UDC 37.02: 376.37:004.9

Hanna Mytsyk
Candidate of Sciences in Pedagogy, Associate Professor
Associate Professor at the Department of Applied Psychology and Speech Therapy
Department of Applied Psychology and Speech Therapy
Berdyansk State Pedagogical University, Berdyansk, Ukraine
ORCID ID 0000-0002-4989-416X
kolibri07s@ukr.net

Alona Babichenko
assistant at the Department of Applied Psychology and Speech Therapy
Department of Applied Psychology and Speech Therapy
Berdyansk State Pedagogical University, Berdyansk, Ukraine
ORCID ID 0000-0001-9843-9844
alenababicenko2213@gmail.com

THE USE OF GAMIFICATION IN THE PREVENTION OF DYSLEXIA OF CHILDREN IN PRESCHOOL AGE

Abstract. In this article, the use of gamification in the organization of preventive work with children prone to dyslexia is analyzed. The factor that causes dyslexia has been identified, emphasizing the need to promptly identify children at risk and intervene, in order to avoid negative psychosocial consequences during their education. The main achievements of scientists in this field have been summarized. The advantages of using individual elements of gamification for propaedeutic purposes in working with children prone to dyslexia are highlighted, and their description is provided. An algorithm for creating a game mechanism, criteria for selecting digital learning platforms, and developing games based on them are proposed.

Considering the variety of available mobile applications and platforms that contribute to the implementation of propaedeutic and developmental goals in working with children with speech disorders, it is stated that they have some disadvantages. Therefore, the main approaches to developing custom digital games on gamified platforms, with the ability to modify their content and tasks, have been considered in such a way that they contribute to the implementation of the goals of corrective and developmental work with children prone to dyslexia. Several variants of such games are proposed as examples. The identified factors that can hinder the achievement of a positive effect of using digital games by a speech therapist in the classroom are discussed, and ways to solve them are explored. The perspective of using digital games in providing remote corrective and developmental assistance to children in conditions of distance learning is indicated.

The article also emphasizes the need for speech therapists to possess a sufficient level of digital competence as a guarantee of methodologically correct creation and implementation of digital games into their work with children.

Keywords: gamification; dyslexia; preventive work; preschool children; digital technologies; digital games.

1. INTRODUCTION

The problem statement. Reading is a complex psychophysiological process, the basis of which is the mechanism of coordinated interaction of the visual, speech and hearing analyzers. Impairment of its functioning, low level of formation of the parties of vocal speech, non-reciprocal functions (visual-spatial representations, visual memory), mental operations and intellectual development can lead to dyslexia. This is a partial disorder of the reading mastery process, manifested in repeated errors of a stable nature (skipping letters and syllables, adding redundant ones, different types of their substitutions, permutation, semantic errors, etc.) [1].

Dyslexia is quite common among speech disorders in primary school children. Delayed mental development, severe speech disorders, and minimal brain dysfunction are among the

reasons for the insufficient psychological readiness of children for schooling. Ignoring the prerequisites for the development of reading disorders in preschool age is among them. Dyslexia is mostly diagnosed in primary school when the most effective time for intervention has passed. In foreign practice, this phenomenon is called «dyslexia paradox» [2]. Therefore, early identification of children at risk in preschool age can prevent dyslexia and psychosocial consequences for the child in the future [2].

It is well-known that, for preschoolers, the leading activity at their age is play. Therefore, preventing dyslexia is advisable to be based on it. Today the problem of play activity of preschool children attracts the attention of researchers in the field of age psychology. This is primarily due to changes in the social situation of preschool children's development and the emergence of new opportunities that stimulate their play activity [3].

Using digital technologies is among the new opportunities. Their active use in the education industry has led to their utilization for supporting learning and development in children with special educational needs. These changes have been accelerated by quarantine restrictions associated with the COVID-19 pandemic. Their application has opened up new opportunities for learning without the time and place restrictions, providing support for inclusive learning, its personalization and individualization, equal access to learning resources and activities for all persons with special educational needs [4]. In the current situation, we emphasize that there is no alternative to using digital technologies, especially during the period of martial law in Ukraine.

In contrast to this, it has led to yet other challenges that speech therapists are facing: changes in established intervention practices towards the active integration of digital technologies; search for new methods of early detection and prevention of speech disorders, in particular, dyslexia in children of older preschool age. Such trends in education and their orientation to the active use of digital technologies in the educational process have created in recent years the prerequisites for using the new educational technologies. One of them is gamification. It refers to the practice of applying game elements or functionalities such as points, rewards, tasks, challenges, goals or immediate feedback for learning purposes [5]. The introduction of game elements to the learning process contributes to the development of learning motivation and initiative [6]. Motivational support is especially important in the context of long-term speech therapy [7] and in cases where its level is lower in contrast to children without dyslexia [8], in circumstances when it comes to children of preschool age who are prone to dyslexia.

It should be recognized that gamification relies on having quality educational content, such as digital games. Nowadays, there are plenty of mobile applications and platforms that can assist modern speech therapists. It contributes to the implementation of propaedeutic and developmental goals in working with children with speech disorders, in particular, the prerequisites for the onset of dyslexia. However, it should be noted that, to some extent, they are not spared the disadvantages. For example, the vast majority of them are in English [9]. This significantly hinders the dissemination of the experience of using them in classes with foreign-speaking children, since the manifestations of dyslexia depend on the spelling of certain languages [1].

In particular, such factors as lack of ability to adapt their content to children's individual and age characteristics, to change the complexity of tasks without knowledge of the programming language; excessive length of games and inappropriate system of passing levels lead to a decrease in children's self-esteem, increased feelings of frustration and other consequences [9]. As a result, there is a need to study the issue of creating such games on gamified platforms with the possibility of modifying their content according to the needs and characteristics of each child, considering the goals and tasks of speech therapy, as well as the expected results. This requires us to focus on the following:

- analyzing gamification practices that are effective in working with children prone to dyslexia using digital games;
- describing the main elements of gamification and creating an algorithm for a game mechanism;
- defining key criteria for selecting digital educational platforms and creating games based on them;
- generalizing and disseminating our own scientific and pedagogical experience in developing digital games for preventing dyslexia in older preschool children on platforms with gamification elements.

Analysis of recent studies and publications. The causes, early detection, symptoms, intervention, and prevention of dyslexia in young children have been explored in the works of O. Arkadieva, E. Danilavichiutie, V. Iliana, Z. Martyniuk, O. Gaggi et al [10]. Additionally, O. Ozernov-Palchik and N. Gaab [2] have pointed out the psychosocial consequences, such as shame, failure, depression, and solitude, that may arise as a result of reading difficulties. Authors, such as F. Nieto-Escamez and M. Roldan-Tapia [11], E. Sudarmilah and A. Arbain [12], Q. Zhang et al. [13], O. Yaroshenko et al. [14], A. Zourmpakis et al. [15], have focused on both the positive and negative aspects of using gamification in children's education. The positive impact of using it for working with children prone to dyslexia have emphasized by M. Behnamghader et al. [16], P. Dymora and K. Niemiec [6], I. Neitzel [7] and M. Saputra [8]. A considerable portion of scientific research focuses on using digital games as a gamification element to prevent dyslexia in older preschool children. This is evident in works by S. Bertoni et al. [17], S. Franceschini et al. [18; 19], C. Green et al. [20], H. Lyytinen et al. [21], and A. Eichenbaum et al. [22].

It should be noted that national scientists are only at the beginning of their search for an optimal model of combining gaming practices and mechanisms with traditional methods of teaching children prone to reading disorders. Some aspects of the application of computer technology and digital tools in classes with children who have educational difficulties are covered in the scientific works of O. Kachurovska [23], Y. Kosenko, O. Boryak, O. Korol [24], P. Leshchenko [25]. Therefore, it is reasonable to study the existing experience of using gamification in preventive work with children with dyslexic tendencies, disseminate scientific findings within the pedagogical community, and introduce them to speech therapy in preschool educational institutions.

The goal of this research is to analyze the use of gamification in organizing preventive work with children prone to dyslexia and emphasize the significance of digital technologies in the implementation of gamification; disseminating personal experiences in using digital games to prevent dyslexia in older preschool children.

2. RESEARCH METHODS

In order to address the issues raised in the scientific article, we have analyzed the works of scientists who have focused on the use of gameplay to prevent dyslexia in older preschool children. Specifically, we have examined the play elements and the algorithm involved in creating a game mechanism. We have utilized the method of generalization to determine the positive effects of gamification in speech therapy. Additionally, we have employed the method of comparison to identify platforms with game elements that meet our criteria and enable the creation of digital games. Finally, we have used modeling and description of game situations to influence the development of functions and operations that are essential to reading in older preschool children, while also generating interest and engagement through the modeling approach.

3. THE RESULTS AND DISCUSSION

3.1 Analysis of the practice of using gamification and digital games in work with children prone to dyslexia

The expansion of the scope of application of digital technologies, the availability of gadgets, and the intensive development of social media have influenced the change in the ways the child knows the world. The modern generation discovers it not only directly, through knowledge of the surrounding reality or learning and family influence, but also indirectly through the use of information and communication means. There are many reasons for their immersion in digital space. First of all, it is their inherent cognitive activity, which they try to satisfy using the Internet. In addition, there is an increased interest in vivid impressions and the need to play as a leading activity. However, despite the advantages of their early introduction into the digital world (expanding the range of their interests, the possibility of obtaining additional knowledge, the development of cognitive mental processes, and the ability to structure the flow of information), there are certain risks. The Internet has become a platform for viewing entertainment content, and the gadget is the most attractive and affordable source of entertainment. Weakness of voluntary and emotional control, impulsive behavior makes children vulnerable to information threats, and their passion for aggressive games can lead to the solution of problems in life by such methods. In addition, children's health and academic achievements are harmed by their long stay on the computer.

This should be duly taken into account in established intervention practices with children with dyslexia. Consequently, a speech therapist has to choose a pedagogical technology that contributes to the implementation of preventive and developmental tasks by the opportunities, needs and interests of his pupils. And his skillful use of the advantages of digital tools in the said process has allowed eliminating the threats mentioned at the level above. In our opinion, in this case, gamification has to justify itself. In the context of clarifying the meaning of this term, we are impressed by the interpretation offered by O. Yaroshenko et al. [14]. They view gamification in the educational process «as the specially created conditions thanks to the game elements that immerse pupils into the unreal game world, but all created conditions are aimed at achieving real goals and tasks» [14, p. 443].

Attempts to combine the gamification approach to teaching children with its traditional methods were made by F. Nieto-Escamez, M. Roldan-Tapia [11], E. Sudarmilah and A. Arbain [12], Q. Zhang et al. [13], O. Yaroshenko et al. [14], A. Zourmpakis et al. [15]. For example, Q. Zhang et al. have studied the differences between gamification and game-based learning at a theoretical level [13]. They have examined the Classcraft platform, in particular its advantages and disadvantages in use with children. They have confirmed the assumption empirically that gamification had a greater positive impact on learning achievement and motivation than game-based learning [13]. Gamification as a technology to improve the cognitive abilities of preschool children was considered by E. Sudarmilah and A. Arbain [12]. Researchers Zourmpakis et al. found out the specifics of the creation of a gamification educational environment by teachers of preschool and primary education [12].

O. Yaroshenko et al. defined that with the appropriate organization and methodological support of gamified classes, it is possible to achieve effective synergy of the game and innovative forms of work [14, p. 437]. They identify among the advantages of using gamification the prevalence of positive background, the provision of instant feedback, the complicating and increasing number of the game tasks, the rapid development of game skills, the availability of clear indicators of progress [14].

F. Nieto-Escamez, M. Roldan-Tapia spoke about the effectiveness of using gamification during distance learning in educational institutions at the period of the quarantine restrictions

caused by the COVID-19 outbreak [11]. They pointed out that teachers should take into account the difficulties that participants may encounter in the educational process. Among them is the lack of high-tech devices or appropriate Internet connection which restricts the introduction of gamification for distance learning, especially in rural areas [11].

The positive aspects of using gamification in work with children with dyslexia were highlighted by M. Behnamghader et al. [16], P. Dymora and K. Niemiec [6], M. Saputra [8]. M. Saputra developed a learning model for dyslexic children by including gamification elements in LexiPal [8]. It was created using 7 game elements (story/theme, clear goals, levels, points, rewards, feedback, and achievements/badges) and clustered into several groups that match 3 considerations: the need of dyslexic children, desired psychological outcomes, and the software requirement [8, p. 39]. According to the results of the conducted experiment, the researcher confirmed that gamification has a positive effect on the level of children's motivation and involvement in the learning process, he considered the need to gradually change the complexity of such games in order to obtain a better result [8]. His views are supported by scientists P. Dymora and K. Niemiec [6]. They presented a mobile application that implements a gamification mechanism and promotes learning by children the rules of spelling and orthography, and game elements encourage them to repeatedly play the game without losing interest in it [6]. While writing the work, the findings on increasing children's motivation with dyslexia to learn using games on mobile platforms, as made by Behnamghader et al., were taken into account. [16]. Among the scientific works, a significant share of those is devoted to the prevention of dyslexia in older preschool children using digital games as one of the elements of gamification.

Thus, scientists S. Franceschini et al. associate the appearance of dyslexia in children of this age group with a low level of development of their spatial attention [18]. In their opinion, in such circumstances, traditional methods of intervention for reading disorders were not very effective. They reduce the concentration period. This affects the child's ability to focus on perceiving various stimuli and establishing new neural connections in the brain over a long time. Whereas computer games make him fixate on the task and learn in a casual way through the game [18]. According to the results of the study, they stated that children's attention should be trained from childhood, thus carrying out early prevention of disorders of the reading process.

H. Lyytinen et al. emphasized the need for early detection of dyslexia even before children are in school [21]. They presented the data of a pilot experiment regarding using of the computer game «Literate», specially designed for the prevention of reading disorders, indicated on its perspective and positive influence in work in this direction with the specified category of children [21].

Researchers C. Green et al. proved that digital games are characterized by a number of qualitative characteristics that provide them with significant advantages over other means of learning, in particular: the constant movement of objects in the game, high degree of perceptual, cognitive and motor load on the child, the unpredictability of the plot, constant need to keep in view objects, to store in memory drawings and to quickly perform actions due to timely getting to the target [20]. The opinion of A. Eichenbaum et al. is interesting [22]. They note that such games improve cognitive functions (the ability to distribute attention to different environmental objects, understand and recycle perceived information and respond quickly to avoid failures; cognitive flexibility) sensitivity to visual contrast; development of the ability to track moving objects in the field of view and plan their own actions according to the goal of the task [22].

S. Franceschini et al. experimentally proved that, under the influence of visual and audio stimuli in video games, the experimental group showed significant changes. The level of development of their attention, memory, and spatial representations improved, as well as their skills in establishing the relationship between grapheme and phoneme. [19]. According to

S. Bertoni et al. such changes are due to the stimulation of the frontal parietal part of the brain responsible for the reading process [17].

It should be added that digital games used in the work of the prevention of dyslexia in preschool children can contribute to the maintenance of motivation during the repeated practice of the necessary skill for a long time, which is usually very relevant in working with those who have educational difficulties [26]; if possible, changes in their content can be useful at any stage of speech therapy [27]. And, finally, they can also be cost-effective, reducing the need for teacher involvement during the practice of skills [5]. This is a significant advantage when providing remote speech therapy to children in cases of territorial distances, especially when the responsibility for their integration into everyday life falls almost entirely on the shoulders of the children's parents (or those replacing them) [28].

3.2 The elements of gamification and the algorithm for creating a game mechanism

In order to achieve the set goals, solve the tasks of the lesson, and obtain the expected results of work with children prone to dyslexia, it is important to create appropriate game conditions in which the players will perform the necessary actions. These conditions, according to Werbach and Hunter should include such elements of the game as dynamics, mechanics and components [29]. Dynamics are the big-picture aspects of the gamified system that should be considered and managed, but which the creator of the game can never directly enter into the game. The most significant game dynamics are: constraints or forced trade-offs, emotions, ongoing storyline, progression (the player’s growth and development), and relationships (social interaction) [29].

The components that form the mechanics of the gamification process include puzzles or other tasks that require effort to solve; rewards, feedback (information about the player’s progress), accumulation of resources (knowledge indicators), victory status (achievement scale, total points, current knowledge with bonuses, final score, rating), etc [29]. Note that in the context of our research, it is extremely important that the tasks correspond to the children’s abilities, and their implementation contributes to the development of sensorimotor, language and semantic operations that form the basis of the reading process. Each mechanic is a way to achieve one or more of the described dynamics. An unexpected reward, such as one that appears without warning, can stimulate players’ positive emotions.

External attributes are defined as components of gamification, in particular: user avatar (player character image), game levels, leaderboards, virtual awards (bonus points, awards, badges, virtual currency), battles (short-term competitions), quests, teams, etc [29]. For example, the leaderboards allow players to compare their performance with their peers’, improving their success and self-esteem, encouraging players to achieve the best results.

Just as each mechanic is linked to one or more dynamics, each component is linked to one or more higher-level elements. Let’s illustrate this with an example. When a certain level of play is reached, the player is allowed to collect rewards that are not available to other users who are below grade level.

It should be noted that the gamification learning process can include all the elements presented together, as well as individual combinations of them, allowing to achieve didactic goals and objectives.

In order to effectively utilize gamification in speech therapy classes for children who are prone to dyslexia, it is necessary to first carefully consider the algorithm for creating a game mechanism. To achieve this, the following steps should be taken:

- define the goal and target audience, including the age group and current skill level of the participants;

- take into account the specific context of the game's introduction, such as the form of work (group or individual) and the mode of interaction (offline or online) with participants;
- consider factors that may reduce the effectiveness of gameplay, such as problems with concentration and motivation of players, lack of skills of participants in the educational process, lack of appropriate technical support, and temporary changes in emotional state (arousal, oppression, fear, anxiety);
- come up with tasks and rules for the game world that will increase the motivation of players, and ensure that their actions will lead to feedback, such as the accumulation of points, virtual rewards, changes in leaderboards, etc.;
- finally, select digital tools that will contribute to the implementation of gamification elements in the context of our research, specifically in preventive work with children prone to dyslexia.

3.3 Description of speech therapy games and a platform for their development

Based on our scientific and pedagogical experience, we suggest the following sequence of actions for developing digital games to prevent reading disorders in older preschool children. Before starting work, one should carefully consider the choice of a platform for their creation. It has to ensure efficient and quick registration processes, and be installable and launchable on various operating systems (Windows, macOS), as well as mobile devices or tablets. Preference should be given to platforms with a clear and easy-to-manage interface for creating games. Additionally, they should support diverse multimedia elements (images, audio, sound effects, video, and text). This allows for the creation of a realistic atmosphere, conveying mood, emphasizing plot points, and interesting and motivating children to interact with characters and complete tasks. Choose platforms that enable the creation of digital games in multiple languages, including Ukrainian. Furthermore, it should contribute to the implementation of gamification, enabling the creation of exciting game scenarios and providing feedback through virtual rewards, prompts, error correction, and leaderboard progress. It should also allow for creating tasks without programming knowledge, adapt them to meet individual needs and age characteristics, and monitoring progress to make timely adjustments in work with children susceptible to dyslexia.

As a recommendation, it is desirable to choose a platform that can technically facilitate the correct placement and combination of game elements. Components with different functional purposes should be placed in different parts of the background [10]. Ideally, the background should not be frequently changed and should have a set of game images that the player perceives as a single unit, such as a scale of scores or time. Changes in size and constant movement of the game character (an element with which the user must interact) are welcomed [10].

Based on these requirements, we have chosen several platforms (Wordwall (wordwall.net) and Educaplay (educaplay.com)). As an example, we will provide variations of certain digital games that we have developed on these platforms and have used to prevent reading disorders in older preschool children. We will describe the main elements of games.

«The racing in the labyrinth» (Fig. 1) is a digital game developed on Wordwall, aimed at enhancing a child's ability to orient themselves on a plane, determine their location among surrounding objects, improve visual gnosis and arbitrary attention, update their spatial dictionary (e.g. down, up, straight), and fix the graphical image of letters. According to the rules of the game, the child must reach the target by bypassing the monsters. At the same time, she can first do it silently, later – voice the direction of her movement, accompanying him with the necessary actions. The game continues until all correct answers are found or until the player uses all their attempts. Before the game, a speech therapist must instruct the child: «Look

closely at the letter presented at the bottom of the screen. Find the same one. However, be careful. Don't run into evil monsters. You have 4 attempts. After that, the game will end».

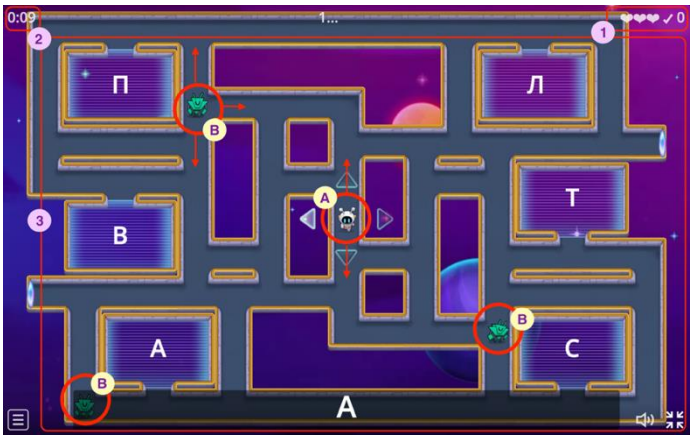


Figure 1. Design of the digital game «The racing in the labyrinth»

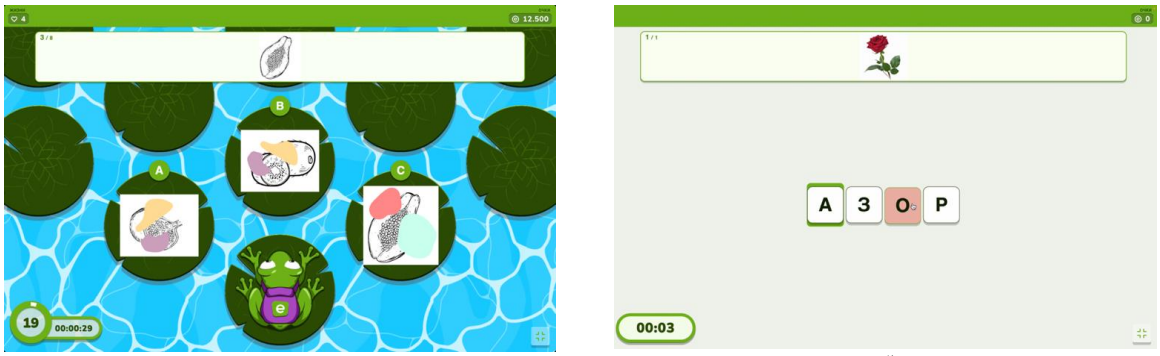
The ergonomic design of the game is presented in the form of three game images (Fig. 1). They are marked with the numbers 1, 2, and 3, while the characters in the game (the picture) are marked with the letters A and B. The playing field under 1 contains a set of elements informing the child of the number of remaining attempts. The game field under 2 is presented as a set of digits that determine the total time allotted for the task. The game field under 3 defines the background of the game as a set of geometric shapes and a set of lines. The game hero, marked with the letter A, can move in any direction defined by the player, while the monster characters (marked with the letter B in Fig. 1) can only move in the specified game direction.

Please note that the illustrative material in all digital games presented by us can be altered. For instance, images can be used instead of letters. However, it is essential to consider the criteria of ontogenetic development and program material that determines the content of speech therapy for children with speech disorders, while selecting illustrative material and tasks. In this regard, the recommendations provided by the domestic researcher Y. Ribtsun are crucial [30]. She emphasizes the need to begin with realistic color images and then progress to contoured color, silhouette, and dotted drawings. Afterward, the material of letters and their elements can be added, which should be chosen based on graphical similarity [30].

The game «Froggy Jumps» (Fig. 2a), which was developed on Educaplay, is an example of the use of contour black and white images under overlapping conditions. Therefore, it is considered to be easier for children than the previous game. The child is given the following instruction: «Carefully look at the picture presented at the top of the screen and find an image similar to it». In each case, when the child chooses the correct answer, the frog will move to the water lily. However, if the child chooses the wrong answer or runs out of time, the frog will sink. It is desirable for the child to not perform the task silently, but to pronounce the words that denote the pictures. This way, you can ensure the correct pronunciation is being reinforced.

The game «Unscramble Letters» (Fig. 2б) is more complex and is aimed at developing advanced analysis and synthesis skills. Instructions for the child: «Read the letters and drag the letters into their correct positions to unscramble the word. You have a hint in the picture at the top of the screen. If you need to, you can enlarge it». Firstly, the child can play the game by relying on their auditory analyzer to pronounce the depicted words. Then, they can arrange the letters without pronouncing the words. Points are awarded and the child moves on to the next word when they provide the correct answer. If a mistake is made, the incorrect letter is marked in red. A timer is situated in the lower-left corner of the game, which can be removed or

extended as desired. Before the time runs out, the child must complete the game. If the game becomes too easy for the child, you can increase the number of syllables in the word.



а) *б)*

Figure 2. Design of the digital game «Froggy Jumps» (a), «Unscramble Letters» (b)

A mandatory feature that unites each game is the presence of a gamification element. Each game has its own storyline, rules, and limitations that the player must adhere to. The achievement of set goals contributes to the player's progress. If the answer is correct, the child receives points or moves to the next level. If an error occurs, the cards/characters are marked with a cross or red color, and the attempt is lost. The state of victory or loss visualizes the scale of achievements and the total score. Additionally, the speech therapist can change the game settings, such as setting a time limit to fulfill each task, and a limited number of lives, degree of difficulty, or shuffling question order; put a question or clue combining text with audios, pictures, or animated gifs. We believe that such properties encourage children to use digital games without decreasing their interest in them.

In summary, we can say that the use of traditional learning approaches in combination with gamification has its advantages, especially in preventive work with children prone to dyslexia. Rewards for achievements and the absence of penalties for failure help to focus the attention of such children on clear goals without fear of taking the wrong step. This contributes to an increase in motivation and the realization of an individual approach in working with them, taking into account their peculiarities, possibilities, and the pace of educational activity in the class. The use of digital technologies and games makes speech therapy classes more adapted to the interests of the child, facilitating their involvement in the game. They are excellent tools that can diversify the ways of speech therapy impact on the child. Due to their interactivity, they can be used by participants in the pedagogical process regardless of space-time interference. For example, a speech therapist can provide assistance remotely in cases where this form of interaction is justified, especially when interacting with children living in geographically remote and inaccessible educational institutions in rural areas.

However, there are some downsides to consider when using gamification. First, there is the risk of prolonged computer use in a static position, which can lead to visual impairment, blood circulation disorders, and congestion in the child. To prevent such consequences, time limits for computer use during speech therapy classes should be established. The position of the preschooler's body when working at a computer should also be monitored by the speech therapist or parents. Second, a low-speed internet connection and a lack of proper equipment can make it impossible to carry out high-quality gamification using digital games. Care should be taken to ensure access to the internet and minimum system requirements for technical equipment. Finally, the process of preparing remedial classes using digital games requires a sufficient level of digital competence from the speech therapist. Therefore, there is a need to

enhance it by attending refresher courses, participating in webinars, seminars, workshops on educational platforms, etc.

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The proposed work of using gamification in the prevention of dyslexia in older preschool children should be perceived as the beginning of work in this direction. We acknowledge that the disadvantages discovered in the process can in some way complicate the implementation of our conclusions. Firstly, it is difficult to affirm the positive impact of gamification, as realized through the presented digital games, on the development of functions and operations that form the basis of reading in older preschool children, since the research did not include empirical data to confirm or refute this. Therefore, there is a need to conduct a pedagogical experiment to obtain such data. Secondly, it is promising to create a comprehensive system of digital games in the future, focusing on a larger number of platforms with gamification elements. This will contribute to verifying the effectiveness of using such platforms in remote and face-to-face formats for providing correctional and developmental assistance to the specified category of persons.

We believe that the proposed results can be useful in solving the problem of preventing dyslexia in preschool children and further researching the possibilities of gamification in this process. Some of the results can serve as a guide for developing digital games for propaedeutic purposes in working with children prone to dyslexia for speech therapists, special education teachers, as well as for teachers in higher education institutions, practitioners, and researchers in the fields of special education.

ACKNOWLEDGMENT

We would like to express our gratitude to the Armed Forces of Ukraine for ensuring the safety necessary to conduct this research. This work was made possible solely due to the perseverance and courage of the Ukrainian army.

REFERENCES (TRANSLATED AND TRANSLITERATED)

[1] M. Rauschenberger, S. Füchsel, L. Rello, C. Bayarri, and J. Thomaschewski, “Exercises for German-Speaking Children with Dyslexia”, in *Human-Computer Interaction – INTERACT 2015*, Lecture Notes in Computer Science, 2015, vol. 9296. https://doi.org/10.1007/978-3-319-22701-6_33. (in English)

[2] O. Ozernov-Palchik, and N. Gaab, “Tackling the «dyslexia paradox»: reading brain and behavior for early markers of developmental dyslexia”, *Wiley interdisciplinary reviews. Cognitive science*, vol. 7, issue 2, pp.156–176, 2016. https://doi.org/10.1002/wcs.1383. (in English)

[3] R. Bui, “Game Teaching Method in Preschool Education Based on Big Data Technology”, *Scientific Programming*, 4751263, 2021. https://doi.org/10.1155/2021/4751263. (in English)

[4] M. F. Rice, “Special Education Teachers’ Use of Technologies During the COVID-19 Era (Spring 2020-Fall 2021)”, *TechTrends*, Vol. 66, pp. 310-326, 2022. https://doi.org/10.1007/s11528-022-00700-5. (in English)

[5] J. Lämsä, R. Hämäläinen, M. Aro, R. Koskimaa, and S.-M. Äyrämö, “Games for enhancing basic reading and maths skills: A systematic review of educational game design in supporting learning by people with learning disabilities”, *British Journal of Educational Technology*, vol. 49, issue 4, pp. 596-607, 2018. https://doi.org/10.1111/bjet.12639. (in English)

[6] P. Dymora, and K. Niemiec, “Gamification as a Supportive Tool for School Children with Dyslexia”, *Informatics*, vol.6, issue 4, pp. 48, 2019. https://doi.org/10.3390/informatics6040048. (in English)

[7] I. Neitzel, “Gamification als Motivator in der Sprachtherapie bei Menschen mit intellektueller Beeinträchtigung: Ein Praxisbeitrag”, in *Spektrum Patholinguistik 14*, Eds. T. Fritzsche, S. Breitenstein, H. Wunderlich, L. Ferchland, Potsdam, Universitätsverlag Potsdam, pp. 109-116, 2021. https://doi.org/10.25932/publishup-51038. (in German)

[8] M. R. Saputra, "LexiPal: Design, Implementation and Evaluation of Gamification on Learning Application for Dyslexia", *International Journal of Computer Applications,* vol. 131, No.7, pp. 37-43, 2015. 10.5120/ijca2015907416. (in English)
[9] S. Saeedi, H. Bouraghi, M. S. Seifpanahi, and M. Ghazisaeedi, "Application of Digital Games for Speech Therapy in Children: A Systematic Review of Features and Challenges", *Journal of healthcare engineering,* 4814945, 2022, https://doi.org/10.1155/2022/4814945. (in English)
[10] O. Gaggi, et al., "Serious Games for Early Identification of Developmental Dyslexia", *Computers in Entertainment,* vol. 15, issue 2, pp. 1–24, 2014. https://doi.org/10.1145/2629558. (in English)
[11] F. A. Nieto-Escamez, and M. D. Roldán-Tapia, "Gamification as Online Teaching Strategy During COVID-19: A Mini-Review", *Frontiers in psychology*, vol. 12, 648552. https://doi.org/10.3389/fpsyg.2021.648552. (in English)
[12] E. Sudarmilah, and A. Arbain, "Using Gamification to Stimulate the Cognitive Ability of Preschoolers", *International Journal of Innovative Technology and Exploring Engineering*, vol. 8, issue 6, pp.1250-1256, 2019. (in English)
[13] Q. Zhang, L. Yu, and Zh. Yu, "A Content Analysis and Meta-Analysis on the Effects of Classcraft on Gamification Learning Experiences in terms of Learning Achievement and Motivation", *Education Research International*, pp. 1–21, 2021. https://doi.org/10.1155/2021/9429112. (in English)
[14] O. Yaroshenko, L. Kokorina, I. Shymanovych, N. Naumovska, N. Shchaslyva, and N. Serdiuk, "The Modern Principles of Gamification in the Teaching of English as a Foreign Language", *Revista Romaneasca Pentru Educatie Multidimensionala*, vol. 14 (1Sup1), pp. 437-452, 2022. https://doi.org/10.18662/rrem/14.1Sup1/560. (in English)
[15] A. Zourmpakis, S. Papadakis, and M. Kalogiannakis, "Education of preschool and elementary teachers on the use of adaptive gamification in science education", *International Journal of Technology Enhanced Learning*, vol. 14, issue 1, pp. 1-16, 2022. 10.1504/IJTEL.2022.120556. (in English)
[16] M. Behnamghader, A. Khaleghi, P. Izadpanah, and F. Rahmani, "Using Gamification Based on Mobile Platform in Therapeutic Interventions for Children with Dyslexia", in *Internet of Things, Infrastructures and Mobile Applications*, Springer, Cham, vol. 1192, 2021. https://doi.org/10.1007/978-3-030-49932-7_76. (in English)
[17] S. Bertoni, S. Franceschini, G. Puccio, M. Mancarella, S. Gori, and A. Facoetti, "Action Video Games Enhance Attentional Control and Phonological Decoding in Children with Developmental Dyslexia", *Brain Sciences*, vol. 11, pp. 171-189, 2021.
[18] S. Franceschini, S. Gori, M. Ruffino, S. Viola, M. Massimo, and A. Facoetti, "Action Video Games Make Dyslexic Children Read Better", *Current biology* : CB, vol. 23, no. 6, pp. 462-466, 2013. doi: 10.1016/j.cub.2013.01.044. (in English)
[19] S. Franceschini, P. Trevisan, L. Ronconi, and S. Bertoni, "Action video games improve reading abilities and visual-to-auditory attentional shifting in English-speaking children with dyslexia", *Scientific Reports*. no. 7, pp.1-11, 2017. doi: 10.1038/s41598-017-05826-8. (in English)
[20] C. Green, R. Li, and D. Bavelier, "Perceptual learning during action video game playing", *Topics in Cognitive Science*, vol. 2, pp. 202-216, 2010. (in English)
[21] H. Lyytinen, M. Ronimus, A. Alanko, A.-M. Poikkeus, and M. Taanila, "Early identification of dyslexia and the use of computer game-based practice to support reading acquisition", *Nordic Psychology,* vol. 59, issue 2, pp. 109-126, 2007 https://doi.org/10.1027/1901-2276.59.2.109. (in English)
[22] A. Eichenbaum, D. Bavelier, and C. Green, "Video games: Play that can do serious good", *American Journal of Play*, No 7, pp. 50-72, 2014. (in English)
[23] O. B. Kachurovska, "Speech development correction of younger schoolchildren with serious speech defects by means of computer technologies": abstract of the candidate's dissertation of the Candidate of Pedagogical Sciences, National Pedagogical University named after M. P. Drahomanov, Kyiv, 2006. (in Ukrainian)
[24] Y. Kosenko, O. Boryak, and O. Korol, "Computer didactic games for teaching history to pupils with intellectual disabilities in conditions of inclusive education", *Information Technologies and Learning Tools*, vol. 77, no. 3, pp. 76-89, 2020. https://doi.org/10.33407/itlt.v77i3.2837. (in Ukrainian)
[25] P. A. Leshchenko, "Computer games as a means of teaching children with special needs" in Modern ICT tools to support inclusive education: a textbook, Yu. G. Nosenko, Poltava: PUET, 2018. pp. 128-151. (in Ukrainian)
[26] M. Hersh, "Evaluation framework for ICT-based learning technologies for disabled people", *Computers & Education,* vol. 78, issue 2, pp. 30–47, 2014. https://doi.org/10.1016/j.compedu.2014.05.001. (in English)
[27] N. L. Saine, M. K. Lerkkanen, T. Ahonen, A. Tolvanen, and H. Lyytinen, "Computer-assisted remedial reading intervention for school beginners at risk for reading disability", *Child development,* vol. 82, issue 3, pp. 1013–1028, 2011. https://doi.org/10.1111/j.1467-8624.2011.01580.x. (in English)
[28] A. Mytsyk, and M. Pryshliak, "Telepractice in the System of Providing Correctional and Developmental Services to Children with Speech Disorders: Interaction at a Distance", *Journal of History Culture and Art Research*, vol. 9, no. 3, pp. 94–105, 2020. https://doi.org/10.7596/taksad.v9i3.2674. (in English)

[29] K. Werbach, and D. Hunter, *For the Win: How Game Thinking Can Revolutionize Your Business*. Wharton Digital Press. 2012. (in English)
[30] Yu. V. Ribtsun, *I'm learning to talk. Speech therapy album (for children 3-6 years).* Kyiv: Genesis. 2019. (in Ukrainian)

Text of the article was accepted by Editorial Team 02.05.2023

ВИКОРИСТАННЯ ГЕЙМІФІКАЦІЇ В ПОПЕРЕДЖЕННІ ДИСЛЕКСІЇ У ДІТЕЙ СТАРШОГО ДОШКІЛЬНОГО ВІКУ

Ганна Мицик
кандидат педагогічних наук, доцент, доцентка кафедри прикладної психології та логопедії
Бердянський державний педагогічний університет, м. Бердянськ, Україна
ORCID ID 0000-0002-4989-416X
kolibri07s@ukr.net

Альона Бабіченко
асистентка кафедри прикладної психології та логопедії,
Бердянський державний педагогічний університет, м. Бердянськ, Україна
ORCID ID 0000-0001-9843-9844
alenababicenko2213@gmail.com

Анотація. У поданій статті аналізується практика, що склалась у використанні гейміфікації в системі організації профілактичної роботи з дітьми, схильними до дислексії. Визначені причини, що спричиняють появу дислексії. Акцентовано на необхідності своєчасного виявлення дітей групи ризику та наданні їм корекційно-розвиткової допомоги з метою уникнення негативних психосоціальних наслідків у майбутньому під час навчання в закладі освіти. Узагальнено основні здобутки вчених у цій царині. Висвітлені переваги використання в пропедевтичних цілях окремих елементів гейміфікації у роботі з дітьми, схильними до дислексії, подано опис цих елементів. Запропоновано алгоритм створення ігрового механізму, критерії добору цифрових навчальних платформ та розробки ігор на їх основі. Зважившись на різноманіття доступних мобільних додатків та платформ, які сприяють реалізації пропедевтичних та корекційних цілей у роботі з дітьми, які мають порушення мовлення, констатовано, що вони не позбавлені певних недоліків. З огляду на це розглянуто основні підходи до розробки власних цифрових ігор на гейміфікованих платформах з можливістю зміни їх змісту та завдань у такий спосіб, щоб ті сприяли реалізації мети корекційно-розвиткової роботи з дітьми, схильними до дислексії. У якості прикладу запропоновано декілька варіантів таких ігор. Виявлені чинники, що можуть перешкоджати досягненню позитивного ефекту застосування цифрових ігор вчителем-логопедом на занятті. Здійснено пошук шляхів їх вирішення. Вказано на перспективність використання цифрових ігор при наданні дистанційної корекційно-розвиткової допомоги таким дітям в умовах значних територіальних відстаней. Наголошено на необхідності достатнього рівня сформованості цифрової компетентності вчителів-логопедів як запоруки методично правильної розробки та впровадження цифрових ігор в їх роботу з дітьми.

Ключові слова: гейміфікація; дислексія; профілактична робота; діти старшого дошкільного віку; цифрові технології; цифрові ігри.