ul style="list-style-type: none"> – AI Buddy – My Voice – Optimized learning trajectories 	<ul style="list-style-type: none"> – Improved personal development – Increased efficiency – Individualization of corrective work 	<ul style="list-style-type: none"> – Adaptive speech learning – Accurate progress diagnostics
Speech Development Tools	<ul style="list-style-type: none"> – Articulation training – Phonemic hearing development – Connected speech practice 	<ul style="list-style-type: none"> – "Speak Correctly" – "Word Constructor" – "Speech Therapy" 	<ul style="list-style-type: none"> – Improved speech clarity – Vocabulary expansion – Development of narrative skills 	<ul style="list-style-type: none"> – Comprehensive development of all speech components – Sound automation – Formation of connected speech

Based on a comprehensive analysis of available research, it can be stated that the integration of software across all mentioned areas demonstrates significant potential in promoting social integration of children with special educational needs. The fundamental aspect of successful socialization is the development of speech and communication competencies, which determines the critical importance of timely diagnostic and corrective work. In the context of optimizing the correction process, the modern toolkit of a speech therapist is enriched with electronic diagnostic complexes and multimedia materials for articulation exercises (Streltsova, 2018).

Current trends in organizing correctional and developmental work indicate the expediency of expanding traditional tools (particularly Microsoft PowerPoint) with innovative solutions such as the Canva online platform. The platform's functional capabilities include not only a wide range of tools for creating and integrating multimodal materials but also specialized filters for evaluating content accessibility for individuals with color perception disorders, which promotes the implementation of universal design principles and social inclusion (Kryvoruchko, 2024).

In the domestic educational space, there is a trend toward developing specialized software for speech and communication development. A notable example is the educational software "Movlyanka," which implements gamification principles through storyline implementation and an interactive helper character. The program's architecture provides cross-platform support (Windows, Android) and a differentiated approach through content distribution into age modules (4, 5, and 6-7 years). The structural organization includes two main components - "fairy tale conversation" and "fairy tale notebook," with an integrated system of sequential material progression and multimodal support (Chekan, 2024).

Considering the primary role of family as a social institution in the integration process of a child with SLI, the implementation of digital technologies in the system of teacher-parent interaction becomes particularly relevant. The diagnostic component of such interaction is effectively implemented through Google Forms tools, which ensures monitoring of dynamics at different stages of correctional work. Cloud technologies demonstrate high efficiency in transforming traditional forms of information interaction, while synchronous communication platforms (Zoom, Google Meet, Microsoft Teams) expand group work opportunities through breakout room functionality (Zalutskyi, 2020).

International developments indicate high effectiveness of integrating specialized software into the educational process of children with special educational needs. In particular, a longitudinal study of Plaphoons software, aimed at developing written speech in children with

visual and musculoskeletal disorders, demonstrated statistically significant positive results not only in forming target skills but also in overall cognitive and socio-emotional development. Empirical data confirms the formation of prosocial behavior, development of self-regulation, and initiative in interpersonal interaction (Osores, 2019).

4. Conclusions

Based on the conducted analysis, the following conclusions can be drawn regarding the role of digital technologies in the social integration of children with general speech underdevelopment.

Firstly, the implementation of digital technologies, particularly specialized software, can demonstrate high effectiveness in the social integration process of children with SLI. Systematization and analysis of available digital solutions have revealed their significant potential in overcoming communication barriers and creating an inclusive educational environment.

Secondly, the comprehensive application of various digital tools, from communication support systems to VR/AR technologies, ensures comprehensive child development, encompassing speech, social, and emotional domains. Particularly important is that modern technologies allow individualizing the correctional-developmental process, adapting it to each child's specific needs.

Thirdly, the implementation of digital technologies transforms traditional forms of interaction between all participants in the educational process. The use of cloud services and platforms for synchronous and asynchronous communication optimizes cooperation between teachers and parents, which is critically important for successful social integration of children with SLI.

Thus, the use of digital technologies in working with children with SLI can have a positive impact not only on the development of target skills but also on the formation of prosocial behavior, self-control, and initiative in interpersonal interaction. This indicates that digital technologies can serve as an effective tool for creating an inclusive environment that promotes unlocking the potential of children with SLI and their full integration into society.

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