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SPEECH THERAPY ASSISTANCE TO CHILDREN OF MIDDLE PRESCHOOL AGE BY MEANS OF COMPUTER DIDACTIC GAMES

Abstract. The article highlights the peculiarities of speech therapy assistance to children of middle preschool age using computer didactic games. All the children who were assisted had generalized underdevelopment of speech (GUS). These children have difficulty understanding and using language, including building sentences, pronouncing sounds, and enriching vocabulary. To increase the effectiveness of pedagogical work, a targeted logotherapeutic program using a computer was introduced into the education process of preschool education institutions. The key criteria were identified, according to which the directions of speech therapy assistance were formed and computer exercises and games for such children were developed accordingly. Didactic material aimed at the development and therapy of speech disorders is posted on the education platforms LearningApps and Wordwall. Methodological rules for speech therapists and other pedagogical staff on organizing and providing assistance to preschoolers have been developed and mastered. Examples of didactic exercises and games are provided for each area of speech therapy practice (articulatory motor skills, sound pronunciation, phonemic awareness, vocabulary, grammatical structure of speech, and connected speech). The development of computer materials was carried out taking into account the individual and age characteristics of children of middle preschool age. To test the effectiveness of the logotherapeutic program, the implementation of its content using computer didactic games, a pedagogical experiment was conducted on the basis of preschool education institutions in Zhytomyr. The formative stage in the experimental group was conducted for 6 months. Diagnostics of the level of these competencies in middle-aged children with speech development disorders before and after the implementation of the logotherapeutic program convincingly demonstrates the effectiveness of this approach in speech therapy. Speech therapists should make more active use of the potential of computer didactic games both in preschool education institutions and at home.

Keywords: speech therapy; computer didactic games; preschool children; generalized underdevelopment of speech; competence; development; intervention; therapy

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1. INTRODUCTION

Among preschool children about 10-12% are children with special education needs, many of whom have speech disorders. According to official data from the Ministry of Education and Science of Ukraine, the number of such children is steadily increasing. Prior to the temporary occupation of the Ukrainian territories in 2022, 3,246 children with severe speech impairments alone were enrolled in special education institutions, with many more with other disabilities. In general, secondary education institutions, there were 32686 children with speech impairments in inclusive classes and 5661 children with speech impairments in special classes [1]. Preschoolers are a potential reserve for primary schools. In general, children with speech development disorders make up approximately 50% of preschoolers, of whom about 10% have speech disorders as their main problem [2]. Preschool age is biologically determined and characterized by the activity of sensitive periods: 1 – from birth to 1 year (formation of sensory perception, emotional attachment), 2 – 1-3 years (development of speech, imitation, motor activity), 3 – 3-6 years (formation of social skills, moral ideas, self-awareness). That is, preschool age is the most favorable for the effective development of a child as well as the correction of speech disorders. Timely speech therapy at a young age corrects 90% of all speech disorders. Deviations in speech development affect the formation of the child's entire mental life. They complicate communication with others, often interfere with the proper formation of cognitive processes, and affect the emotional and volitional sphere. The authors of the article relied on the theoretical works of world-famous child psychologists Jean Piaget, Françoise Dolto, Erik Erikson, Donald Winnicott that play in preschool children is the leading activity that develops them as a personality. This also applies to the category of children with generalized underdevelopment of speech (GUS). It is possible to achieve significant results in the therapeutic work of a speech therapist with the help of modern computer' technologies. The role of such technologies in the practice of speech therapists is growing every year.

Statement of the problem

In Ukraine over the past 75 years a system of organization and provision of speech therapeutic services has been formed and is constantly being improved. Today, speech therapists believe that one of the most effective and innovative ways to provide speech therapy services to children is to use computer technology. Such technologies integrate traditional and modern teaching methods based on the use of a computer and its software. Computer-based speech therapy allows, on the one hand, to take care of children's mental and mental health – to prevent children's fatigue, stress, negative emotions, while increasing their cognitive activity and healthy interest in learning activities, and, on the other hand, to ensure children's successful socialization in society by improving communication processes, and to improve the effectiveness of the speech therapist's therapeutic work.

Analysis of recent research and publications

To date, the primary experience of providing speech therapy assistance using computer technologies in the education process of preschool education institutions has been presented by Ukrainian scientists O. Vasylchenko, O. Lastochkina, O. Korol, O. Churai and others. The range of areas of logotherapeutic work is provided by various programs: diagnostic, therapeutic, developmental, speech visualization, speech recognition, and sound parameter recognition. In addition, the programs are local (without the use of computer networks) or networked (using the global Internet). In particular, O. Lastochkina emphasizes that remote speech therapy for uncles has become quite common now. Thanks to multimedia technology full visual and audio contact between the speech therapist and the child is maintained [3].

O. Korol [4] proposed the use of cards with the help of a computer for diagnostic purposes. With the help of these methods, teachers or parents can determine the level of preschooler's speech development as well as form an individual trajectory of speech therapy

for a child.

O. Vasylchenko [5] experimentally investigated the use of information and communication technologies in the formation of speech competence of preschool children with SEN.

O. Churai's work on the use of computers in working with preschoolers with SEN was useful for practitioners. The author characterizes the capabilities of computer programs "Parrot Kesha", "Visible Speech", "Games for Tiger", "Speech Development", "Learning to Speak Correctly", "Garfield for Kids" for children with various developmental disorders. She notes that all the exercises in the programs are based on visual and auditory control over the child's performance. They are visualized on the monitor screen in the form of cartoon images and symbols. In some exercises that cause difficulties, there is a possibility of additional auditory support when performing the task. This allows to correct speech disorders in preschool children more effectively and in a short time [6].

H. Mytsyk shared her own view on a partial solution to the problem of preventing reading disorders in older preschool children through the use of computer games for developmental support [7]. It was noted that it is quite important in this regard to disseminate her own findings which highlight the practice of using them to prevent dyslexia in older preschool children [8]. Several examples of the author's computer games on this topic are provided. It is stated that a positive effect of their use by speech therapists in the education process is possible provided that the relevant requirements are met. It has been proven that the use of digital games in the provision of developmental services allows for the organization of appropriate work not only in synchronous but also in asynchronous modes which is quite convenient, especially when interacting with children living in geographically remote rural areas that are difficult to access for education institutions.

A. Bober, Y. Kosenko, and O. Korol presented a website with interactive education games for developing the vocabulary of primary school students with intellectual disabilities. According to their research, the use of artificial intelligence to generate images made the games more interesting and attractive to children. The images were generated based on the age, interests, and needs of each child, which increases the effectiveness of learning and engages children in the process [9].

The research of modern foreign scientists in speech therapy is of interest. Researchers from India Hasan, N. & Nene, M. J. devoted their research to the study of specific requirements for the design and development of computer exercises and games for teaching children with autism spectrum disorders [10]. They proposed a model of education products created by artificial intelligence.

J. Musaraj and B. Muskaj also studied the problem of computer-assisted learning for children with autism spectrum disorders [11]. They highlighted the difficulties of children with autism in processing e-learning. According to their observations, a clear understanding of the situation helps to develop the most appropriate education policy where it is necessary to anticipate and be prepared for exceptional situations when e-learning should be used. The study is based mainly on the life experiences of families who have children with autism and who are more open to seeking speech therapy help and solutions, as they often feel alone and helpless.

Greek scientists A. Panagopoulos, G. Stamoulis [12] offer an online program "DysCreTe" for dyslexia screening. The software consists of nine tests that assess children's competencies in reading, spelling, arithmetic, and cognitive skills. The program was tested among Greek middle school students. The main advantage of such software is the creation of a pleasant environment for the user, while achieving more accurate results in less time, unlike classical clinical trials.

I. Rujas, M. Casla, E. Murillo, M. Lázaro [13] investigated the possibilities of assessing early vocabulary acquisition in Spanish-speaking children using an Android application

(FastMApp).

The problems of teaching and educating preschoolers in an inclusive education environment were studied by Slovak scientists V. Šilonová, V. Klein, V. Kušnirová, M. Čarnická, and I. Rochovská. The authors emphasize that preschool children with developmental disabilities require special forms and methods of pedagogical influence. This is due to deviations in mental and physical development. The teacher or special educator must carefully select didactic material, in particular visual aids (pictures, photographs), and create a favorable education environment. In the process of interaction, active forms of learning act as an additional stimulus in the acquisition of new knowledge [14; 15; 16].

US researchers Z. Chai, C. Vail & K. Ayres investigated the use of an iPad with a touch screen for early literacy training for young children with disabilities. The aim of the study was to evaluate the effects of using the iPad app in the learning process of young children with developmental delays to receptively identify initial phonemes using procedures with a constant delay of 0 to 5 seconds in the context of a design with multiple probes for three sets of behaviors. The dependent variable was the percentage of unprompted correct receptive identification responses for target phonemes during instructions and probes. All children mastered their target phonemes, generalized their skills across materials, and maintained skills at or above 50% accuracy 4 and 7 weeks after the intervention ended [17].

C. Guardino, J. E. Cannon & K. Eberst noted that 25% of students with hearing impairments come from families where a language other than English is spoken. Their study tested the effectiveness of an ICT-based reading instruction strategy. To this end they proposed that education institutions teach children vocabulary through repeated preparatory sessions combined with viewing American Sign Language books using technical aids (DVDs). The results showed that after a series of training sessions lasting from 1 to 5 weeks using ICT most participants (90% to 100%) showed positive results in vocabulary development [18].

Researchers from Taiwan such as P. Wu, H. Cannella-Malone, J. Wheaton & C. Tullis investigated the usage of ICT in working with autistic children. Two childrens with developmental disabilities were taught two daily living skills using video prompting with error correction presented on an iPod Touch, and two different fading procedures were implemented. In one fading procedure, individual video clips were merged into multiple larger clips following acquisition of the entire skill. In the second fading procedure, video clips were backward "chunked" during the intervention as individual steps were mastered. A multiple probe across participants design within a reversal design was used. Results showed that video prompting with error correction was effective in teaching both daily living skills. Furthermore, fading the video prompts during the intervention resulted in more rapid learning and higher maintenance and generalization effects than fading after acquisition [19]. S. C. Cheng & C. L. Lai note in their study that children with disabilities often face greater difficulties in learning due to physical or mental impairments. In an effort to improve their learning, researchers have introduced digital tools to improve the adaptation of students with disabilities to the learning environment and their academic achievement. The use of technology-supported special education has been gradually increasing in recent years. However, trends in the application and development of technology integration in special education have not yet been sufficiently researched and analyzed. According to the results the number of studies is growing every year and the choice of education devices and programs is becoming more diverse; but teaching strategies still tend to be conservative as most studies have adopted a guided learning strategy [20].

Researchers from Hong Kong and China P.C. Fung, B.W.Y. Chow, and S. McBride-Chang, studied the acceleration of speech development in preschoolers using a special interactive dialogic reading method developed by Whitehurst et al. in Hong Kong. In kindergarten children were pre-tested on their receptive vocabulary during dialogic and typical

reading. After an 8-week intervention the children were re-tested. As a result their vocabulary during dialogic reading using interactive methods improved significantly. It was also noted that high-quality interaction with parents and the use of illustrative materials were key factors in the program's success [21].

H. Ibrahim Amal & O. Aseel (Department of Counseling and Special Education, School of Education Sciences, The University of Jordan, Amman, Jordan) [22] conducted a study on the role of artificial intelligence such as ChatGPT in achieving sustainable development. In their opinion, artificial intelligence will soon be a key tool in improving education practices especially in special education. This tool will contribute to achieving quality education for all, reducing inequality, and achieving the standards of the Council for Children with Special Needs among future special education teachers. The study's findings indicate the viability of integrating ChatGPT into special education programs as well as the need for both teachers and students to know how to use it effectively.

As a result, there are many education programs in speech therapy practice today, authored by scientists and practitioners from both far and near abroad. Such education products include “Speech Viewer-3”, “Adaptation-Logo”, “Visual Pronunciation Trainer”, “Games for Tiger” technology, “Sunny Castle”, “Delpha-141”, “Palatometer”, etc. However, the education problem of the effectiveness of speech therapy using computer programs in the therapy of speech of children of middle preschool age remains relevant.

The purpose of the article is to highlight the effectiveness of speech therapy with the implementation of a program for the therapy of articulatory motor skills, sound pronunciation, phonemic awareness, vocabulary, grammatical structure of speech, connected speech using computer didactic games in the environment of middle-aged preschool children with SEN.

2. METHODS OF THE STUDY

To achieve this goal we used theoretical methods: analysis, synthesis and generalization of special literature and documents on the problems of introducing computer didactic games in speech therapy, *empirical methods* – study and systematization of the experience of speech therapists of preschool education institutions on the use of computer technologies in education work; observation; diagnostic methods for determining the level of speech development of children with SEN (articulatory motor skills, sound pronunciation, phonemic awareness, vocabulary, grammatical structure), a pedagogical experiment to determine the effectiveness of a logotherapeutic program in working with children with general speech underdevelopment.

3. RESULTS OF THE RESEARCH

The author’s speech therapy curriculum for children of middle preschool age (4-5 years) with generalized underdevelopment of speech included the purpose, content, areas of work and digital platforms. Generalized underdevelopment of speech is a complex speech disorder that covers all components of speech and manifests itself in children with normal hearing and intelligence, but with significant delays in speech development [23]. It can include disorders at all levels of the speech system: phonetic-phonemic, lexical-grammatical, syntactic, semantic, pragmatic (communicative). All of these disorders can usually be accompanied by additional disorders: mental retardation; cognitive problems; motor disorders (especially articulation); learning difficulties (reading, writing, mathematics). Based on the psychological and pedagogical characteristics of children, taking into account their individual and age characteristics we identified the following six areas of correctional and developmental work: development of articulation motor skills; therapy of sound pronunciation; development of

phonemic awareness; enrichment of vocabulary; development of grammatical word structure; development of coherent speech.

The program was implemented through a set of interactive games and exercises posted on the LearningApps and Wordwall education platforms.

LearningApps.org has a number of advantages over other similar platforms: the service is absolutely free; the interface is simple and clear; interactive tasks can be created and edited online; templates support work with multimedia materials (images, sound, video); instant checking of the correctness of tasks is provided; it is possible to receive an email link or QR code [https://learningapps.org].

Wordwall is an excellent tool for creating interactive speech therapy games, and here are its main advantages for therapy of preschoolers' speech:

- clear and Ukrainian-language interface;
- a large number of ready-made templates;
- ease of customization and adaptation;
- the ability to use your own materials: especially valuable for speech therapy, as you can use pictures that are familiar to the child or record the correct pronunciation of sounds and words in your own voice;
- variety of game types: allows you to create games for the development of different aspects of speech: phonemic awareness (games for distinguishing sounds, making words from sounds), sound pronunciation (games for repeating words, distinguishing correctly and incorrectly pronounced words (with audio)), vocabulary (games for finding correspondences between pictures and words, classifying objects, expanding vocabulary by topic, grammatical structure of speech (games for making sentences, matching words, forming plural/singular), connected speech (games for making stories from pictures (dragging pictures in the correct sequence);
- interactivity and engagement;
- instant feedback, which helps the child immediately see their results and learn from mistakes;
- the ability to print materials, which can be useful for individual work or home speech therapy;
- easy resource sharing: you can easily share created games with colleagues or parents using a link [https://wordwall.net/uk/features].

Thus, the use of such services opens up new opportunities for speech therapists to organize therapeutic and interactive learning.

The creation of the content of computer exercises and games was based on the fundamental rules that speech therapists, educators, psychologists and parents had to follow to fully promote the child's comprehensive development: speech, cognitive, social, emotional. According to S. Chupakhina and V. Stynska these are the classical pedagogical principles of game activity for classroom organizers: compliance with age and individual characteristics; voluntariness and interest; activity and independence of the child; education and upbringing orientation of the game; systematic and consistent; integration with other activities; emotional involvement; partnership interaction between an adult and a child; development of speech and cognitive activity [24].

The tasks for each exercise or game included audio and video elements to activate attention, perception, and improve preschoolers' memorization; gradual complication of tasks in accordance with the child's progress. The need for multiple repetition and self-testing was also taken into account. Before the lesson began, preparatory activities were carried out to familiarize children with computer equipment, safety measures, maintaining order and discipline, combining computers with traditional teaching methods, controlling the duration of work with technology, and organizing feedback and discussion of completed tasks.

Scientists Yu. Kosenko, O. Boryak, O. Korol believe that preparation for the introduction of computer games into the education process involves taking into account important organizational issues: 1) game rules should be simple and understandable for such children; 2) game tasks should be accessible and interesting; important and useful; 3) games should be suitable for both group and individual work; 4) when selecting tasks take into account the content of comprehensive education programs for preschool education institutions; 5) factual material, concepts should be repeated in a modified form in different games in order to consolidate, correct and transfer the acquired knowledge to new conditions [25].

It should be noted that the integration of traditional and modern pedagogical technologies requires adherence to clear methodological recommendations developed by practitioners of special pedagogy. These include the following:

- clear instructions (before starting to work with the program, clearly explain the task, make sure that all children understand it)
- demonstration (showing by example how to perform a task in a game or exercise)
- verbal support (encouraging children to comment on their actions, name objects, sounds, make sentences);
- encouragement and motivation (use positive reinforcement to maintain children's interest);
- playful moments (create playful situations, use surprises);
- pauses and rest (take regular breaks during the lesson, do physical exercises or eye exercises. Do not forget the time of work at the computer for children of middle preschool age up to 10 minutes);
- individual assistance (provide individual assistance to children who have difficulties, create a situation of success);
- control questions (ask questions on the content of the game or exercise to check understanding of the material and development of dialogic speech) [26].

Also, do not forget about organizing a proper education environment:

- ensure convenient and ergonomic placement of computer equipment;
- organize the workplace in such a way as to be able to observe the activities of each child;
- ensure sufficient lighting and compliance with sanitary and hygienic standards [27].

Compliance with these guidelines will help to effectively use computer equipment in speech therapy activities with middle-aged children with SEN, promoting their speech and cognitive development in an interesting and modern way.

For a clear understanding of the content of developmental work, we present individual exercises and games visually by area.

According to the research of O. Korniev, Ye. Sobotovych, V. Tyshchenko and others, the etiology of speech underdevelopment in most children is complex: a combination of genetically determined deficits in certain cerebral systems and the effects of organic brain damage [28]. Such children often have articulatory motor disorders in the form of mild paresis, tremors and violent movements of certain tongue muscles, which leads to the detection of erased dysarthria. Therefore, *the first area of* speech therapy involves the development of articulatory motor skills and includes a set of articulatory exercises for whistling sounds "Fun Exercises for the Tongue" (Fig. 1).

The purpose of the game is to prepare and train the articulatory apparatus for the correct pronunciation of whistling sounds ([s], [z], [ts]) by performing a set of interactive articulation exercises in a game form. In the course of the exercise, the child develops an understanding of the names of articulation exercises, establishes a connection between the name and the corresponding action, improves mobility, accuracy of control of the articulatory apparatus movements. Also, cognitive processes are developed: concentration on the task, memorization

and compliance with instructions [29].

Each exercise is accompanied by a colorful picture illustrating the desired articulation exercise. The child needs to drag the pictures, i.e. perform the action correctly.

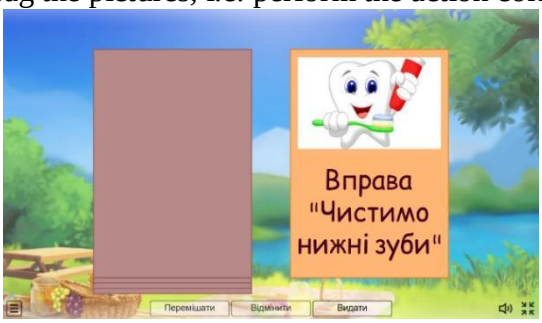

Fig. 1. Computer exercise "Fun exercises for the tongue" on the Wordwall platform

Also, this area of work includes a set of exercises for hissers "Winter Wheel for the Tongue", which aims to strengthen the muscles of the articulatory apparatus for the correct pronunciation of hissing sounds ([sh], [zh], [h], [shch]) and a set of games "Magic Pairs" to prepare the articulatory apparatus for the production of sounds according to the individual needs of children (sonority), consolidate knowledge about the correct performance of articulatory exercises, establish a correspondence between the name of the exercise and its visual image. Thus, the development of articulatory motor skills involves exercises for the tongue, lips, and cheeks aimed at forming the correct articulation of sounds.

In his special studies among children with generalized underdevelopment of speech, Mastiukov identified a group with uncomplicated versions of generalized underdevelopment of speech, which are characterized by impaired sound pronunciation and phonemic hearing [28]. There are many methods of correction of sound pronunciation and phonemic hearing, but speech therapy practice shows that positive results can be achieved with the help of interactive computer games. *The second area of* speech therapy involves a set of games aimed at correcting pronunciation. For this purpose, computer games "Flight with an alien", "Find the words, name them correctly", "What's in the bag?" have been generated. Before starting the first game, make sure that the child correctly pronounces the [s] sound in isolation. At first, we use only simple open syllables (sa, so, su...). Gradually, we complicate the task by adding reversed and closed syllables, syllables with consonantal matching (Fig. 2).

The purpose of the game is: primary automation of the [s] sound at the syllable level after its production (if the sound is not yet fully automated). To consolidate the correct pronunciation of the sound [s] in syllables of different structures (direct, reversed, closed), to develop auditory attention to one's own pronunciation and the speech therapist's pronunciation, to improve phonemic awareness of the sound [s] in syllables.

Procedure on the computer: an alien appears on the screen, controlled by the child. Various "obstacles" and "targets" with syllables with the sound [s] are moving in front of him/her. The child's task is to control the alien so that it "collects" only those syllables that contain the [s] sound and avoids unnecessary syllables. The mouse is used for control. If the alien collides with the wrong syllable, it can "lose speed" [29]. The game continues until all the syllables are used up.

Fig. 2. Computer game "Flight with an alien" on the Wordwall platform

Further games in this area improve and expand the developmental work. The game "Find the Words, Call Them Correctly" automates the [s] sound in words, teaches children to identify the presence of the [s] sound in a word and its position, and trains visual memory. The game "What's in the Bag?" automates the correct pronunciation of the [s] sound in a child's spontaneous speech at the sentence level, develops attention and observation. Thus, therapeutic work on sound pronunciation involves: the production of missing or distorted sounds, automation and differentiation of problematic sounds in syllables, words, phrases and independent speech.

The third area of speech therapy work includes a set of computer games aimed at developing and therapy the child's phonemic hearing. The program includes the games "Spoken and unspoken sounds", "Listen and name", "Where is the sound [C]?". Note that before starting the game, we explain to the child the difference between speech and non-speech sounds and give examples. We make sure that the child understands the symbols (lips/tongue – speech sounds, ear – non-speech sounds). In the initial stages of the game, we use clear and familiar sounds. Gradually complicate the task by adding less obvious or similar sounds. Encourage the child during the game. After the game, we discuss which sounds were speech and which were non-speech (Fig. 3)

The purpose of the game is to develop phonemic awareness, to teach children to distinguish between speech (speech sounds, phonemes) and non-speech (environmental noise) sounds; to develop auditory attention and to train reaction speed.

The procedure on the computer: The screen displays numbered pink squares that open when you click on them, showing images that represent a particular sound. At the same time, an audio recording of this sound is played. The child's task is to quickly react and click the mouse on the square of a speech sound (speech sound, phoneme, for example, [a], [s], [m], syllable "ba"), a non- speech sound (noise, for example, dog barking, ringing a bell, splashing water) [29].

Fig. 3. Computer game "Spoken and unspoken sounds" on the Wordwall platform

Other games are aimed at improving speech therapy practice. The game "Listen and Name" teaches children to distinguish by ear the sounds [z] and [zh] in words, to correlate the heard word with the corresponding visual image (picture) and to name these words independently. These exercises also develop cognitive processes: the child's auditory and selective attention. The game "Where is the [S] sound?" allows you to develop children's phonemic awareness, teach them to identify the [s] sound at the beginning, middle, and end of a word; encourage them to listen carefully to the word to determine where the [s] sound is located. These exercises also train the ability to distinguish and identify the [s] sound among other sounds, teach them to concentrate their auditory attention on subtle acoustic differences between phonemes, isolating the [s] sound and determining its place.

Important for the organization of speech therapy work is the coverage of the problems of the GUS by scientists Ye. Sobotovych, V. Tyshchenko, L. Trofymenko about the typical manifestations of deficiencies inherent in children of this category. Based on the well-known for speech therapy science peridization of children [28], who can be attributed to the second level of GUS and who are characterized by the presence of communicative difficulties associated with the predominance of passive vocabulary, lexical errors, lack of formation of figurative and coherent speech, etc. Therefore, based on the psychological and pedagogical characteristics of children, our game-based therapeutic program includes specific exercises to master vocabulary, grammatical structure of the native language and pronunciation, and gradual improvement of coherent speech.

The fourth area of speech therapy includes a set of computer games aimed at enriching the child's vocabulary. The program includes the games "Choose the right words", "Sound pairs: S and S", "World of Professions". Before starting the game, we make sure that the child understands the names of the categories. We encourage the child to name each object before assigning it to a category. Provide assistance if the child has difficulties. After the game is over, we discuss each category and name other examples of objects that belong to it (Fig. 4).

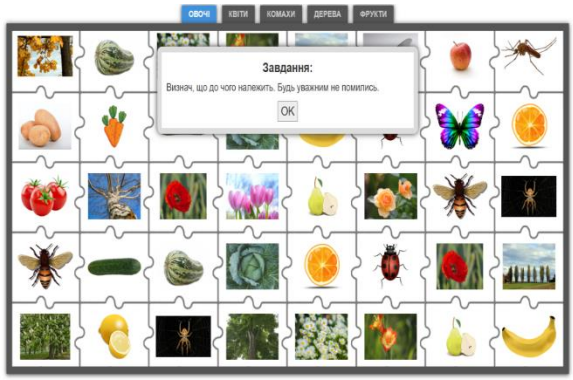

Fig. 4. Computer game "Choose the right words" on the Wordwall platform

The purpose of the game is to enrich and expand vocabulary, the ability to classify nouns into categories (vegetables, flowers, insects, trees, fruits), to promote the correct use of genitive noun endings, to coordinate words in a sentence when naming and describing objects, to train attention and memory.

Procedure on the computer: At the top of the board are the categories: "vegetables", "flowers", "insects", "trees", "fruits". Below the categories are mixed images that belong to one of these categories. The child looks at the images on the board and names them. By clicking on each image, the child must determine which of the upper categories it belongs to.

Additional games can be used to improve speech therapy. The game "Pairs of sounds: S and Sh" is aimed at expanding the vocabulary; differentiating S-Sh; teaching the child to distinguish by ear and pronunciation paronyms (words that sound similar but differ in meaning) that differ only in [s] and [sh] sounds. This helps to develop phonemic awareness, refine vocabulary, and elimination possible pronunciation errors. The game “World of Professions” expands children’s vocabulary on the topic of "Professions" and teaches them to correlate the names of professions with the corresponding tools or attributes. It also provides for the expansion of knowledge about different types of work, the development of attention and visual perception.

The fifth area of speech therapy includes a set of computer games aimed at developing the grammatical structure of speech and involves the introduction of computer games “Find a Match by Gender”, “World of Prepositions”, “One-Many”. Before starting the lessons, a speech therapist needs to explain the concepts. You can start with simple and familiar words for the child, clearly name the words, focusing on the endings. In the course of the game, it is advisable to encourage the child – for example, to ask a simple question (“who is it?”, “what is it?”) to determine the gender. It is important to vary the difficulty of the game: Increase the number of cards, use less obvious examples, introduce words whose gender is determined only by meaning, encourage the child to make simple sentences with the formed pairs (Fig. 5).

The aim of the game is to develop the ability to match adjectives with masculine, feminine and neuter nouns. This will enrich the vocabulary, systematically develop the child’s attention and memory.

Procedure of actions on the computer: The child is asked to look at the object on the central card (blue scarf) and determine its gender. Then the child should think of an adjective that goes with the noun (e.g., *blue).* Next, the child has to match this adjective with the corresponding question and the sector that symbolizes this gender. In this case: *scarf is a masculine noun. What color is it? It’s blue* and drag it to the boy’s box.

Fig. 5. The computer game “Find a Match by Gender” *on the Wordwall platform*

The following games complement and expand speech therapy intervention. The game “The World of Prepositions” involves consolidating the understanding and correct use of prepositions that indicate spatial relations, matching nouns with prepositions by gender, developing the grammatical structure of speech, expanding vocabulary which significantly contributes to the development of attention and spatial orientation. The game “One-Many” aims to improve the process of forming and consolidating the skills of forming plural nouns, developing the grammatical structure of speech (matching numerals with nouns), expanding vocabulary, which contributes to the development of attention and observation.

The sixth area of speech therapy includes a set of computer games aimed at developing coherent speech. The program includes the games “Who Eats What?”, “Make a Story”, and

"Make a Story "Kolobok". The first game is based on established correspondences. You need to ask the child to tell what each animal in the picture eats. Ask: "Why does this particular animal eat this food?" (for example, "Why does the squirrel eat acorns?"). Ask them to write a story about one of the animals and its food. Use the game as a basis for discussing different types of animal nutrition (herbivores, carnivores, omnivores).

The aim of the game is to develop the ability to make simple sentences and short descriptions, making connections between animals and their food; to develop grammar skills, noun and verb agreement in number and gender. Expanding vocabulary with names of animals and food. Developing skills in describing, explaining and constructing logical statements.

Procedure of actions on the computer: The game is based on the principle of "find the match". The child needs to establish a connection between each animal on the left side and its favorite food on the right side by dragging the corresponding images to form pairs. The speech therapist invites the child to tell about what each animal eats, using the compound sentences as a basis for a short story (Fig. 6).

Fig. 6. The computer game "Who Eats What?" on the Wordwall platform

Other game tasks deepen speech therapy. In particular, the game "Make a Story" develops the ability to compose a sequential story based on a series of plot pictures, establishes temporal and cause-and-effect relationships between events, forms coherent monologue speech, uses different types of sentences, enriches vocabulary, promotes the development of imagination, attention and memory. The game "Make a story "Kolobok" enhances the development of coherent speech (recreating a familiar story, making up a sequential story), the ability to retell a familiar story consistently, using a series of story pictures as a support. The skills of coherent monologue speech, reproduction of the storyline, description of characters and their actions are formed. Vocabulary, memory, attention, and emotional development are also activated.

Thus, the targeted speech therapy program for preschool children of middle age included the development and therapy of articulatory motor skills (exercises for the tongue, lips, cheeks aimed at forming the correct articulation of sounds), sound pronunciation (production of missing or distorted sounds, automation and differentiation of problematic sounds in syllables, words phrases and independent speech), phonemic awareness (ability to distinguish speech sounds, syllables and words), vocabulary (learning new words, understanding their meaning and use in speech), grammatical structure of speech (formation of correct grammatical structures), connected speech (learning to compose stories, descriptions, paraphrases).

To understand the role and importance of using computer exercises and games in the development and therapy of speech disorders, a pedagogical experiment was conducted with 32 children of middle preschool age, pupils of preschool education institutions in Zhytomyr. All children were conditionally divided into two groups: experimental 16 (10 girls and 6 boys) and control (6 girls and 10 boys). According to the conclusions of the Inclusive resource center,

100% of children in the experimental group and the control group (32 people) were diagnosed with level II GUS. Prior to the formative part of the experiment, i.e., the implementation of logotherapeutic work, we carried out an initial diagnosis of children's speech competencies according to the criteria established previously (phonetic and phonemic development, development of grammatical structure of speech, vocabulary and connected speech). In order to assess the levels of competence formation, a set of methods for examining sound pronunciation, phonemic processes and syllabic structure (state of sound pronunciation, state of phonemic hearing, state of syllabic structure of the word), a set of methods for examining vocabulary (vocabulary volume, quality of vocabulary); a set of methods for examining the grammatical structure of speech (state of word formation, state of word change, state of syntactic structure of speech); a set of methods for examining coherent speech (understanding of coherent speech, self The author of all sets of diagnostic methods is a Ukrainian speech therapist O. Korol.

The purpose of the experiment was to evaluate the effectiveness of the therapeutic and developmental program using computer didactic games. After the formative stage of the pedagogical experiment, i.e., the implementation of the program for 6 months, the level of speech competencies was reassessed. A comparative analysis of the diagnostics of preschoolers' developmental levels before and after speech correctional work is presented (Tables 1-4).

Table 1

Results of diagnosing levels of phonetic and phonemic development of middle-aged preschool children with SEN before and after the program implementation*

Levels of formation	Sound pronunciation				Phonemic awareness				Syllabic structure of the word			
	EG %		CG %		EG %		CG %		EG %		CG %	
	before	after	before	after	before	after	before	after	before	after	before	after
high	-	12.5	-	12.5	25	50	12.5	50	12.5	37.5	12.5	37.5
average	25	75	25	62.5	37.5	37.5	37.5	25	50	50	50	37.5
low	75	12.5	75	25	37.5	12.5	50	25	37.5	12.5	37.5	25

**author's* approach

A comparative analysis of the results of diagnosing the levels of phonetic and phonetic development of preschool children has shown that the use of computer games can affect the effectiveness of speech therapists' logotherapeutic activities. The children of the experimental group who played interactive games showed positive dynamics in the development of sound pronunciation and phonemic awareness. If at the statement stage both in the experimental and control groups the vast majority of children (from 37.5 to 75%, i.e. 12 people) belonged to the low level, then at the control stage there were fewer such children (from 12.5 to 25%, i.e. 2-4 people). Of course, not all children reached a high level of development of these indicators: 12.5 percent of children had a high level of sound pronunciation, 50 percent of children had a high level of phonemic awareness, and 37.5 percent of children had a high level of word structure. It is important to note the positive dynamics of growth of speech competence indicators.

Table 2

Results of diagnostics of vocabulary levels of middle-aged children with SEN before and after the program implementation*

Levels of formation	EG (%)		CG (%)	
	before	after	before	after
high	25	62.5	25	37.5
average	37.5	37.5	50	50
low	37.5	-	25	12.5

*author's *approach*

A comparative analysis of the results of diagnosing preschoolers' vocabulary levels shows that this is one of the successful areas of learning through computer-oriented games. All the children (100%) who were involved in targeted developmental exercises and games using a computer significantly enriched their vocabulary. After mastering the logotherapeutic program, 37.5% (6 children) had an intermediate level and 62.5% (12 children) had a high level. While in the control group, the indicators changed, but minimally. 'Thus, using computer games can qualitatively improve the vocabulary of children with SEN.

Table 3

Results of diagnosing the levels of grammatical structure of speech of middle-aged children with SEN before and after the program implementation*

Levels of formation	EG (%)		CG (%)	
	before	after	before	after
high	-	37.5	-	25
average	37.5	50	50	62.5
low	62.5	12.5	50	12.5

*author's *approach*

A comparative analysis of the results of diagnosing the levels of grammatical structure of speech shows that logotherapeutic activity in this area also brings about positive changes. The dynamics of improvement is observed, especially in the middle and high levels. The vast majority of children at the low level, i.e. 50%, have reached the intermediate level, and those at the intermediate level (37.5%) have all reached the high level. No progress was made in the development of the grammatical structure of 2nd person speech. The analysis suggests that these preschoolers need additional classes on the development of perception, attention, and memory. The low level of development of their cognitive sphere hindered the development of speech processes.

Table 4

Results of diagnosing the levels of coherent speech of middle-aged children with SEN before and after the program implementation*

Levels of formation	EG (%)		CG (%)	
	before	after	before	after
high	12.5	50	12.5	37.5
average	37.5	37.5	25	37.5
low	50	12.5	62.5	25

**author's* approach

A comparative analysis of the results of diagnosing the levels of children's coherent speech demonstrates insignificant dynamics in the therapeutic work of the speech therapist in both groups, but there is progress. The number of high-level children increased and the number of low-level children decreased (from 50 to 12.5%). Therefore, there is reason to believe that the content of the logotherapeutic program for middle-aged preschoolers is professionally formed and can be widely used in speech therapy practice. Computer didactic games should be constantly improved and strengthened based on individual psychological characteristics and education needs of children with SEN.

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

In recent years, computer didactic games have become an integral part of the everyday life of the education environment and for children with special education needs, in particular with speech development disorders they have become not only a tool for entertainment but also a powerful means of learning about the world around them. Their versatility opens up wide opportunities for active use in the therapeutic and logotherapeutic process of preschool education institutions.

The proposed logotherapeutic program using interactive computer didactic exercises and games for preschool children of middle age with SEN included six areas of developmental work of a preschool speech therapist: articulatory motor skills, sound pronunciation, phonemic awareness, vocabulary, grammatical structure of speech, and connected speech. For each area of speech therapy there were three exercises or games that took into account the content of the education programs of the education institution and the individual and age characteristics of children, were regulated by methodological instructions, time and were accompanied by professional actions of the speech therapist.

The results of the experimental study convincingly demonstrated the effectiveness of speech therapy using computer didactic games. The preschoolers of the experimental group in all the identified areas of the program showed positive dynamics in developmental and therapeutic work. Computer-based didactic games can take a solid place in the education process of preschool education institutions where children with SEN are brought up and prepared for school.

Prospects for further research are seen in the experimental verification of the impact of new logotherapeutic programs using computer exercises and games on the development of the cognitive sphere of preschool children with GUS.

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ЛОГОПЕДИЧНА ДОПОМОГА ДІТЯМ СЕРЕДНЬОГО ДОШКІЛЬНОГО ВІКУ ЗАСОБАМИ КОМП'ЮТЕРНИХ ДИДАКТИЧНИХ ІГОР

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Анотація. У статті висвітлено особливості логопедичної допомоги дітям середнього дошкільного віку за допомогою комп'ютерних дидактичних ігор. Усі діти, яким надавалася допомога, мали загальний недорозвиток мовлення (ЗНМ). Такі діти мають труднощі з розумінням та використанням мови, включно з побудовою речень, вимовою звуків та збагаченням словникового запасу. Для підвищення результативності педагогічної роботи в освітній процес закладів дошкільної освіти була впроваджена цільова логотерапевтична програма з використанням комп'ютера. Визначено ключові критерії, відповідно до яких сформовано напрямки логопедичної допомоги та відповідно розроблено комп'ютерні вправи та ігри для таких дітей. Дидактичний матеріал, спрямований на розвиток та терапію

мовленнєвих порушень, розміщено на освітніх платформах LearningApps та Wordwall. Розроблено методичні правила для логопедів та інших педагогічних працівників з організації та надання допомоги дошкільнятам. Із кожного напрямку логопедичної практики (артикуляційна моторика, звуковимова, фонематичний слух, словниковий запас, граматична будова мовлення, зв'язне мовлення) наведено приклади дидактичних вправ та ігор. Розробка комп'ютерних матеріалів здійснювалась із врахуванням індивідуальних та вікових особливостей дітей середнього дошкільного віку. Для перевірки ефективності розвитко-терапевтичної роботи, реалізації змісту програми з використанням комп'ютерних дидактичних ігор проведено педагогічний експеримент на базі закладів дошкільної освіти м. Житомира. Формуючий етап в експериментальній групі проводився впродовж 6 місяців. Діагностика рівня зазначених компетентностей у дітей середнього дошкільного віку з порушеннями мовленнєвого розвитку до та після впровадження логотерапевтичної програми переконливо свідчить про ефективність такого підходу в логопедичній роботі. Логопеди повинні активніше використовувати потенційні можливості засобів комп'ютерних дидактичних ігор як в умовах дошкільних закладів освіти так і в домашніх умовах дитини.

Ключові слова: логопедична допомога; комп'ютерні дидактичні ігри; діти дошкільного віку; загальне недорозвинення мовлення; компетентність; втручання; терапія

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