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DEVELOPMENT OF AN INTERACTIVE WEBSITE WITH DIDACTIC GAMES TO ENHANCE VOCABULARY IN YOUNG STUDENTS WITH INTELLECTUAL DISABILITIES

Abstract. The article investigates the development of a website that includes interactive didactic games designed to improve the vocabulary of primary schoolchildren with intellectual disabilities. It describes the importance of developing vocabulary in children with intellectual disabilities and shows how the game approach can be an effective tool for teaching and developing speech in this category of children. The process of developing a website with didactic games is considered, which includes the selection of appropriate software, interface design, development of interactive tasks and games, as well as testing and improvement of the website. In particular, the article discusses methods and approaches to creating games aimed at developing lexical skills, expanding vocabulary and improving communication skills in children with intellectual disabilities. The advantages of using interactive didactic games in the educational process of junior schoolchildren with intellectual disabilities are highlighted. They stimulate children's interest in learning words and expanding their vocabulary, develop cognitive and speech skills, improve memory and concentration, and increase motivation and enjoyment of learning. A game-based approach can keep children interested, motivated, and effective, helping them to develop their language skills and achieve greater academic success. The website was created on the wix platform. The collection of didactic games was developed on the LearningApps platform. There are various types of tasks, for example quizzes, puzzles, crosswords, matching exercises, etc. Images for didactic games were generated by playground.ai artificial intelligence, which opens up new opportunities for creating visually appealing games and tasks. The importance of developing website with interactive didactic games for the development of vocabulary of younger students with intellectual disabilities is emphasized, they can become an effective tool for teaching and developing speech in children of this category, contributing to their success in learning and overall development.

Keywords: interactive didactic games; vocabulary; younger students with intellectual disabilities.

1. INTRODUCTION

Younger students with intellectual disabilities have an underdeveloped vocabulary. The vocabulary of these students is much poorer than that of students without special educational needs. There is the key difference between the volume of passive and active vocabulary: the active vocabulary of these children is much smaller than the passive one. The speech of primary school children consists mainly of nouns and everyday verbs. Adjectives, adverbs, and conjunctions are rare. There is an inaccuracy in the use of the simplest words, a lack of differentiation in the designation of similar objects. Pupils with intellectual disabilities use only a small number of words denoting the characteristics of an object, naming the main colors (red, blue, green), the size of objects (large - small), taste (sweet - bitter). Antonymic relations, such as "long - short", "thick - thin", are used very rarely. This is primarily due to the difficulty of differentiating the very ideas about the qualities and characteristics of objects [1].

One of the means of developing vocabulary and speech in general is a didactic game. The effectiveness of didactic games largely depends on their systematic and purposeful use in combination with didactic exercises. At the same time, didactic games are used in parallel with the main content of education for younger students with intellectual disabilities, helping to activate the learning process, to master the elements of learning. Thus, it is necessary to use different types of didactic games for the development of descriptive vocabulary of younger students.

The use of gaming technologies in the educational process ensures the development of cognitive abilities, the formation of experience of active interaction, cooperation of students, using the significant correctional and developmental potential of didactic games and exercises. Interactive technologies expand students' cognitive capabilities in obtaining, analyzing and applying information from various sources, and help transfer the acquired skills to various spheres of their life [2].

A number of studies [3], [4] confirm the effectiveness of using game-based methods to develop vocabulary in children with intellectual disabilities. Games make the learning process interesting and exciting, which in turn contributes to better learning of new material.

[3] argue that interactive learning has become widespread and is now a necessity in modern society. It is considered an important tool that should be considered in both formal and informal learning contexts. They also emphasize that interactive learning can have a positive impact on the learning and motivation of younger students with intellectual disabilities by expanding the learning space, promoting collaboration, and improving engagement with the content of the subject matter. They also noted that research generally shows that computer games contribute to students' enjoyment of learning. They also argue that research has demonstrated positive effects on student learning outcomes and motivation through the use of computer-based didactic games.

[4] analyzed research on game-based learning for students with disabilities. The content analysis of 96 studies provided relevant information on each component of the activity: subject (students with disabilities), technology (game-based curriculum), object (target skills or behaviors), rules (implementation procedure and performance indicators), community (students with disabilities, special education professionals, and parents), division of labor (between students, professionals, and parents), and outcome (performance of target skills or behaviors). The study revealed a lack of parental involvement, difficulties in standardizing performance indicators due to the heterogeneity of student profiles, and contradictions (e.g., opposing expert opinions on the role of educational games in social interactions).

[5] investigated the use of information and communication technologies (ICT) and their variability in teaching children with special educational needs (SEN). The author has developed a computer program "Mobile and computer software and pedagogical tool "Movlyanka" (software and pedagogical tool "Movlyanka") for the development of the speech sphere in children with special educational needs (SEN) of preschool age who have mental retardation

(retardation of mental development), autism spectrum disorders (ASD), severe speech disorders (SSD) and intellectual disabilities. The methodology includes: substantiation of the requirements for the introduction of a computer in the practice of teaching children with SEN of preschool age, directions of using the Movlyanka software in preschool education institutions, inclusive resource centers, and educational and rehabilitation centers. Characterization of modern software and pedagogical tools for speech development for children aged 4-7 years and research on their application in practice. Recommendations and requirements for the creation of a software and pedagogical tool. The use of a computer for the development of the speech sphere of children with SEN of 4, 5, 6 and 7 years of life. Organization of correctional work of children in a computer-game complex.

Against the background of the issues highlighted above, this article proposes a methodology for developing a website with a complete set of stages, actions, models, tools, and methods for developing a website. It discusses the process of developing a website for the development of descriptive vocabulary for young students with intellectual disabilities using a systematic approach. This study provides guidance through evolutionary prototyping for the design, development, and evaluation of the website. The choice of this website development methodology is crucial because using an appropriate software methodology reduces the likelihood of software failure according to previous research.

The purpose of the study. To develop a website featuring the author's interactive didactic games aimed at enhancing the vocabulary of younger students with intellectual disabilities.

LITERATURE REVIEW

Teaching students with intellectual disabilities requires some reference points:

- positive emotional support;
- multisensory approach;
- use of technology;
- developmentof all cognitive processes [6].

[7] argue that although the introduction of digital tablets in schools has become widespread, researchers repeatedly point to the lack of evidence-based program development needed to support the multitude of available curricula. This lack is a result of the absence of educational researchers who are engaged in the development, design, and implementation of tablet apps in the classroom. They argue that researchers, educators, and developers need to collaborate and adopt appropriate methodologies to radically improve the design of apps used by students for learning. This implies the need for an appropriate methodology to develop a quality website. In developing website, a deep understanding of the subject matter is required, making requirements development a key step.

Motivation and interest are important for the continuous learning of children with intellectual disabilities. In this study, a game-based cognitive training program was proposed to motivate and induce interest, and its effectiveness was compared to that of a conventional cognitive training program through an analysis after both programs were implemented by occupational therapists. The results of the pre-and post-tests of the game-based cognitive training program were statistically significant and showed an advantage over the conventional program. Thus, it was determined that the game-based cognitive training program developed in this study using digital media would be effective in improving cognitive learning ability [8].

[9] proved that computer-based learning is the most effective teaching method for children with disabilities in terms of conceptual learning, academic achievement, and skill development. The main contribution of [9] is to determine the perception of specialists and the possibility of using digital games in educational institutions for children with intellectual

disabilities. The paper highlights how to use digital games in education. In addition, this paper conducts a case study using a closed-ended questionnaire with special educators working with children with intellectual disabilities. According to this case study analysis, the quantitative analysis shows that correctional educators have a strong need to use digital games to optimize learning for children with intellectual disabilities and promote digital inclusion. Digital game-based learning can be more beneficial for students with intellectual disabilities.

Positive outcomes can be achieved through game-based learning, but children with physical disabilities have fewer opportunities to participate in enjoyable physical activity. Since intelligent serious games can provide personalized learning opportunities, motivate the learner, teach 21st-century skills, and create an environment for authentic and relevant assessment, they can be used to help children and adolescents with various types of learning disabilities develop social and cognitive abilities [10].

[11] introduced the LudoMinga platform, with educational games designed to facilitate the learning process of students with intellectual disabilities. The platform is focused on providing an inclusive and accessible learning environment. Serious Games combines educational content with video game mechanics, and the platform aims to enhance the learning experience and promote active participation. Through an iterative development process, including user feedback and evaluation, the platform was developed using the iPlus methodology to align it with the specific requirements of the target audience. Preliminary user testing results indicate positive results in terms of user engagement, learning, and satisfaction. This accessible platform based on educational games promises to improve educational opportunities and outcomes for students with intellectual disabilities, ultimately contributing to their personal and cognitive development. The success of the LudoMinga platform lies in the combination of interactive games, personalized support, and accessibility features, which ultimately create an engaging and effective learning environment. Continued progress in this area has the potential to remove barriers for people with intellectual disabilities, promoting their growth, independence, and active participation in society.

2. METHODOLOGY

An appropriate website development methodology is crucial as a guide for the implementation of any software project [12]. Determining the methodology is the key to website development [13]. Based on the review, it was concluded that the WIX platform is considered the best for website development.

Evolutionary prototyping is a type of Agile model that was applied in the development of the website. Figure 1 illustrates a diagram of the evolutionary prototyping methodology, while Table 1 shows the phases of this methodology, along with the activities within each phase and the artifacts involved, such as documentation and deliverables from an early working system model.

At the analysis stage, we studied scientific articles and research on the topic of didactic games for vocabulary development in younger students with intellectual disabilities, searched for information on effective methods and techniques used in such games, and analyzed existing didactic games for compliance with the needs of the target audience.

The next step was to write a set of didactic games. The concepts of didactic games were developed based on the results of the literature analysis, defining the purpose, tasks, and rules for each game and creating scenarios with a clear description of game actions and stages. The complex of didactic games for the development of a descriptive vocabulary of younger students with intellectual disabilities is an important tool that helps to overcome difficulties in the speech development of this special group of children. The use of games helps to increase motivation, interest, and positive attitude to learning, as well as to develop confident and effective

communication in younger students with intellectual disabilities. The complex is currently being submitted for publication.

The study found that artificial intelligence can create realistic images, helping children with intellectual disabilities to better understand and memorize new words. The platform "AI generator" was chosen to generate images. The use of artificial intelligence for generating images also helps to individualize and adapt games to the needs of each child. Images can be created with the age, interests, and needs of each child in mind, which improves the effectiveness of learning and engagement of children in the process.

The collection of didactic games was developed on the LearningApps platform. The platform offers a wide range of templates for different types of didactic games, such as quizzes, puzzles, crosswords, matching exercises, etc. You can easily edit the templates by adding your content, images, sounds, and videos.

The website was created on the Wix platform. A user-friendly and intuitive interface for the website with didactic games has been developed. Work continues to ensure the accessibility and adaptability of the interface for different devices. Wix has a user-friendly interface that makes it accessible to users without programming experience. It offers a wide range of templates for different types of websites, including those with games. You can easily edit the templates by adding your content, images, sounds, and videos. Wix offers hosting for your website, making it accessible to users without their server.

Conducting a survey and testing the website with didactic games with the participation of the target audience. The main page of the website has a link to the survey via Google Forms.

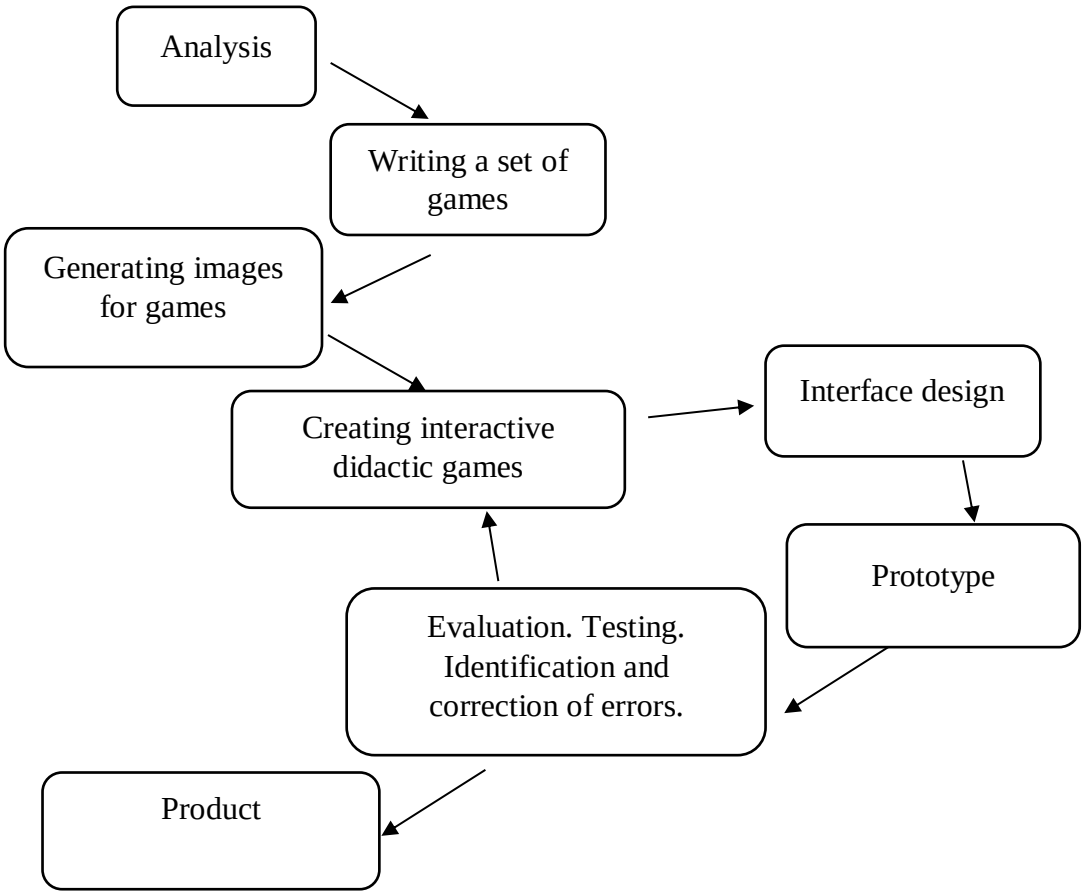

Figure 1. Methodology for creating a website with didactic games

Table 1

Details of the prototyping methodology

Stage	Activities.	Technique/models /tools	The result.
1	Literature analysis	Literary sources: Web of science, Scopus	Literature analysis of schoolchildren with IE
2	Writing a set of games	Tools: Word	A set of didactic games
3	Image generation	Tools: Playground.ai, Dream.AI	Realistic images for games
4	Interface design	Tools: Wix	Layout of the user interface
5	Creating interactive didactic games	Tools: Learningapps	Collection of didactic games for vocabulary development
6	Creating a draft version of the website	Tools: Wix	Prototype of the website
7	Evaluation. Testing. Detection of errors.	Techniques: surveys, testing Platform: Google form	Comments and suggestions from the client
8	Product.		A website with didactic games for younger students with intellectual disabilities

Requirements analysis

Requirements analysis is the first and the most important stage of website development, regardless of which builder the developer chooses. Two important activities at this stage are requirements gathering and requirements modeling. Numerous requirements-gathering methods can be used to identify user requirements. The purpose of requirements gathering is to understand the problem that arises from the needs of stakeholders and translate it into requirements to define and develop a suitable solution. After the requirements gathering phase is completed, all requirements must be analyzed through modeling. Requirements analysis is the process of determining user expectations for a new software or information system.

Software developers can use a variety of discovery methods to obtain relevant information to define requirements. In this study, methods such as surveys and interviews were used. The survey was conducted through Google Forms. Children, parents, and teachers participated in the survey.

When creating the website, we were guided by the principles of organizing the educational process that ensures the development of speech and communication skills and the formation of the basics of computer literacy in younger students:

- the principle of visibility (the interface should be visually appealing, with clear and understandable icons and icons, and the use of multimedia makes the learning process more interesting and effective);
- the principle of accessibility (the interface should be simple and intuitive to minimize the need for instructions, tasks should be formulated and appropriate for the age of children);

- the principle of an individual approach (the system should take into account different levels of training and learning styles of children, the ability to adapt tasks, and the interface to individual needs makes learning more effective);
- systematic and consistent (logical order - learning new material is based on what was learned earlier);
- developmental learning (in the process of learning, in addition to acquiring knowledge, a child develops skills, cognitive, mental, volitional and emotional processes, and personality development; during speech and communication development, a child acquires knowledge and improves its quality);
- consciousness and activity in the acquisition and application of knowledge (organization of the educational process at a level where the activity of the teacher and each child is best combined);
- humanization of the pedagogical process (personality-oriented model of education and training).

Compliance of the computer program with the requirements. The website is designed in the state language, the tasks are understandable and interesting for students, evoke positive emotions, activate the cognitive and mental activity of younger students, make them want to learn to work independently, meet the age and psychophysiological characteristics of children, develop the child's creative abilities, are educational and controlling in nature, have a gradual transition from simple to complex, display the optimal amount of information on the screen, and are easy to use.

Brightness, image animation, and voiceover help develop involuntary attention and memorization of learning material.

Design

Figures 2-4 show some of the interfaces of the developed website. The main goal of user interface design is to create a user-friendly design that is easy to learn and use. The development of this design was based on the eight golden rules of interface design [14]. These include: striving for consistency, finding universal use, offering informative feedback, making it easy to undo actions, keeping users in control, and reducing the load on short-term memory. The main user interface is shown in Figure 2.

The website contains a home page with a greeting, information about the author, links to surveys through Google Forms, and links to articles about didactic games. The page with didactic games contains games according to the following vocabulary topics for speech development: people, clothes, animals, seasons, vegetables, fruits, berries, transport, trees, flowers, bushes, teaching aids, household appliances, and furniture.

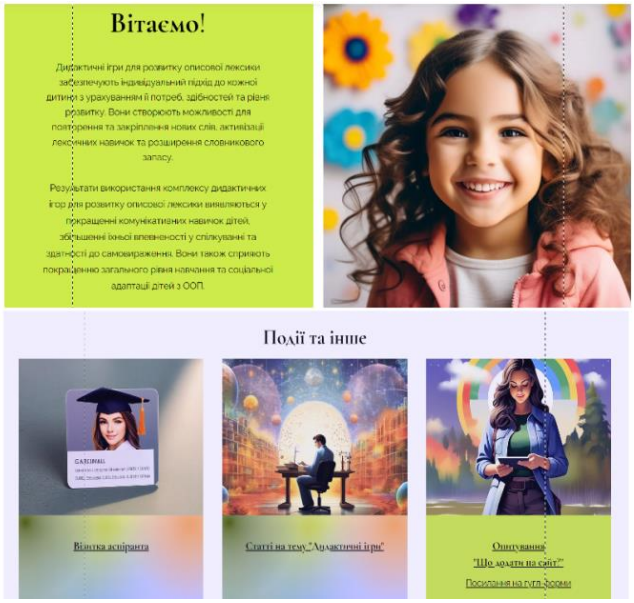

Figure 2. Home page of the website *with didactic games*

Figure 3. Examples of games on the website

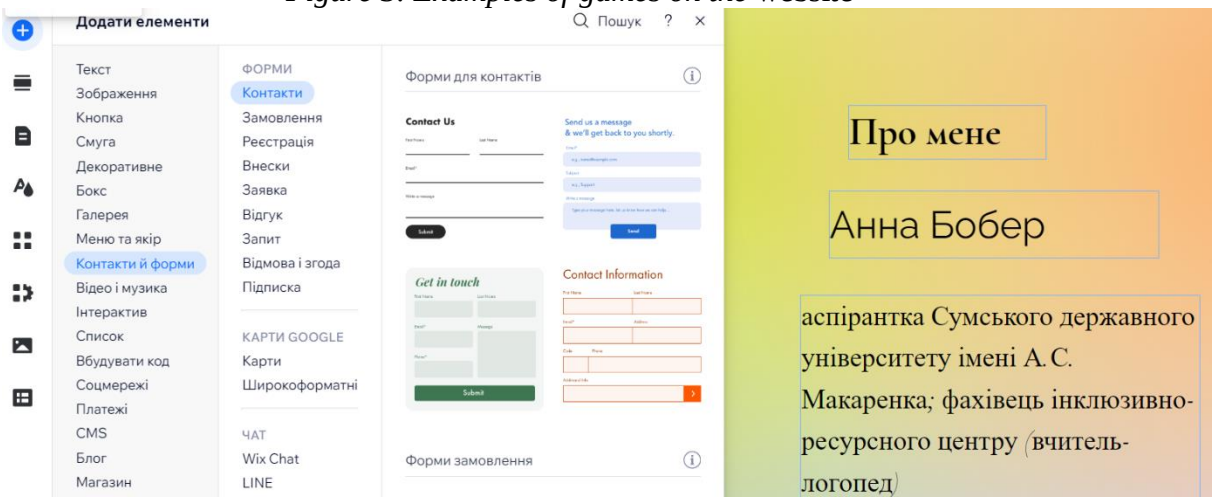

Figure 4. WIX environment for developing a website for didactic games

Table 2

Types of tasks and their description

Type	Description
Find a match	Find pairwise matches for the given texts, images, audio
Classification	The teacher sets 2-4 groups to which the listed items should be assigned. The screen is divided into parts according to the defined groups, and the student needs to drag multimedia objects to the appropriate areas of the screen
Numerical line	You need to arrange the images in chronological order
Image fragments	The background image contains markers that you can select text, images, audio, and video clips to match. The markers can have different colors.
Quiz	It can be used to assess children with special educational needs. You must select the correct answer
Puzzle	Several groups of concepts are placed around the perimeter of the workspace. After selecting a particular group, you need to click on all the images that belong to it. Each correctly named term opens a part of the main image
Dividing into groups	The teacher indicates several categories into which you should categorize the objects that appear on the screen
Table of correspondences	A table is created with defined row and/or column headings. You drag the items listed at the top of the screen into the cells of this table. You can set up an arbitrary order of row or column elements
Horse racing	This type of task allows learners to move from one question to the next while answering questions or completing tasks. If you choose the right answer, the horse moves closer to the finish line, if you make a mistake, it stays where it is, and the first one to arrive wins. You can play alone or with friends.

3. EVALUATION RESULT

The evaluation of the developed website was conducted mainly to assess whether the website meets the requirements of users. Functionality refers to the task that the website should support as an assessment tool in teaching and learning. The functionality of a program plays an important role in user evaluation. Functional testing should check whether each component of the website works properly.

A qualitative study was conducted with 50 teachers (speech therapists, teachers of inclusive education classes, assistants, teachers of special schools, special classes) who teach the subject in primary schools and 50 parents of children with SEN to obtain feedback, identify strengths and weaknesses of the prototype and make improvements in the next stage, improving the prototype. Comments and suggestions from respondents were collected.

Children:

86% found the games interesting and exciting.

84% said they would like to play these games again.

81% would recommend these games to their friends.

Parents:

90% consider these games useful for their children.

88% said that these games help their children learn.

85% would recommend these games to other parents.

Teachers:

91% consider these games useful for the learning process.

93% plan to use these games in their classes.

90% recommend these games to other teachers.

Recommendations for expanding the website with didactic games.

Sections:

Forum/chat. Creating a space for communication and exchange of experience between website users: parents, teachers, and children.

Blog. Publication of articles, tips, and recommendations on the use of didactic games in teaching and development of children.

Video library. Educational videos and recordings of lessons with didactic games.

Functionality.

Personalization. The ability for users to create profiles, build game collections, track progress, and receive personalized recommendations.

Social features. Share games, comments, scores, and compete with friends.

Search system: Search for games by topic, age, difficulty, skills, and other criteria.

Download option: Download games for offline use.

Section for teachers.

Methodological recommendations for using didactic games in the classroom.

Lesson plans with didactic games.

Presentations for lessons using didactic games.

Section for parents.

Information about didactic games and their importance for children's development.

Tips for using didactic games with children of different ages.

Examples of didactic games you can make with your own hands.

Finalizing the prototype and deployment

At the stage of finalizing the prototype, all shortcomings and errors were corrected. In addition, all comments and suggestions for improving the functional aspects of the website were taken into account.

The improvement cycle continues until all stakeholders are satisfied with all the features the website offers. This stage is not complete until all the requirements specified by the user are fulfilled. When the user is satisfied with the developed prototype, the final system is expanded to the final version of the system based on the approved final prototype.

4. CONCLUSION

This article presents the development of a website with the author's interactive didactic games for the development of vocabulary of younger students with intellectual disabilities.

The website is designed with the principles of visibility, accessibility, individual approach, systematic and consistent learning, developmental learning, awareness and activity in the acquisition and application of knowledge, and humanization of the pedagogical process in mind.

The website contains a collection of didactic games that meet the age-specific characteristics and psychophysiological needs of children with intellectual disabilities. The games stimulate children's interest in learning words and expanding their vocabulary, develop cognitive and speech skills, improve memory and concentration, and increase motivation and enjoyment of learning.

Benefits of using the website. Stimulates children's interest in learning words and expanding their vocabulary. It develops cognitive and speech skills. Helps improve memory and concentration. Increases motivation and enjoyment of learning. The game-based approach used on the website makes the learning process fun and engaging. This contributes to better

learning of new material. Students can quickly and conveniently use learning resources anytime and anywhere. The development of descriptive vocabulary using the website is interactive and fun, as it offers many approaches to completing tasks rather than answering questions with a notebook. It was created in accordance with the correctional and developmental curriculum "Speech Development" and certain educational requirements.

The use of artificial intelligence to generate images made the games more interesting and attractive to children. Images were generated based on the age, interests, and needs of each child, which improves the effectiveness of learning and engagement of children in the process.

The results of the website's evaluation by teachers and parents of children with intellectual disabilities demonstrate that the website is a useful and effective tool for developing the vocabulary of younger students with intellectual disabilities.

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РОЗРОБЛЕННЯ САЙТУ З ІНТЕРАКТИВНИМИ ДИДАКТИЧНИМИ ІГРАМИ ДЛЯ РОЗВИТКУ СЛОВНИКОВОГО ЗАПАСУ МОЛОДШИХ ШКОЛЯРІВ З ІНТЕЛЕКТУАЛЬНИМИ ПОРУШЕННЯМИ

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Анотація. Стаття присвячена розробці сайту з авторськими інтерактивними дидактичними іграми для розвитку словника молодших школярів з інтелектуальними порушеннями. Вона описує важливість розвитку словникового запасу у дітей з інтелектуальними порушеннями, у ній показано, як ігровий підхід може стати ефективним інструментом для навчання цієї категорії дітей та розвитку їх мовлення. Розглянуто процес розробки сайту з дидактичними іграми, у якому передбачено вибір відповідного програмного забезпечення, проєктування інтерфейсу, розробку інтерактивних завдань та ігор, а також тестування та вдосконалення сайту. Зокрема розглядаються методики та підходи до створення ігор, спрямованих на розвиток лексичних навичок, розширення словникового запасу та покращення комунікативних здібностей у дітей з інтелектуальними порушеннями. Висвітлено переваги використання інтерактивних дидактичних ігор у навчальному процесі молодших школярів з інтелектуальними порушеннями. Вони стимулюють інтерес дітей до вивчення слів та розширення словникового запасу, розвивають когнітивні та мовленнєві навички, сприяють покращенню пам'яті та концентрації уваги, а також підвищують мотивацію та задоволення від навчання. Ігровий підхід може забезпечити зацікавленість, мотивацію та ефективність навчання, що допоможе дітям розвивати їхні мовленнєві навички та досягати більшого успіху в навчанні. Сайт створено на платформі wix. Колекцію дидактичних ігор розроблено на платформі LearningApps. Є різноманітні типи завдань, наприклад, перетягування, множинний вибір, нумерація, правильно та неправильно, відповідність та головоломка. Зображення для дидактичних ігор були згенеровані штучним інтелектом, який відкриває нові можливості для створення візуально привабливих ігор та завдань. Підкреслено значущість розробки сайтів з інтерактивними дидактичними іграми для розвитку словника молодших школярів з інтелектуальними порушеннями. Вони можуть стати ефективним інструментом для навчання та розвитку мовлення у дітей цієї категорії, сприяючи їхньому успіху в навчанні та загальному розвитку.

Ключові слова: дидактичні ігри; словник; молодші школярі з інтелектуальними порушеннями.