



ВЕСТНИК РОССИЙСКОГО УНИВЕРСИТЕТА ДРУЖБЫ НАРОДОВ. СЕРИЯ: ИНФОРМАТИЗАЦИЯ ОБРАЗОВАНИЯ

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The journal scope covers the whole spectrum of EdTech landscape, including curriculum development and course design, digital educational environment, distance, blended and flipped learning, digital technology for inclusion, ICTs and personalized learning for students and high-school children.

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- educational electronic editions and resources;
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СОДЕРЖАНИЕ

РАЗРАБОТКА УЧЕБНЫХ ПРОГРАММ И ЭЛЕКТРОННЫХ РЕСУРСОВ

Mozheikina L.V., Emelyanov P.G. Mobile applications for diagnostics, development, and alternative communication for children with language disorders (Мобильные приложения для диагностики, развития и альтернативной коммуникации для детей с общим недоразвитием речи) 69

Lvova O.V. Application of situative vocabulary and linguistic quasi-corpus for language acquisition (Использование ситуативного вокабуляра и лингвистического квазикорпуса для изучения языка) 90

Nikonorova E.I. Professional development e-course on how to integrate interdisciplinary approach into the learning process in schools that practise multimodality and use interactive educational online services (Разработка курса профессионального развития по реализации междисциплинарного подхода в школах с использованием интерактивных онлайн-сервисов, обеспечивающих развитие мультимодальности в образовательном процессе) 97

ПЕДАГОГИКА И ДИДАКТИКА ИНФОРМАТИЗАЦИИ

Векуа Н.Н., Мамаева Е.А. Использование флэш-карт как средства развития вербальной креативности студентов 108

Shamkut V.L. Application of information technologies as a significant factor in the formation of conceptual thinking of schoolchildren (Применение информационных технологий как значимый фактор формирования понятийного мышления школьников) 121

ВЛИЯНИЕ ТЕХНОЛОГИЙ НА РАЗВИТИЕ ОБРАЗОВАНИЯ

Rizakhojayeva G.A., Akeshova M.M. Shift from traditional into interactive approach: teaching monologue with the use of information and communication technologies (Переход от традиционного подхода к интерактивному: обучение монологической речи с использованием информационно-коммуникационных технологий) 135

Семенова Д.А. Особенности, опыт и преимущества внедрения STEAM-технологии в подготовку учащихся основной школы 146

ОБУЧЕНИЕ ИНФОРМАТИКЕ

Anikanova K.I. Engineering design as a general area of study of informatics at the school of International Baccalaureate (Инженерный дизайн как эффективное направление изучения информатики в школах Международного бакалавриата) 157

CONTENTS

CURRICULUM DEVELOPMENT AND COURSE DESIGN

Mozheikina L.B., Emelyanov P.G. Mobile applications for diagnostics, development, and alternative communication for children with language disorders 69

Lvova O.V. Application of situative vocabulary and linguistic quasi-corpus for language acquisition 90

Nikonorova E.I. Professional development e-course on how to integrate interdisciplinary approach into the learning process in schools that practise multimodality and use interactive educational online services 97

PEDAGOGY AND DIDACTICS IN INFORMATIZATION

Vekua N.N., Mamaeva E.A. The use of flash cards in teaching as a means of developing students' verbal creativity 108

Shamkut V.L. Application of information technologies as a significant factor in the formation of conceptual thinking of schoolchildren 121

EVOLUTION OF TEACHING AND LEARNING THROUGH TECHNOLOGY

Rizakhojayeva G.A., Akeshova M.M. Shift from traditional into interactive approach: teaching monologue with the use of information and communication technologies 135

Semenova D.A. Features, experience and benefits of implementing STEAM technology in the main school 146

TEACHING COMPUTER SCIENCE

Anikanova K.I. Engineering design as a general area of study of informatics at the school of International Baccalaureate 157



РАЗРАБОТКА УЧЕБНЫХ ПРОГРАММ И ЭЛЕКТРОННЫХ РЕСУРСОВ


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Mobile applications for diagnostics, development, and alternative communication for children with language disorders

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Abstract. *Problem and goal.* Language disorders of different kinds may cause personal issues and prevent the successful development of an individual. Early diagnostics and precise correctional recommendations enable such issues to be resolved efficiently in childhood. A modern speech therapist needs mobile facilities that can both make his/her work with prescribed protocols easier and perform high-quality professional diagnostics. Creating software tools is quite important, especially when dealing with children. The peak of prophylactic and therapeutic activities occurs in pre- and primary school age. *Methodology.* In the scope of this research, the current state of the problem was observed and analyzed, psycholinguistics part and informatics part of the problem were identified, and their interaction was specified. The results of application of these approaches on the base of several longitude psycho-diagnostic experiments were analyzed and evaluated. *Results.* The software tools to diagnose child language disorders and to develop language abilities in the case of problems are presented. In addition, a tool for an alternative communication via pictograms is described. These tools implement a playing strategy to decrease stress and improve effectiveness. *Conclusion.* Experimental evaluation demonstrates that mobile approach reduces time for the therapist's routine duties and makes diagnostic and correctional process attractive for children.

Keywords: language disorders, language development, diagnostics, alternative communication, mobile applications

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Conflicts of interest. The authors declare no conflict of interest.

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Мобильные приложения для диагностики, развития и альтернативной коммуникации для детей с общим недоразвитием речи

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Аннотация. *Проблема и цель.* Недоразвитие речи различного вида может приводить к личностным проблемам и препятствовать успешному развитию личности. Ранняя диагностика и точные коррекционные рекомендации позволяют эффективно решать данные проблемы в детстве. Современный терапевт нуждается в мобильных средствах, которые одновременно облегчают работу по предписанным протоколам и выполняют высококачественную профессиональную диагностику. Создание программных средств особенно важно для детей. Пик профилактических и лечебных мероприятий приходится на дошкольный и младший школьный возраст. *Методология.* В рамках исследования сделан обзор и проанализировано текущее состояние проблемы, определены психолингвистическая и информационно-технологическая ее части, установлено их взаимодействие. Анализ и оценка результатов применения этих подходов проведены на основе нескольких лонгитюдных психодиагностических экспериментов. *Результаты.* Представлены программные средства для диагностики недоразвития речи у детей и для развития речевых возможностей при наличии проблем. Кроме того, описаны инструменты для альтернативной коммуникации посредством пиктограмм, которые реализуют игровую стратегию для снижения стресса и повышения эффективности. *Заключение.* Эксперименты демонстрируют, что основанный на мобильных приложениях подход сокращает время на исполнение формальностей и делает диагностический и коррекционный процесс более привлекательным для детей.

Ключевые слова: языковые расстройства, развитие речи, диагностика, альтернативное общение, мобильные приложения

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Problem and goal. Language communication is an essential part of an individual's private and social life. Thus, it has a significant impact on life quality. Language disorders of different kinds may cause personal issues and prevent the successful development of an individual. Early diagnostics and precise correctional recommendations enable such issues to be resolved efficiently in childhood; postponing corrective efforts to later stages can have serious adverse effects. Indeed, it is vital for children to have convenient and expressive ways to communicate even if they are currently struggling with language problems.

Several common manifestations appear in children with language disorders, and indicate a systematic pathology of language activity [1]. These include a range of disorders, from specific language impairment (incoherent speech; a sequential, lexical, and grammatical construction of speech; and a phonetical and phonemical understanding and verbalization of concepts in general) to disorders that can be placed on the autism spectrum (from limited communication with the external world to the complete rejection of social interaction). The systematic nature of speech disorders manifests in the following ways: children begin to speak later, their speech is devoid of grammar, and their insufficiently phonetically framed speech activity is reduced and with age, if not corrected, declines sharply. Such incomplete speech activity also has an effect on other areas of a child's mental development. Children with such disorders may have unstable attention and not know how to distribute it. Their verbal memory may be deficient. They may not develop verbal and logical thinking as quickly. In addition, they may lag behind their peers in the reproduction of motive assignments, in terms of space-time parameters and tasks that involve fine motor skills. There are data to support that such children have difficulty learning the Russian language in a comprehensive school environment [2]. Our experience reveals that language disorders can be an obstacle to academic success, even if the university does its best to remedy the situation.

We are interested in developing software tools designed for the diagnostic and correction of language development in children with special health disabilities. Creating software tools is quite important, especially when dealing with children. The peak of prophylactic and therapeutic activities occurs in pre- and primary school age.

Duenser et al. [3] found that, in Australia, 20% of children at the age of 4 years have a language disorder that hinders their development and understanding of the English language. Of the total number of children who undergo special logopedic examinations, 25% wait approximately six months for the preliminary results, while 15% of children wait for more than a year. After receiving the preliminary results, 18% of children wait an entire year before the speech therapy sessions begin. In remote areas, this issue is exacerbated by the shortage of specialists. Lack of diagnosis or additional training can lead to a sharp decline in the progress and literacy of children, increasing the likelihood of problems in social interactions, which can negatively affect a child's emotional state. The authors

affirm the need to create a mobile application that can diagnose and correct language disorders, and that would allow parents to help their children without requiring them to obtain special knowledge in the field of language disorders.

At the moment there is no official statistics on speech diagnoses in Russia. One of the causes is differences between practice and official standards that difficulties comparison of particular issues. For example, the International Statistical Classification of Diseases and Related Health Problems (ICD-11) accepted in Russia does not recognize dyslexia. Another cause is a lack of organizational and methodological ways to collect comprehensive information by federal statistical organisms. In general, according to national sources [4; 5], about 20–25% of preschoolers suffer from speech disorders and from general speech underdevelopment in particular. The draft of “The Strategy of Development of Education for Children with Health Disabilities in the Russian Federation until 2030” (dated April 16, 2019)¹ tells us that at the beginning of 2019, more than 1.15 million of physically challenged children and more than 670,000 children with disabilities live in Russia. According to the definition of the World Health Organization, physically challenged children include children with visual, hearing and speech problems, mental retardation, mental development disorder, autism spectrum disorders (ASD), disorders of the musculoskeletal system, and emotional-volitional defects, as well as complex developmental disorders. According to the Strategy, negative trends in the educational system development for physically challenged children should include an increase in the number of children with developmental disorders and complex disorders, in the extent of functional disorders and chronic diseases, and in the number of disorders with an unclear etiology. This requires early complex diagnosis, which would allow for identification of speech disorders in the initial stages and prevent their development in later adulthood.

Several years ago, the Department of Fundamental and Applied Linguistics of the Humanitarian Institute of the Novosibirsk State University initiated an interdisciplinary project that integrates fundamental and applied research in applied linguistics, computer linguistics, psycholinguistics, speech therapy and cognitive psychology. The practical result of this project was the creation of software tools for the diagnosis and development of speech disorders in children with special health abilities. To date, we have developed and tested three programs for the language therapy practice:

- LogoBall, diagnostic program;
- Logokvest, a game-based diagnostic tool;
- PiktObschenie (the Russian for ‘communicate through pictures’), a mobile application for the development of coherent speech and alternative communication.

Parts of this paper appeared in the proceedings of SocInfo’18 Conference [6]. This extended version includes new results, not mentioned in our previous publication as well as discussion of practical issues of tool evaluation.

¹ *The Strategy of Development of Education for Children with Health Disabilities in the Russian Federation until 2030*. Moscow: Moscow International Education Salon; 2019. (In Russ.) Available from: <http://souz-defectology.ru/wp-content/uploads/2019/07/STRATEGIYA-RAZVITIYA-OBRAZOVANIYA-detej-s-ogranichennymi-vozmozhnostyami-zdorovyya-i-detej-s-invalidnostju-v-Rossijskoj-Federacii-na-period-do-2030-goda.pdf> (accessed: 25.12.2021).

Methodology. The complexity of disorders observed in recent years, and the increasing number of children in pre-school and school who need speech therapy create such conditions for the speech therapist so that he or she must work quickly. As a result, a modern speech therapist needs mobile facilities that can both make his/her work with prescribed protocols easier and perform high-quality professional diagnostics. This is the reason why mobile applications based on various platforms are so important in speech therapy practice. Their portability, additional visual and auditory stimuli have become key parameters for fast and high-quality diagnostic and special educational work.

When comparing the traditional “paper” approach to the modern mobile-based one, Robles-Bykbaev et al. [7; 8] confirmed that the traditional approach has significant shortcomings: a small number of therapists, a large number of children for whom testing is necessary, in addition to planning, a large amount of preparatory work, processing of the results, monitoring, inter alia. Nevertheless, in language therapy practices, paper carriers are still widely used, both in Russia and abroad. One disadvantage is that they are voluminous and take up much of a therapist’s office space. An experimental evaluation of mobile applications’ effect on children with specific language impairments (32 and 26 children respectively) has found that the amount of time needed to achieve an appropriate level of the language development is substantially reduced, compared to the traditional approach. The difficulties in using paper methods are evident in the time-consuming diagnostics of language development:

- the diagnostic material is selected manually by examining several collections of illustrations;
- the results are recorded in a special form;
- the results are then transferred into electronic tables for processing;
- decisions are subsequently made and recommendations given.

The personal experience of one of the authors reveals that the traditional “paper” method for testing a group of 20–25 preschool children requires up to three weeks to accomplish. Hence, there are at least three reasons to involve modern information technologies:

- the diagnostics methods should be applicable on a mass scale;
- they should be attractive and non-disturbing for a child;
- they should be easily reconfigurable and tunable.

Using mobile applications is also highly beneficial for therapists. First, it cuts the amount of time required for preparatory procedures, as well as the time needed for processing all of the data received during a child’s diagnostics. In Russia, therapists spend one-third of their working time preparing and processing paper carriers. Thus, if they spend less time on these tasks, they can devote more time to face-to-face communication with children. Secondly, the therapy process becomes universal: the electronic form allows a specialist to work with a child at any convenient location. Thirdly, the work of the speech therapist is automated: the program records the intermediate and final results, visualizes the results in the form of tables and graphs, and saves them.

Children with developmental challenges, including language disorders, require a special learning environment that should meet educational needs and create comfortable conditions for development. For modern children, mobile applica-

tions are a natural part of their daily lives. Thus, the use of mobile applications can make receiving help more interesting, more comfortable and more productive. Preparing for the implementation of mobile applications, the authors used an eye-tracking technique to compare the effectiveness of diagnostics when using paper carriers and when using a portable device. Although the authors cannot insist on the completeness of this study, it nevertheless demonstrated that the electronic approach aided the child in focusing on the test for a longer period of time than did the paper approach.

Among the substantial number of children's applications (entertainment, gaming, regulating activities, developing) there are various training programs that allow children to navigate a studied topic independently, or in tandem with an adult. Using these programs, children can be in charge of their own educational trajectory and the application will monitor its own effectiveness in the training process. In addition, mobile applications help to maintain children's attention on the therapeutic process and motivate young patients for active participation.

Moreover, software tools reduce the cost of therapy, making it more affordable. For example, the price of printed sets of testing and training papers can be as high as several hundred dollars in the US market. In contrast with the printed version, software errors can easily be corrected and therapeutic methods can be updated intermittently.

The current trend in the development of universal design [9] involves the creation of products and objects that can be used by all people without special adaptation or design. The fundamental principles of universal design are:

- 1) equality and flexibility in use;
- 2) simple and intuitive design;
- 3) easily perceived information.

The principles are equally implemented for both adults and children as well as for persons with and without disabilities. Modern products of such design are created specifically as universal. Another popular trend with which the development of technical equipment for persons with disabilities began was the adaptation of products that people corresponding to the conditional standard use for the needs and goals of disabled people.

When identifying the potential of a mobile application for working with both "non-speaking" children and children corresponding to the conditional standard, we relied on the experience of creating and using alternative communication tools and their potential for the universal design of modern speech therapy. Let us briefly analyze modern alternative communication applications.

Rodriguez and Cumming [10] studied the influence of the Language Builder application, designed specifically for children with speech disorders, on their language skills (i.e., how receptive (passive) vocabulary, expressive vocabulary and the skill to formulate sentences have changed after using this application). In the experiment took part 31 pupils from the first to third grade with identified speech disorders. Each of the participants had to use the Language Builder application for 30 minutes a day. Children were divided into control and experimental groups for the 8-weeks experiment. The data showed that children in the speech therapy group made much more progress in forming syntactic structures compared to the control group. In addition, the author did not reveal significant differences be-

tween the two groups in expressive and receptive vocabulary. The authors concluded that using the Language Builder application can increase the skills of forming sentences in children with language delays.

Kultsova and Matyushechkin [11] described the development of the Travel and Communication Assistant auxiliary mobile application supporting the independent movement and communication of people with cognitive disorders. The authors claim that the application allows the supervisor to track the movement of the ward along a given route, as well as to communicate using text, voice and messages from pictograms. The team also noted that a special Russian-language extension of the Text2Picto web service was implemented to translate Russian text messages into pictograms [12].

Lee et al. [13] presented the application PuzzleWalk. Adults with ASD are less physically active than adults without such a diagnosis. After analyzing the situation, the authors concluded that smartphone applications with augmented reality can be an effective solution to this problem. In this application, according to the authors, the user can mark his location and frequently visited places on the map and, most importantly, the user can mark his responsibilities in these places and make notes. Such visualization will help people with ASD to structure their thoughts and increase their physical activity.

Barman and Deb [14] explain that the main idea of this application is to provide a platform for people with autism and aphasia, allowing them to understand and formulate sentences, which cause difficulties due to certain damaged areas of the brain. The authors believe that the mobile application, which works as a device for formulating sentences, will help to overcome these difficulties.

Mooney et al. [15] found that complementary and alternative communication strategies developed for people with chronic aphasia contribute to generative language skills. The authors argue that it is necessary to find a strategy for complementary and alternative communication for people experiencing primary progressive aphasia (PPA) and neurodegenerative dementia (ND). According to the authors, an experiment was conducted in which alternative procedures were used to compare the vocabulary used for retelling in three conditions: lack of technical support, use of photos only and the CoChat application with photos and shortcuts. This study allows concluding that CoChat proposed by the authors provides the necessary support during natural conversations on personal topics for people with PPA. The authors also say that a graphical interface and visualization of words in applications increases the efficiency of the latter.

Cheng et al. [16] argued that facial expression awareness is one of the main tools for building social relationships, and recognition of emotion is one of the most crucial problems for people with autism spectrum disorders (ASD). The authors note that mobile learning creates the learning environment that will help adapt people with ASD to recognize other people's emotions. In this study, the three-dimensional complex facial recognition system (3CFER) has an important place. It was used when working with children who had ASD. With this program, children were shown the simulated faces of people with different emotions. The results demonstrated that the participants in the experiment showed a significant improvement in their understanding of emotions after conducting it several times. The authors note that *surprise* and *shyness* were easily identified by almost

all participants. The article ends with the conclusion that the mobile training system is promising.

Askari et al. [17] presented studies on the ability of children with autism to recognize facial expressions using the humanoid robot Ryan. Six children with ASD and six typical children took part in the experiment: Ryan showed them six core emotions (i.e. anger, disgust, fear, happiness, sadness and surprise) with different levels of intensity. According to the authors, the participants were asked to identify the emotions depicted by Ryan. The results of the study show that there are no general violations in the ability to recognize expressions in the ASD group compared to the control group; however, as noted by the authors, both groups showed flaws in revealing disgust and fear. Increased intensity of Ryan's facial expressions significantly improved the accuracy of facial recognition. This study proves that both groups were able to recognize the emotions demonstrated by Ryan with high average accuracy. It means that children with ASD can perceive emotions expressed by other people.

Whilst the educational programs are quite diverse, the diagnostic programs are not many. For example, the program *Speech Doctor* (developed by 1SpecialPlace²) seems to be interesting. This application allows parents to test the child's level of language development. The diagnosis is carried out by answering questions; the answer options are yes/no. After the program has received all the answers, they are sent to speech therapists for analysis. After this, a letter with the results of the diagnostics is sent to the parents' mail. We did not find among the Russian-language applications those that would be directly intended for diagnosis, with the exception of one "Speech Therapist."³ It proposes to conduct rapid testing on its own and to identify problems in the pronunciation of sounds in the child. The results offer a set of articulation exercises with their descriptions, aimed at correcting the identified problem. Testing is an assessment of a child's sound by the "right/wrong" criterion. Unfortunately, "Speech" has a very narrow scope and users note its unclear interface.

Lorusso et al. [18] have stated that, at the moment, software tools for aiding in language disorder therapy are not well characterized with regard to therapeutic effectiveness. In addition, there is scarce information about the clinical testing of such solutions, which makes it difficult to assess their effectiveness.

Results and discussion. *LogoBall*. This diagnostic program was designed to automate the process of detecting a child's speech pathology: create tables and graphs, compare the results of diagnostics at different stages of training, and save the list of errors made by the child during the diagnosis. It is beginning to be introduced into logopedic practices.

The application for diagnosing children's speech has a diagnostic structure, according to Nishchevaya [19], that consists of 9 series and 33 groups. Each diagnostic criterion is subdivided according to the age gradation (4, 5, and 6 years). The diagnostic series are as follows:

² 1SpecialPlace. *Speech Doctor*. 2014. Available from: <https://1specialplace.com/app-store/speech-doctor/> (accessed: 25.12.2021).

³ Logoped. 2017. Available from: <https://play.google.com/store/apps/details?id=com.moslogoped.logoped> (accessed: 25.12.2021).

- 1) sound-syllabic structure of the word;
- 2) phonemic perception;
- 3) phonemic analysis and synthesis (an example Figure 1);
- 4) understanding of speech;
- 5) understanding of word combinations and simple sentences;
- 6) lexical and grammatical structure of the child's speech;
- 7) inflection;
- 8) word formation;
- 9) coherent speech.

Thus, it is further necessary to examine the application from two perspectives: that of the speech therapist and that of the child. The directly stimulated diagnostic material is divided into two types: with and without illustrative support.

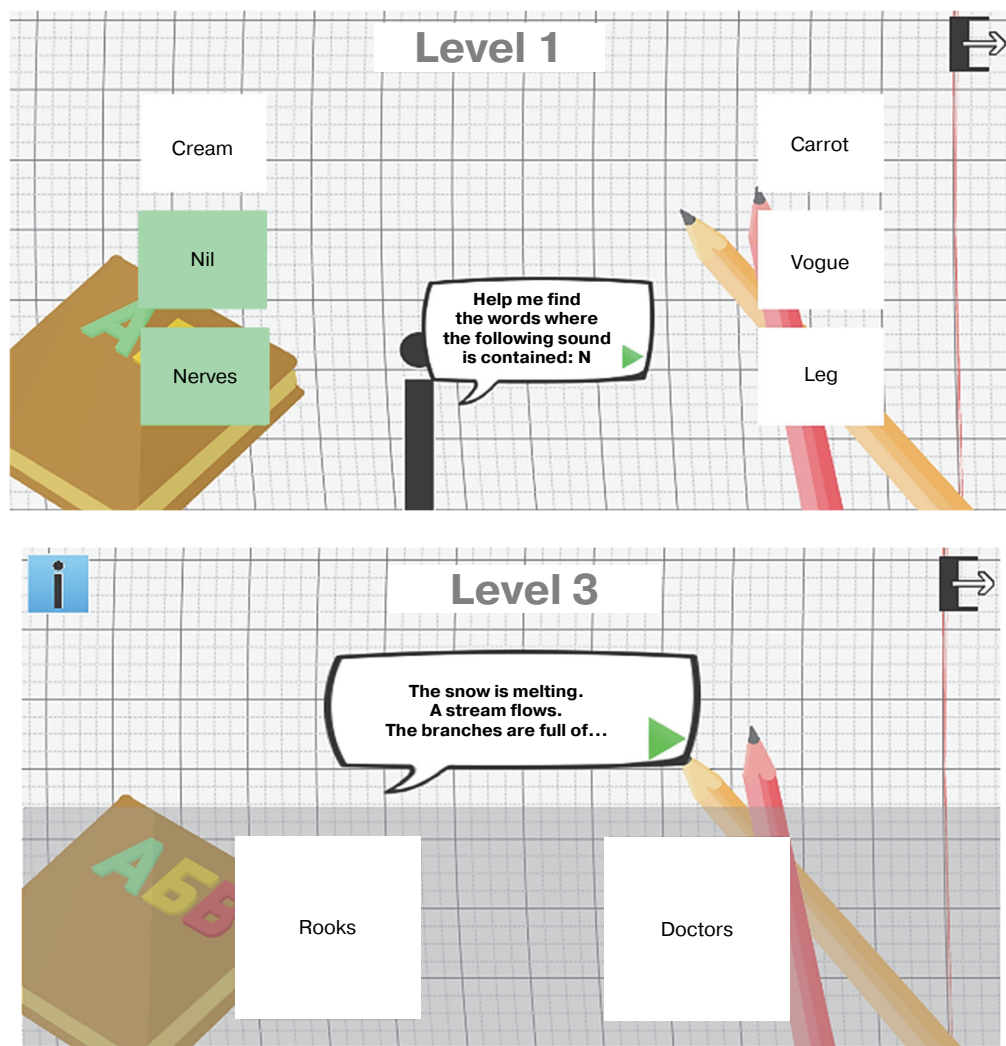


Figure 1. Series for sounds and phonematics

If the task on the screen does not provide illustrative support, the child can only see buttons with words, phrases or sentences, with which he/she must perform the task. If the child's answer is wrong, then the app saves information about

the mistake. Recording the child's errors is integral for further constructing the individual trajectory of the developmental work for each child by the speech therapist. If the task on the screen does provide illustrative support, then the child must perform the tasks specified by the illustrations. The child's errors are also recorded for these tasks. On the right side of the screen, there are buttons numbered from 0 to 3, which represent an evaluation of the child's performance. The specialist can move to the next task but it is not possible to go back. However, there is no time limit to perform a task.

The principal functionality of LogoBall is to record and synchronize the scores set by the language therapist for each task; record the errors made by a child when pressing the incorrect button that corresponds to the incorrect word; provide a simple interface to make the application easy to use; implement an illustrative series to help children concentrate.

A session consists of a series of tasks. For example, one task tests the ability of a child to match adjectives with nouns in the singular (e.g. a green bucket, a red flag, a blue pencil, etc.). The therapist shows a picture on the screen and asks questions so that the child can demonstrate his ability to match the adjectives with the nouns: "What color is the bucket? Which bucket will we take to fetch water? Which bucket can we fill with water? To which bucket can we attach a rope?", etc.

After the child has completed a task, the therapist assigns a corresponding score according to the rating system to which he adheres. We recommend using the following system, although we do not insist upon it:

- 0 means that the child has absolutely failed the job;
- 1 means that the child has performed less than 30% of the task;
- 2 means that the task has been partially performed correctly (no more than 70%);
- 3 means the task has been performed completely, or almost completely.

We deliberately do not prescribe clear criteria for scoring, because in Russian language therapy there are controversial ways of evaluating the results. Thus, the program is purposefully flexible to allow the specialist to choose the criteria independently.

To receive feedback on the quality of the developed application, 22 experts, teachers, and language therapists were questioned. We developed a questionnaire, which includes nine evaluation criteria. All of the questions aim at identifying issues with the program. In order to improve the functionality of the application, each criterion is assessed on a five-point scale, where 1 is very poor, 2 is poor, 3 is satisfactory, 4 is good, and 5 is excellent. The open questions asked encouraged respondents to express their desires for the application and specify its shortcomings. Based on the results of the questionnaire, we calculated the results (average score for each criterion of the questionnaire).

The most successful aspect of the application is its stability, with a rating of 4.93. The second best was the speed of the application, at 4.86. Subsequently, how well the diagnostic material corresponds to the original received a rating of 4.71. The average scores obtained for the rest of the criteria are as follows: application design – 4; navigation – 4.23; color solution – 4.05; correspondence between illustrations and tasks – 4.1; and application functionality – 4.47. The criterion with the lowest score is the quality of visualization, which received an average score of 3.84.

Taking into account the results of the experts' evaluation, the following conclusions are drawn with regard to improvements that need to be made to the application LogoBall. The first improvement relates to the illustrative series. Illustrations are perceived by the children better if they are decorated in the same style and presented against a white background, without any additional background (context). Second, it is reasonable to place no more than three or four pictures on one slide. This allows the therapist to improve the child's concentration on a specific task. Third, to work with preschool-age children, it is necessary to include "step back" and "pause" handles because such young children are unable to concentrate on any task for more than 20 minutes and therefore, speech therapists and teachers must conduct diagnostics in two or even three stages. Fourth, the program should contain extensive instructions and explanations for each diagnostic task so that it can be used by anyone, and not just specialists can use it.

We believe that the following suggestions will greatly improve the application. To facilitate the child's perception of the interface, we should continue improving the illustrative application series. This is a challenging task, which involves an examination of complex cognitive problems relating to human-computer interactions. Moreover, tasks should be arranged with respect to their complexity level to allow the therapist to distinguish among children with different levels of language development and thus, differentiate their tasks. Finally, adding several game elements may increase a child's motivation to undergo diagnostics.

Logokvest. At the moment, there is a wide spread of speech disorders associated with problems in a particular language area. They are most effectively resolved at preschool age; however, to correct them, it is necessary to determine exact diagnoses. Various logopedic diagnostics can be carried out in specialized kindergartens and centers. The vast majority of them are questionnaires with tasks involving various areas of the language, such as phonetics, morphology, and psycholinguistic processes of perception and speech formation.

Such diagnostics due to the children's specificity can take several days. This not only slows down the examination process but can also lead to an incorrect diagnosis since a child's well-being and mood may bias exam results. This form of diagnostics quickly causes a loss of interest and a decrease in concentration of attention. In addition, it was noted that logopedic diagnostics techniques weakly interacts with modern linguistic investigations which describe the language as a system and individual elements of this system with their features and parameters important in the process of communication. This phenomenon may cast doubt on the rigorous validity of diagnostic methods.

Our diagnostic experience has shown that there is an urgent need to solve these problems. One of the simplest and universal solutions is the creation of a mobile application. We attempted to create a theoretically justified diagnostic tool in a form that is fascinating for preschool children, taking into account their mental, age characteristics and specifics of speech development.

This application Logokvest implements game-based diagnostics to test a child's level of lexical and grammatical proficiency. It is a set of mini-games grouped into five thematic complexes depending on the game story. The results can be recorded in the program memory.

When the application is launched, the user opens the main menu with two buttons: “Play” and “Children” (Figure 2). To start the game, the first button is pressed, to access the data about the children who have been screened and their results – the second. Before the game starts, a window with back and add buttons is displayed. When you click, the second form of registration of the child with the fields “Family, child’s name,” “Age of the child,” “Name or group number” comes out. Underneath the fields are the Back and Add buttons. After pressing the second one, a line with the child’s data appears in the window. In the absence of data in the Age and Group Fields, the default values are “7 Years” and “Rainbow Unicorns” respectively. The unfilled field of surname and name remains empty. There is an opportunity to enter both the name and surname together, and one thing.

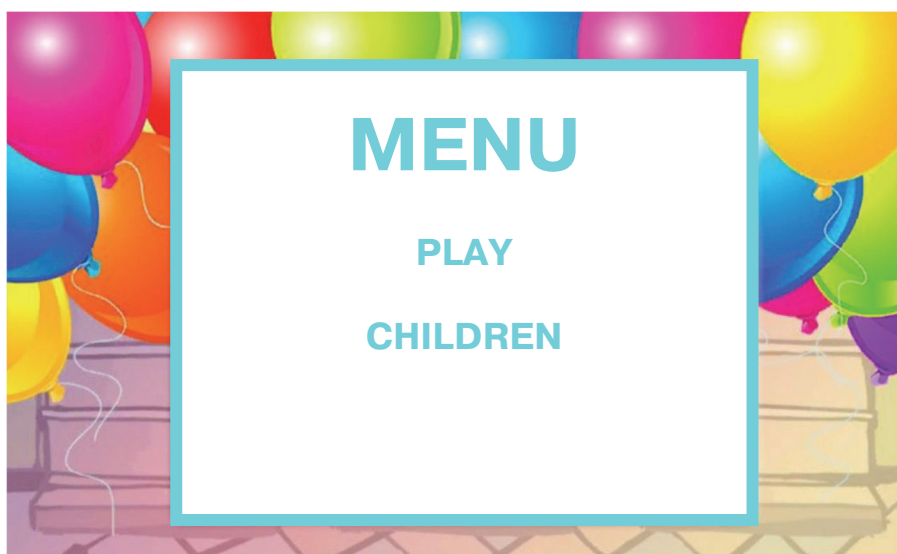


Figure 2. Welcoming window of Logokvest



Figure 3. An example of a Logokvest task window

During the game, the child should distribute images of items on the shelves of cabinets with the names of thematic groups of words in which they are included (Figure 3). Each correct ratio adds one point. In the event of an error, the image remains on the shelves of the wrong cabinet. Regardless of the number of points

scored, the child continues to play. The levels differ from the thematic groups of words to the principle of the frequency of use of the objects they designate in the task introduction. everyday life. Thirteen images are provided to the child to relate, so he has the right to make three mistakes. Depending on the number of points scored at all levels of the game, the preliminary level of specific language impairment is determined: less than ten – the first, from ten to twenty – the second, from twenty-one to twenty-ten – the third, thirty – the absence of language impairment. The program also allows you to re-pass the game for re-examination. To do this, just click *n*...

In the first complex, the child is invited to select items belonging to a certain group from presented shelves and collect whole things from pieces, thus allowing them to improve the lexical level of their language. The second complex is a journey through a zoo, during which the child must identify the sounds produced by the animals, give the correct names of the offspring of various animals and match the animals and parts of their bodies, composing the forms of possessive adjectives. The third complex encourages the child to assume the identity of an artist. Here, the lexical and grammatical aspects of speech are tested. The child is asked to assemble a palette of certain colors, draw geometric figures and paint objects; all of which is accomplished by composing a word combination in the correct form. In the fourth complex, the child is tasked with “creating” several items from one, dividing them into groups of two and five, and verifying the presence or absence of certain objects; this tests the child’s knowledge of plural forms, and determines whether she/he can use numerals with them, etc. The fifth complex, which is set in the wilderness, tests the child’s ability to form prepositional-case constructions with prepositions and create verbs of the perfective aspect.

For each correctly classified object, the child receives one point; errors do not affect the diagnosis, which helps reduce the level of stress. Each mini-game has four levels. The number of points received for each mini-game and each complex is entered into a table, after which the total number of points is counted. The more points a child gets, the less serious is his or her language development problem. The illustrative material is created in a uniform style to ensure that the external component of the program appears attractive, and that the game process is fascinating.

When selecting the “Children” button in the main menu, the speech therapist gets the opportunity to view the list of all past games, as well as add the child at the touch of the “Add Child” button. It is not possible to remove a child from the list. After analyzing the analogues and the object of the diagnostics, getting the illustrations created specifically for the program and creating the application code, the goal was achieved. The result was one of the mini-games of the game mobile diagnostics of the lexicon-gram level *Logoquest* in children of primary school age with language impairment. It has a bright, aesthetically pleasing interface and the ability to count points. The ease of working with the application allows you to use it not only speech therapists, but also parents. At the moment, the program is being tested.

PiktObschenie. This mobile application was designed to improve children’s coherent speech and alternative communication. This application allows an individual to communicate using the language of the icons and their color scheme. The same pictogram can denote an action (if it is red), an object (if it is blue),

or a sign (if it is green). Examples are homonyms like to smile and a smile. The color black is used for service words. Color indication helps to construct phrases more correctly. Children can make both simple and complex sentences by placing the pictograms in a certain order, which is the most important stage of learning cohesion (Figure 4).

The application was developed for pictogram-based communication, which is an interactive version of the learning exercises from speech therapy workbooks. Our experience demonstrates that pictograms enable speech-impaired and/or non-



Figure 4. An example of the PiktObschenie session: the composed sentence is “I like to draw with a pencil on the table”

a button the child can quickly report a situation that requires immediate resolution (for example, “I have a headache”, “I want to go to the toilet”).

I want: the section enables a child to ask quickly for a certain thing, simply by clicking on the object icon. It consists of a limited number of pictographs most needed by the child.

Phrases: in this section, the child can put pictograms together to make phrases.

The users tested the developed application to assess its perception. We registered a developer account on GooglePlay, where the mobile application was hosted. Subsequently, a test group of 50 people – specifically, parents of children with speech disorders – was recruited. A questionnaire was compiled to assess the level of the children’s familiarization with the language of pictograms, effectiveness of the mobile application as a means of alternative communication, and its influence on the development of coherent speech. The parents’ responses indi-

speaking children to satisfy their need to communicate. Actions

The program consists of two modules: a trainer and a communicator. Before undertaking software implementation, ontological modelling was accomplished.

The training module serves to familiarize the child with a symbol-meaning relationship; the module trains the child to associate the images of objects with their functions, and teaches the principles of the logical construction of a phrase by encouraging the child to choose the right symbols.

The communicator module is an alternative means of communication and a tool for the development of coherent speech. The main sections of this module are as follows:

Specials: the section is designed so that at one touch of

cate that, in general, the idea of such an application is interesting and in high demand, but there are also some issues; for example, the quality of the pictures. The application is currently being improved and refined to address these issues.

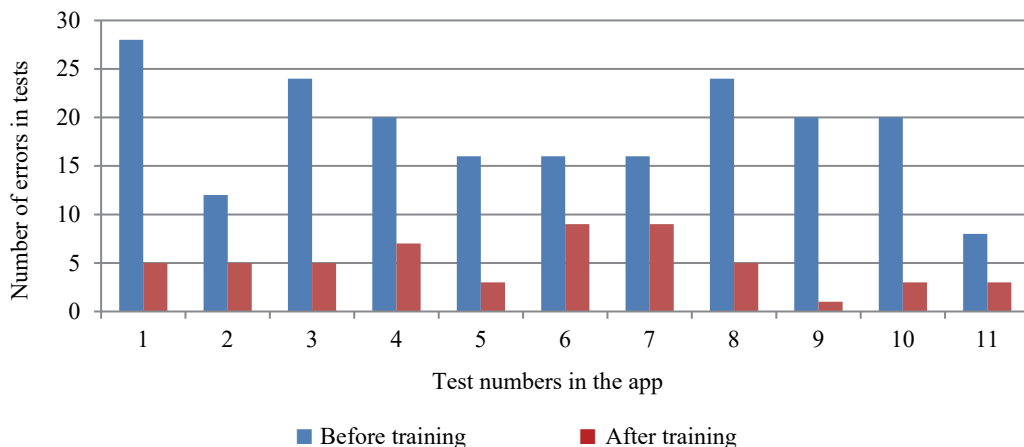


Figure 5. Number of errors in the tests occurring at the beginning and at the end

Of the 50 people who enrolled, only 40 passed the test; several refused, either for no apparent reason or under the pretext that, for example, the children would find the application boring. Judging by the feedback and the results, the icons initially seemed somewhat scaring, but after a short interaction with the training module, the users’ attitudes changed. It should be mentioned that in contrast with the initial testing where average number of errors (their range is from 8 to 26) was 18 per test after training average number (their range is from 1 to 9) of errors was 5 per test (Figure 5).

Overall, the application demonstrates significant potential for speech development, in particular, for the development of coherent speech. Currently, we are working on improving the following areas:

- the quality of the graphics of the pictogram base: creating animated pictograms (instead of using the originals [20]);
- the communicator module: in particular, adding assignments directly aimed at developing the coherence of speech as a key parameter of speech development;
- application testing: to not only include children who are on the autistic spectrum, but also children who suffer from various manifestations of language underdevelopment.

The current trend in the development of universal design involves the creation of products and objects that can be used by all people without special adaptation or design. PiktObschenie was developed in 2016–2017 for a tablet PC (Android OS) for communication based on pictograms, which is an interactive version of speech therapy workbooks by L.B. Baryaeva. Using the application, we assumed that it has a number of possibilities for alternative communication, in particular for children with ASD. Let us clarify what we mean by “alternative communication.” All communication systems that are not related to voice are called alternative systems. They can completely replace speech or become an addition to it. They can be a complete alternative in the absence of spoken language: in this case, communication involves the mastery of a completely different communicative system, where nonverbal communicative means are especially important: photographs, drawings, and so on. In the case of PiktObschenie, these are pictograms.

Even without a detailed study of the methodology used in the applications, it can be revealed that all of them have the potential to be used for educational purposes for “speaking” children and adolescents with minor speech disorders or for those who want to deeply engage in speech development. Let us analyze the capabilities of PiktObschenie. It consists of three modules described below.

Acquaintance with Pictograms. The module aims at making the child familiar with the pictograms and clarifying that he or she understands them and can somehow identify them.

In the “Acquaintance with Pictograms” module, it is necessary to show the pictograms to the child, ask him to identify them (Figure 6). Then the child should match some separate pictograms with the picture, which presents to some extent a realistic image of the object, feature or action of interest (for example, a house or a shower as an object; sweeping or grunting as an action of the object; fat or old as a feature of the object). As has been mentioned above, a certain color is assigned to each category of pictograms, and a child must be warned about this in advance.

This module presents six of eight topics. The child will have to get acquainted with the following pictograms: ‘I,’ ‘Family,’ ‘Home,’ ‘Toys,’ ‘School,’ ‘Animals.’ For each topic, there are almost similar exercises in six proposed topics:

- 1) “select the picture:” object, action or feature;
- 2) “show what an adult will call:” an object, action or feature;
- 3) “find the same pictures” among the pictures with an object, action or feature;
- 4) “find the same picture:” object, action or feature.

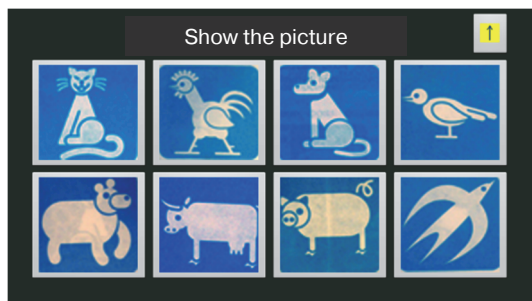


Figure 6. An exercise from the “Acquaintance with Pictograms” module



Figure 7. An exercise from the “Objects. Actions. Features” module

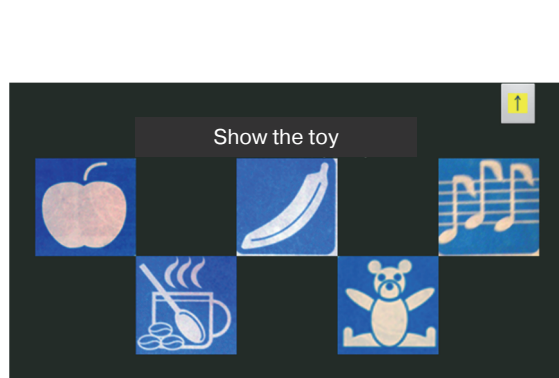


Figure 8. An exercise from the “Objects. Actions. Features” module



Figure 9. An exercise from the “Objects. Actions. Features” module

Objects, actions, features. The purpose of this module is to familiarize with a number of new pictograms that were not presented in the “Acquaintance with Pictograms” module, as well as strengthen the received knowledge about pictograms and do additional exercises (at the adult’s discretion or if the child still has difficulties with identifying some of the pictograms) devoted to the same six topics that are proposed in the module “Acquaintance with Pictograms:” ‘I,’ ‘Family,’ ‘Home,’ ‘Toys,’ ‘School,’ ‘Animals.’ The following types of exercises are presented here (Figures 7–9):

- 1) “show what I’m talking about:” the child chooses from a pair of sentences made up of pictograms what the adult said;
- 2) “show the picture:” similar to the first exercise in the “Acquaintance with Pictograms” module.

Communication. This module focuses on communication with the help of pictograms and the development of coherent speech. It includes the ‘Phrases’ section, which implements the compilation of phrases and small texts based on pictograms. In fact, this section is similar to typing of an alphabetic text. It is intended for communication with the help of pictograms, and it can also be used as a tool for the development of coherent speech, using the corresponding exercises. The module presents six topics: ‘I,’ ‘Family,’ ‘Home,’ ‘Toys,’ ‘School,’ ‘Animals,’ ‘Nature,’ ‘Plants’ (Figures 10–11).

The stages of teaching a child to work with pictograms in a series of workbooks and a mobile application are almost identical:

- the child gets acquainted with the sign-symbol (pictogram) and the supervisor clarifies whether the child understands what this or that pictogram means;
- the child establishes the connection between images of objects and their functions; then he or she sequentially logically formulates the sentence by independently choosing desired symbols.

The first testing of the application (2015) (carried out by parents of non-speaking children with ASD) revealed significant shortcomings, one of which was the lack of guidelines on the application. In this connection, serious work was required to identify the app’s developing potential for children with speech disorders and create speech therapy recommendations for using the application in specific language classes.

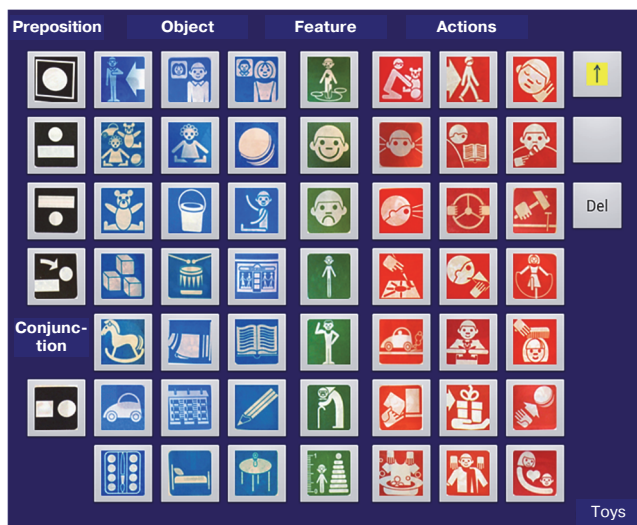


Figure 10. Screenshot of the “Communication” module, topic “Toys”

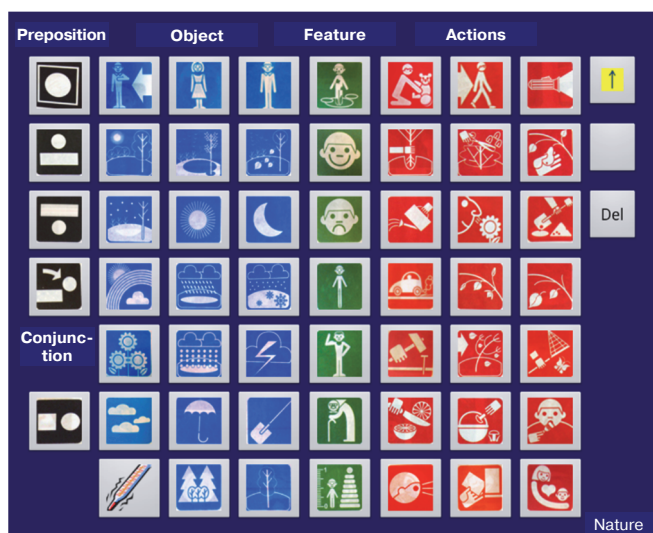


Figure 11. Screenshot of the “Communication” module, topic “Nature”

In 2019, we studied the possibilities of the application and revealed its potential not only for alternative communication but also for speech development of preschool children, both typical and those who are diagnosed with general speech disorders.

To study the PiktObschenie’s possibilities, we worked with speech therapists who have experience with children with various speech disorders and use technical communication tools in their practice, in particular, computer speech therapy programs and developing mobile applications. We developed a questionnaire for speech therapists and practitioners, which helped study expert data on the developing potential of the application.

To evaluate PiktObschenie in practice, we selected the following criteria:

- the app usability for both adults and children, i.e. the interface, navigation and the quality of the icons should be at the acceptable level;
- the ability to perform certain exercises aimed at developing coherent speech in children, in particular, its leading components: expanding vocabulary and grammatically correct use of words in the sentence as well as coherent speech, i.e. composing various stories with the help of pictograms;
- children’s interest in the application;
- the application motivates children to make contact with adults.

About the PiktObschenie mobile application 56 experts (speech therapists) were questioned. The following positive features were mentioned in working with children who suffer from general speech underdevelopment, using the PiktObschenie application:

- children were interested in the application (89% of the experts’ responses);
- many children were easily contacted because of interest (87%);
- children did the proposed exercises with no difficulty (mainly on the development of grammar and coherent speech) (71%).

Some problems relating to the app interface were detected and included in development plans to fix.

Based on the results of our work with speech therapists, we found that PiktObschenie is most productive not for alternative communication of “non-speaking” children (as previously thought), but for the development of coherent speech of children with speech disorders as well as for typical children’s development.

Conclusion. To analyse the results of the development and implementation of mobile applications we collaborated with speech therapists. Applications used in children’s speech therapy are discussed at specialized workshops. Questionnaires for experts were created to discuss and evaluate the effectiveness of using applications. The questionnaires have both open and closed questions, and have tasks related to the ratings and scoring of a particular application’s function. Quality, functionality, stability, reliability and availability are evaluated separately.

Expert evaluation allows us to improve the applications. Our working hypotheses about the demand and necessity of mobile applications are confirmed by real speech therapy practice. For further discussion, we raise the issue of creating training and methodological complexes for working with mobile applications for both speech therapists/professionals and parents of children with speech disorders, including those with autism spectrum disorders. For example, we are developing specific guidelines, lessons and exercises with which PiktObshchenie will become a tool for specialists. In addition, we are working on the creation of a special textbook for parents and mentors of children, who do not have special pedagogical or speech therapy education about children with speech disorders. This textbook includes a number of recommendations and specific developing techniques. In addition, the text contains QR codes. By scanning these, users will be able to see a record of the real lesson of a professional speech therapist with a child who is using the technique described in the text. Thus, we will address the issue of prolonged assistance for those involved in various rehabilitation practices, using diagnostic and developing mobile applications with children who suffer from speech disorders. Finally, we believe that the technique used in the application can also be adapted for use by adults who have speech problems caused by, for example, accidents or insults.

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Research article / Научная статья

Application of situative vocabulary and linguistic quasi-corpus for language acquisition

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Abstract. *Problem and goal.* Application and integration of ICT-technologies into different human activities and fields of knowledge appeared to be rather fruitful and very promising for further improvement of existing and development of new tools. In particular, it equipped linguistics with very powerful and perspective innovative original tool – linguistic corpus, and opens new horizons for teachers in dealing with actual learning and educational tasks and responds to the challenges of modern life. Two ICT-linguistic tools – situative vocabulary and linguistic quasi-corpus were developed using the ideas of traditional topic vocabulary united with modern telecommunicative tools as blogs and chats and linguistic corpus with specific database and “human” concordance. *Methodology.* Potential of the tools for improvement of communicative skills in foreign language as well as in mother tongue is analyzed thoroughly and ways of their application are described. *Results.* Proper application of situative vocabulary and linguistic corpus for educational purposes also helps to develop multiculturalism, foster tolerance – both topics being very actual and even crucial under current circumstances and as areas for different project activities. *Conclusion.* Combination of ICT and linguistics allows developing modern and perspective tools shown to be effective for different learning situations.

Keywords: ICT-tools, situative vocabulary, linguistic quasi-corpus, learning tasks

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Использование ситуативного вокабуляра и лингвистического квазикорпуса для изучения языка

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Аннотация. *Проблема и цель.* Применение ИКТ-инструментов и их интеграция в различные сферы деятельности человека и области знаний оказались плодотворными и представляются довольно многообещающими для развития существующих и разра-



ботки новых инструментов. В частности, лингвистика получила мощный и перспективный оригинальный инновационный инструмент – лингвистический корпус, открывший новые горизонты в области образовательных и актуальных языковых задач и отвечающий вызовам современной жизни. Соединяя идею традиционного тематического вокабуляра с такими современными телекоммуникационными инструментами, как блоги и чаты, и лингвистического корпуса со специализированными базами данных и конкурдансом, осуществляемым человеком, разработаны два лингвистических инструмента – ситуативный вокабуляр и лингвистический квазикорпус. *Методология.* Произведен детальный анализ возможностей этих инструментов для развития коммуникативных компетенций как на иностранном, так и на родном языке, подробно описаны методы их использования. *Результаты.* Надлежащее использование ситуативного вокабуляра и лингвистического квазикорпуса в образовательных целях способствует развитию мультикультурализма и воспитанию толерантности, что актуально на данном этапе; также возможно их применения при различных видах проектной деятельности. *Заключение.* Соединение информационных и телекоммуникационных технологий и лингвистики позволяет создавать современные и перспективные инструменты, которые могут эффективно использоваться для решения различных образовательных задач.

Ключевые слова: ИКТ-инструменты, ситуативный вокабуляр, лингвистический квазикорпус, обучающие задания

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Problem and goal. Department of Informatization of Education of Moscow City University celebrates its 15 anniversary this year. Mentioning this event is not accidental. If the department had not been created, new linguistic and pedagogical tools mentioned below would not have appeared and successfully developed. In addition to ethnical heterogeneity of the world's countries, mass international migration in the context of globalization also contributes much to multicultural and ethnical diversification of population of individual states making demographic situation more and more complicated. Local authorities and governments are concerned about increasing “amount of conflicts because of religious, ethnic and cultural reasons among different ethnic and cultural communities.” Besides traditional dissention among small and leading groups immigrants nowadays face new forms of racism promoted by political situation strongly.

Moreover, on one hand, values of education are mutually enriched due to globalization, on the other hand, aggressive nationalism, separatism, xenophobia are manifested by globalization also. Thus, we can observe contradictory influence of globalization on culture in multicultural communities and consequently on education itself. All above said contributes to prominent increase in polyethnicity and multiculturalism phenomena in the world and consequently their manifestation in educational processes [1]. The social, political, demographic, and cultural transformation of multi-ethnic, multicultural states has made it necessary to find adequate pedagogical models for solution in nation-states and post-colonial states of different old and new to solve the problems excluding violence and taking into

account aspirations of all ethnocultural groups composing the society. Thus, successive educational processes (organization, implementation, result) can be considered as one of the tools to resolve the problem¹ [2].

Main components of pedagogy namely learning and education cannot exist separately especially for subjects of the humanities cycle and in the context of a variety of cultures. One should keep in mind that solving learning without thinking about the educational tasks does not mean that educational goals will not be achieved but the result may be completely different from needed under given conditions [3]. In “traditional” didactics the abovementioned aspects that have been well studied and repeatedly discussed by scientific and pedagogical community. Traditional courses with use of ICT tools integration into, or newly developed innovative ICT-educational tools and technologies with “traditional” methods bias, the educational component either overlooked or sometimes deliberately ignored, being completely unacceptable. Thus, the question of setting task and careful thinking-over solutions to educational tasks is quite acute under current conditions.

To reveal the opportunities of application of innovative ICT linguistic and educational tools, namely of situative vocabulary and linguistic quasi-corpus, for foreign language textbooks is the study purpose. We want to show a wide range of learning and educational goals that can be reached via the tools.

A term situational vocabulary stands for lexical constructions containing an ICT tool for specific communicative situations (sometimes small excerpts from the rules of behavior in the situations), as well as blogs, chats, forums, mailing lists, etc. composing modern ICT tools. Making possible supplement of the relevant material and discussion of various linguistic constructions or word meaning application in different ways and for different situations.²

Moreover global computerization and development of computer support for information technologies allowed to obtain an absolutely new, powerful and very effective linguistic tool-linguistic corpora, which laid the foundations of a whole area in linguistics – corpus linguistics. From the point of view of methodology due to the concordance program allowing specific words and expressions location identification in text arrays and use a problem-based approach to learning “Research – Study – Use” linguistic corpora are to be widely used in developing and promoting lexical and grammatical students skills. To be representative, i.e. indicative in any field, a linguistic corpus is to contain more than a million of units. However, quite often there is a need to study not the use of a single word or phrase, but the whole text, for example, its structure or design methods. It is clear that an array of a very large number of elements is not suitable in such cases, since the analysis should be carried out not by a machine, but by a person. For such cases, in the opinion of the authors, the innovative ICT tool proposed by them – a linguistic quasi-corpus- is quite relevant.

Quasi-corpus is:

– a database whose elements are entire texts or specially selected passages from texts;

¹ Roell K. The Visual learning style. *ThoughtCo*. 28 August 2020. Available from: <https://www.thoughtco.com/visual-learning-style-3212062> (accessed: 10.09.2021).

² Kurt S. *Problem-Based Learning (PBL)*. *Educational Technology*. 8 January 2020. Available from: <https://educationaltechnology.net/problem-based-learning-pbl/> (accessed: 05.06.2021).

- a set of text data from a particular language in written form, which is small in size, since it can only be analyzed by a user (i.e., a person, not a machine);
- a set of natural written texts in any language that is stored in electronic form and allows its use, completion, correction, discussion through telecommunications and computerized search.

Very often people in need to fill in/write a document but not knowing how to do it search in the internet for 2 or more variants, look it through, compare and make a necessary compilation i.e. work with linguistic quasi-corpus. Samples for business letters, complaints, invitations, writing essays, annotations, etc., demonstrated on various websites also can be considered as quasi-corpus for a given situation. It shows that prototype of linguistic quasi-corpus in a free form has been existed for a long time. Novoresume – a free resume builder [4] can be mentioned as an example.

Methodology. Application of of situative vocabulary and linguistic quasi-corpus by the author and their potential in relevance to the aims of learning and educational tasks for different cases are demonstrated and analyzed.

Results and discussion. It is obvious that improvement of professional and multicultural environment language competence demands consideration of correlated with different situations and different languages for different cultural environments speech model needs a methodical system for developing speech competence, the idea of which is being worked out by the authors.

The first step in development of the system was suggestion that one can use thematic vocabularies (glossaries) including terms and lexicological units common to different disciplines. Group e-mail can serve an example of a network resource available for corrections and comments to all members of the group (learners as well as teachers) can contain the glossaries. When developing the thematic vocabularies it resulted in of situative vocabulary (vocabulary for the situation). For example, “a table demonstrating what lexic-grammatical structures match which motives of speech activity” and many others [5] at first can serve as a good supplement for students of non-humanitarian specialization to communicate, then it can be extended (by students or teacher), unified if necessary and used to perform a variety of educational or learning tasks.

Use of of situative vocabulary are augmented by new opportunities due to current development of information and communication adds for. First of all, elaboration of of situative vocabulary (for foreign language) nevertheless improves and broadens own vocabulary of the learner in native language. Ways and situations of application of various linguistic constructions can be thoroughly discussed by learners via different associated chat rooms, blogs, forums, etc., thus they not only improve understanding of one or other lexicological unit but develop communicative skills as well.

When somebody wants to share experience gained or the aroused problem to be solved by others, to find out ways being encouraged they can initiate discussion not only as necessity to fulfill learning/educational task but free due to various circumstances they were involved in obviously increasing interest and motivation [6]. Another wide and fruitful area of of situative vocabulary application is project activities of learners.³ They can extend or updated and unify, develop new of situative vocabulary, illustrate them, make small videos, etc.⁴

³ Careerblog. Available from: <https://novoresume.com/career-blog> (accessed: 01.10.2021).

⁴ Uplifting Motivation Article Collection. Available from: <https://www.motivation-for-dreamers.com/motivation-article.html> (accessed: 05.10.2021).

Language and behavior mistakes are often associated with cultural differences consequently education under multicultural conditions improves language skills and also helps learners to behave correspondingly. Unsurprisingly, next came of situative vocabulary compilation for abovementioned linguistic-cultural situations. On one hand for cultural differences not understanding and knowing proper samples or modes learners communicate in definite situations using noncorresponding expressions which on the other hand can be perceived by interlocutors as rude hurtful communication mode resulting in failure of communication unfortunately. Compilation of situative vocabulary for a definite situation is to serve as a solution for the situation. In this case questioning focus groups for which the tool is compiled should be considered as the first step. A questionnaire can be used to draw attention to reflection of the situation peculiarities in the focus group culture of. It should for sure contain questions revealing the situation as completely as possible. Development of proper questionnaire and a crucial role thereby has a teacher or another expert also plays a great role in solving the problem.

Establishing relevant links and then selection of necessary expressions can be performed via comparison of the questionnaire cultural and linguistic situation information. Learners can use simply the resulting of situative vocabulary distributed among them or a teacher can use it as described above for educational purposes. Paying a visit to somebody of local residents people just come to the country especially from Asia or similar culture countries are often confused starting conversations. Thus, often resulting in the situation visitors being considered as rough intolerant persons and preventing not only making friends but even terminates communication. A questionnaire presented below in Table can serve an example of the first step on the way of solution to the problem.

What people say starting a visit

Situations presented in the questionnaire	For your country/culture	For the host country/culture
Greeting formal/informal		
Introduction of new comers formal/informal		
Introduction of hosts formal/informal		
Other obligatory phrases formal/informal		

Encouraging learners to offer matter for discussion and questions of interest one can get a large variety of situations covered. Some columns of the questionnaire will be filled easily without discussion, the other via hot discussion the teacher moderating it (focusing on relevant information/expressions) and helping to communicate (giving lexica to be polite and convincing) as well. Nevertheless, the more learners do themselves the better. The work should motivate and assist learners to gain information “about the host country/culture” on the one hand and make it possible to them presenting native country/culture, on the other hand.

Classmates inclusion in work with the of situative vocabulary [7] can be considered as further step in developing multiculturalism. Influence on learners emotivity in the telecommunicative media via of situative vocabulary and linguistic quasi-corpus in order to develop tolerance gives us another scope for application of the abovementioned tools [8].

The approach is based on research of V.I. Shakhovsky [9] and criteria of tolerant and intolerant behavior designed by G.U. Soldatova [10].

The laws of neurolinguistics say that positive or negative environment as well as proper attitude towards different events and phenomena can be fostered via vocabulary of individual i.e. the abovementioned tools are very helpful for the case. Especially it is important for groups/net communities of young people [11].

Situative vocabulary and linguistic quasi-corpus can also be used for some special goals in continuous education. It is obvious that language (mostly English) is one of the crucial points in the field. Learners in continuous education need specialized resources in English (another language in interest) for adequate translating, acquiring, mastering, brushing up foreign language. Also by means of the tools strengthening in competitive global education market positions as well as increase in the attractiveness of national educational institutions abroad and promotion of their efficiency as exporters of education can be reached.

Moreover detailed comparison of certain native language speech situation samples and modes with farther compilation of vocabulary in foreign language promotes development of learners communicative skills in mother tongue. Preceding or following work of that type revealed of situative vocabulary and linguistic quasi-corpus application methods effectiveness in a wide range of areas. Also should be mentioned motivating factor of interaction in ICT media familiar to learners that increases the intensity of the activities and promote their effectiveness [11].

However, studies of new opportunities offered by the abovementioned tools are currently at the process. Authors prognosticate wide dissemination to the perspective and highly demanded area of research and practical activities in the nearest future.

Conclusion. Relatively high application effectiveness for the tools for wide range of learning and educational tasks is already demonstrated. Furthermore, significant improvement can be reached in future while realizing great potential of abovementioned ICT-tools application. However, further theoretical and practical investigations are in demand being of international scale mostly.

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Professional development e-course on how to integrate interdisciplinary approach into the learning process in schools that practise multimodality and use interactive educational online services

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Abstract. *Problem and goal.* The problem of implementation and realization of interdisciplinary approach in the learning process at schools is demonstrated. The goal of this research is to create professional development e-course for teachers, which can include practical approaches to integrate interdisciplinarity and to develop multimodality through the application of online services. *Methodology.* The practical research is carried out based on organizing an experimental (93 people) and control (71 people) groups of students in different ages (4–8th grades) and disciplines. The students from an experimental group are taught by the teachers who took part in the designed e-course. These teachers use practice-based methods and strategies to integrate interdisciplinary approach in the lessons of Geography, Mathematics, Russian, English, Social Studies and Literature in a primary school. They apply online services such as Padlet, Zoom and Google Tools as well. Analysis of interdisciplinary skills level is carried out with the help of control diagnostics before and after the experiment. *Results.* The tools for the integration of interdisciplinary approach and the application of online services in educational process have appeared to be effective. The evidence of this conclusion is the toolbox with methodological interdisciplinary materials and resources which has been created for the learning process with the help of online services which can help students develop transfer skills, creative and critical thinking. The tools and services demonstrated in this research allow students and teachers to develop agency, i.e. the ability to be responsible for their life, in particular for their learning, to make a choice and to have a voice. They also help increase motivation to the process of learning. Such tools and online services can play a significant role for informatization of the learning process because they have an impact on the development of students’ multimodality. *Conclusion.* The results allow to identify the effectiveness of the implementation and integration of interdisciplinary approach in educational process, especially in the framework of narrow disciplines, with the help of online services. Teachers, who had taken part in a designed professional development e-course, used strategies and tools, online services in practice. The students demonstrated an enhanced level of creative and critical thinking and transfer skills during control diagnostics after the research.

Keywords: online services, informatization of education, interdisciplinary approach, multimodality

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Разработка курса профессионального развития по реализации междисциплинарного подхода в школах с использованием интерактивных онлайн-сервисов, обеспечивающих развитие мультимодальности в образовательном процессе

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Аннотация. *Проблема и цель.* Предлагаются способы решения проблемы внедрения и реализации междисциплинарного подхода в образовательный процесс, в частности в узконаправленные предметы. Цель исследования – разработка онлайн-курса профессионального развития для учителей, в котором могли бы реализоваться практические подходы развития междисциплинарности и мультимодальности через использование онлайн-сервисов с дальнейшим применением и экспериментальным подтверждением эффективности соответствующего подхода в практической деятельности учителя. *Методология.* Осуществлено практическое исследование на основе формирования экспериментальной (93 человека) и контрольной (71 человек) групп школьников разных предметов и возрастных групп (4–8 классы). Обучение школьников экспериментальной группы проводилось учителями, принимавшими участие в онлайн-курсе, с применением практических методов и приемов, способствующих внедрению и реализации междисциплинарного подхода на уроках географии, математики, русского и английского языков, окружающего мира и литературного чтения, а также с использованием онлайн-сервисов Padlet, Zoom Google Tools. Анализ уровня междисциплинарных навыков школьников осуществлялся при помощи диагностик метапредметных умений и критического и креативного мышления. *Результаты.* Показано, что предложенные инструменты и приемы для реализации междисциплинарного подхода и применение онлайн-сервисов в образовательном процессе эффективны. Обоснованием служит создание банка методических материалов и инструментов для уроков с внедрением междисциплинарного подхода и онлайн-сервисов – помощников, способствующих более высокому и эффективному результату в развитии метапредметных умений и навыков критического и креативного мышления школьников. Предложенные инструменты и сервисы способствуют развитию субъектности учащихся, то есть способности брать на себя ответственность за собственное учение, делать осознанный выбор и высказывать свою точку зрения, и развивают мотивацию, что ведет к вовлечению в образовательный процесс. Они могут играть значительную роль для информатизации систем обучения школьников, так как оказывают непосредственное влияние на развитие мультимодальности учащихся. *Заключение.* Экспериментально подтверждена эффективность предложенного подхода к внедрению и развитию междисциплинарности в образовательном процессе в рамках обучения узконаправленным предметам с использованием онлайн-сервисов. Учителя, прошедшие онлайн-курс, активно внедряли инструменты и применяли онлайн-сервисы на практике, а школьники показали повышенный уровень навыков креативного и критического мышления и метапредметных умений в рамках проведения контрольных диагностик.

Ключевые слова: онлайн-сервисы, информатизация образования, междисциплинарность, мультимодальность

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Problem and goal. The modern world, in which technologies are developing much faster than generations are changing, requires us to be flexible, make decisions quickly, and take responsibility for our development.

Until recently, we said that we live in a VUCA world (V – volatile; U – uncertain; C – complex; A – ambiguous). Some time ago, Jamie Cascio, a historian, anthropologist, is among the top 100 global thinkers of our time according to the rating of the magazine “Foreign Policy”, proposed a new concept to describe modern realities: BANI world (B – brittle; A – anxious; N – nonlinear; I – incomprehensible¹).

Linking these two concepts, we can see that constant variability logically turned into fragility, uncertainty gave birth to anxiety, complexity led to nonlinear thinking, and ambiguity turned into incomprehensibility. Such a world forces us to radically change all systems – from global trade networks and information to personal connections [1]. These changes should be based on a deep understanding of the interrelationships and integration of knowledge and skills from different disciplines and fields to solve real life problems. Undoubtedly, the changes should also affect education [2].

For example, new Federal State Educational Standards, unlike previous versions, focus on the development of students’ “soft” skills: to perceive a stressful situation as a challenge requiring countermeasures; to assess the level of stress, correct decisions and actions taken; to formulate and assess risks and consequences, to create experience, to be able to find positive in the situation that has occurred; to be ready to act in the absence of guarantees of success; basic research skills; working with information; emotional intelligence. An important role in the new standards is given to the concept of “interdisciplinary approach.”²

Professor, Doctor of Philosophy B.G. Kapustin in his article for the magazine “Kommersant”³ mentions that “interdisciplinarity is a method of research and pedagogical work that integrates data, tools, techniques, concepts of two or more specialized disciplines in order to advance the understanding of fundamental problems or answer questions the study of which goes beyond the capabilities of each individual discipline”. I.T. Kasavin, a Soviet and Russian philosopher, a specialist in the theory of cognition, philosophy of science, philosophy of language,

¹ Lerner E. *Simply about difficult: what is BANI world?* (In Russ.) Available from: https://cetru.ru/category/stil_zhizni/prosto-o-slozhnom-cto-takoe-bani-mir-/ (accessed: 03.02.2022).

² *Federal State Educational Standards*. Russian Ministry of Education. Available from: <https://www.garant.ru/products/ipo/prime/doc/401333920/> (accessed: 10.03.2022).

³ Kapustin B.G. Interdisciplinarity opens the way to a new state of knowledge. *Kommersant*. 28 July 2017. (In Russ.) Available from: <https://www.kommersant.ru/doc/3367606> (accessed: 03.03.2022).

writes that “interdisciplinary interaction is the natural state of any science” [3]. An interesting description of interdisciplinarity is also given by Edgar Morin, a French philosopher and sociologist. He says that “interdisciplinarity can only mean that different disciplines sit down at a common table, just as different nations gather at the UN solely to assert their own national rights and their sovereignty in relation to the encroachments of a neighbor. But interdisciplinarity can also strive for exchange and cooperation, and as a result it can become something organic...” [4].

Interdisciplinary learning is based on academic disciplines, but at the same time expands and deepens them by combining facts, concepts, methods and means of communication [5]. Such integration contributes to the search and creation of new effective solutions to real existing problems. The use of an interdisciplinary approach has benefits for all participants in the learning process [6]. For example, in the International Baccalaureate system, interdisciplinarity and interdisciplinary teaching and learning are very important. The benefits for students, teachers, as well as for the direct development of an educational institution are clearly highlighted.

Benefits for students:

- allows students to use knowledge from different disciplines;
- develops a deeper understanding and high-level thinking;
- develops mental flexibility;
- allows to look at real existing problems from different angles;
- demonstrates the need for collaboration and group work;
- allows to develop and apply transfer skills (i.e. the transfer of knowledge and skills from one discipline to another);
- involves students to look for solutions to real-world local, national and global problems.

Benefits for teachers:

- develops a holistic understanding and vision of the educational program;
- expands cooperation between teachers of different disciplines, thereby developing a common vision and values of education;
- allows teachers to integrate the content of different subjects, thus developing deeper authentic (close to real life) and challenging tasks for students;
- encourages teachers to reflect and process content, methods, strategies, technologies to achieve high results.

Benefits for schools:

- creates opportunities for the development of an effective broad connected and integrated educational program;
- creates an atmosphere in which diversity of viewpoints and opportunities are recognized;
- contributes to the development of an educational program dedicated to conscious service;
- creates opportunities for the development of agency of the school community (the concept of agency includes three components: the ability to express your point of view, the ability to choose and the ability to take responsibility);
- encourages cooperation between a school and learning communities;
- forms a unique school culture.⁴

⁴ *Middle Years Programme Interdisciplinary teaching and learning in the MYP (for use from September 2021/January 2022)*. Geneva: IBO; 2021.

However, despite the obvious benefits of an interdisciplinary approach, the key position of interdisciplinarity in educational system, the new requirements of the Federal State Educational Standards, the opportunities of international education systems, will require a serious growth in the professional level of a teacher not only in the field of broad horizons and the ability to lead students to new understandings at the intersection of disciplines, but also the highest level of information literacy, since due to the large flow of online services products that can be used for educational purposes, the main problem is to choose the most effective tools that could be adapted to any goal and age group [7]. Thus, there is currently insufficient experience in creating online advanced professional development courses for teachers of different age groups, considering the interdisciplinary approach and effective use of online tools for educational purposes for the development of multimodality of schools.⁵

Methodology. The research described in this article was based on several basic assumptions. Digital transformation, scientific and technological progress, and the active growth of the IT sphere require the teacher to immediately and continuously develop and adapt his practical activities and strategies to modern realities, which means constant improvement of his qualifications

While researching the market offering a variety of courses, including online, advanced training for teachers, the following problems were identified: the duration of the course did not always correspond to the possibility of mastering the material (too short and saturated or too stretched, filled with not always useful information that can be applied), a large amount of theoretical base without the possibility of practical application, complex online resources in English that are not always available to a Russian-speaking teacher.

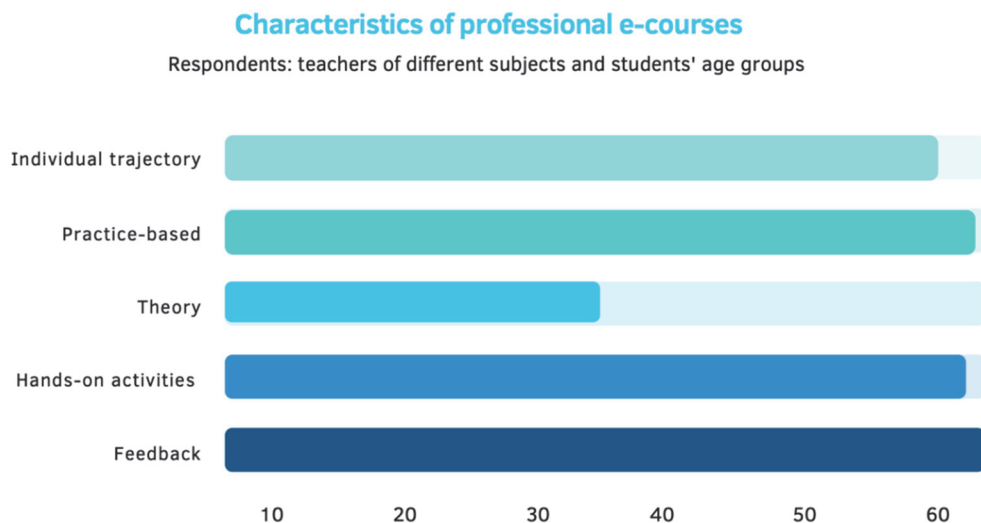


Figure 1. Results of a survey among teachers on crucial characteristics of professional e-course

⁵ Temmen M. *BANI vs VUCA – a new acronym for a new world*. Available from: <https://marian-temmen.medium.com/bani-vs-vuca-a-new-acronym-for-a-new-world-59c7be2dddce> (accessed: 10.03.2022).

In addition, a number of courses have been found, offering mass training for all students, often without feedback and individualization in the learning process. The conducted survey (Figure 1) among teachers of different age groups and disciplines showed that such courses are less in demand, because today, despite the fact that we are all involved in the learning community, teachers work in completely different school contexts and often absolutely identical teacher questions require an individual approach, taking into account the characteristics, context and contingent of the educational institution in which a particular teacher works [8].

On the other hand, what courses could attract a teacher today? It was revealed that the requirements for advanced professional development courses are as follows: flexible, diverse content, the use of practice-based approach, the development of an individual trajectory of each participant, considering his individual characteristics: the level of knowledge, the style of educational activity, etc., individual feedback, the ability to ask a question not in a chat, but in an online conversation in real time, etc. In addition, one of the main reasons for choosing an online course by a teacher was the online platform on which the course was developed.

Criteria of different online-services



Figure 2. Comparison of different online services

The survey results show that the online platform should be in Russian, accessible and intuitive to use, the structure of the course should be traced, as well as the possibility of long file storage and easy access to materials after completing the course. This request was included in the development of criteria of choosing an online course platform. Further, a study of several online services for the design and main platform of the e-course was conducted. Google Docs toolkit, including Google Classroom, Padlet online service, Edmodo platform, Moodle service are included in this study. Figure 2 represents the results of identifying the advantages and disadvantages of these online services and platforms, decomposed by criteria.

The next step is the choice of the topic of our e-course. As we have revealed earlier, educational standards call the teacher to use an interdisciplinary approach in the basis of the educational process. However, when searching the Internet,

a small number of online courses were found aimed at a deep understanding of interdisciplinarity, and most importantly, including practical tasks [9]. Basically, such courses are offered in English, including workshops and trainings from the International Baccalaureate Organization. However, these courses are quite specific and are aimed at mastering this approach in the context of this international educational system.

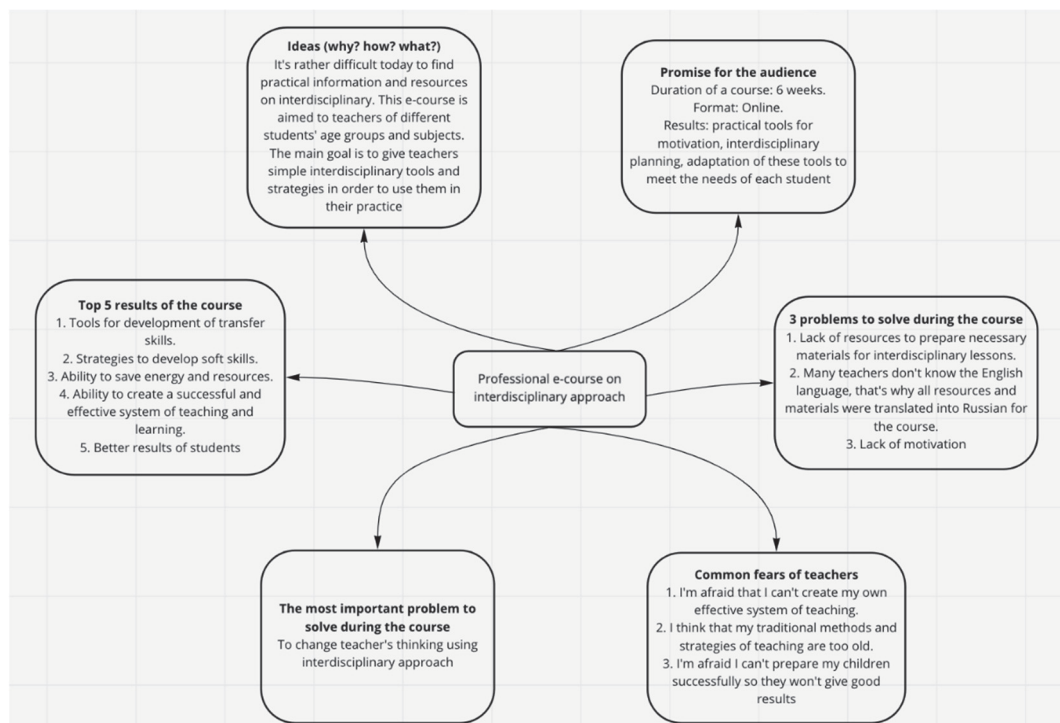


Figure 3. The constructor of the e-course

Within the framework of the conducted research, new methods and a set of tools for an e-course were developed, based on an interdisciplinary approach in teaching and learning and using convenient and effective online services for the development of multimodal skills and the integration of this experience into the learning process. A constructor of e-course was developed in the framework of this research (Figure 3).

The main objectives of the course were:

- formation of an understanding of a holistic interdisciplinary system;
- development of an action plan for the formation of an interdisciplinary atmosphere;
- application of a cycle of interdisciplinary inquiry in practice;
- creation of a planner for interdisciplinary inquiry.

The following services were selected for the design of the e-course: Padlet, and when developing the course, we will take into account the possibility of adding a Zoom video conference service, since we need to organize group practical online work, as well as real-time communication to answer questions and exchange opinions; Google Tools (in particular, Google Docs and Jamboard) will be an integral part of the online course.

The main idea underlying the research is the use of a practice-based approach, which will allow the participants of the e-course not only to get involved in the study of theoretical material, but also to take a part in the development of interdisciplinary inquiry. The use of this technology can allow teachers taking part in the course to immediately transfer the experience gained into their professional activities.

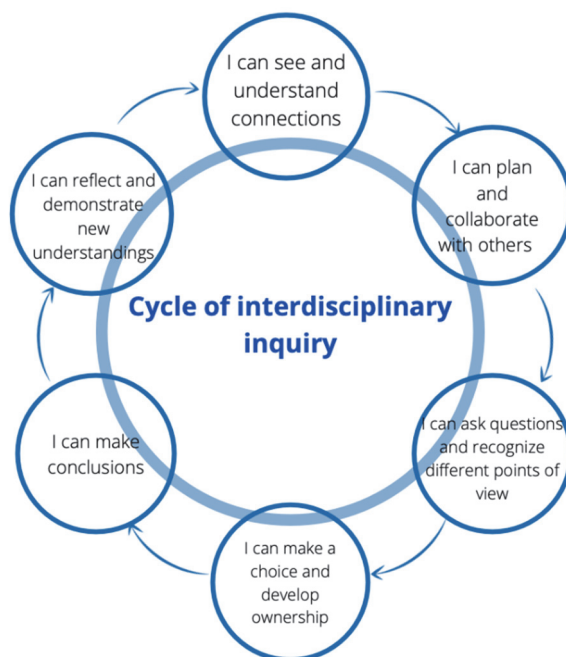


Figure 4. The cycle of interdisciplinary inquiry

During this research and design of the course, the cycle of interdisciplinary inquiry (Figure 4) was created, which became the basis for the modular system of the online course (that is, each stage of the cycle was one module of the course). A planner for interdisciplinary inquiry has also been designed, which participants will have to fill out during their own group and individual practice within the course. The result of the course will be the development of an interdisciplinary inquiry by the participants using a cycle and a developed planner. This result and the materials obtained can be immediately put into practice as part of their lessons.

Experimental studies of the effectiveness of this online e-course were conducted in several schools in Moscow with students of different ages (4th, 6th and 8th grades). In general, 5 teachers in the following disciplines took part in the experiment: Geography, Mathematics, Russian and Literature, English and Social Studies, as well as 164 schoolchildren. During the experiment the planner, interdisciplinary cycle and the materials developed during the course were applied, as well as the online platform used for the development of students' multimodality.

Results and discussion. During the experiment, students were divided into control and experimental groups, for each of which separate data were collected and processed during all stages and types of experimental verification.

The control group included a total of 71 students, the experimental group – 93 students. All types and stages of experiments, as well as the methods used,

educational and control materials were aimed at identifying transfer skills of the student developed during the collaborative design of interdisciplinary inquiry in the areas of Mathematics, Russian and Literature, Geography and English, Social Studies in primary school, as well as using selected online services that will contribute to effective individualization, the development of multimodal skills and high-quality timely feedback.

The students of the control group studied for five weeks according to traditional educational program without using an interdisciplinary approach as a fundamental one. The students of the experimental group created interdisciplinary inquiries where they explicitly and implicitly applied skills and knowledge from different disciplines and created new understandings. They applied the planner for interdisciplinary inquiry, which allowed them to structure the information obtained during the process of learning, as well as a cycle of interdisciplinary inquiry, which contributed not only to the integration of knowledge and skills from one subject to another, but also provided the opportunity to develop emotional intelligence, personal qualities, empathy, as well as the proposed online services that allowed involve students in the inquiry with their interactivity and develop information literacy skills and multimodality [10]. After the inquiry, students of the control and experimental groups were asked to undergo control diagnostics. The diagram shows the generalized results of the experiment (Figure 5).

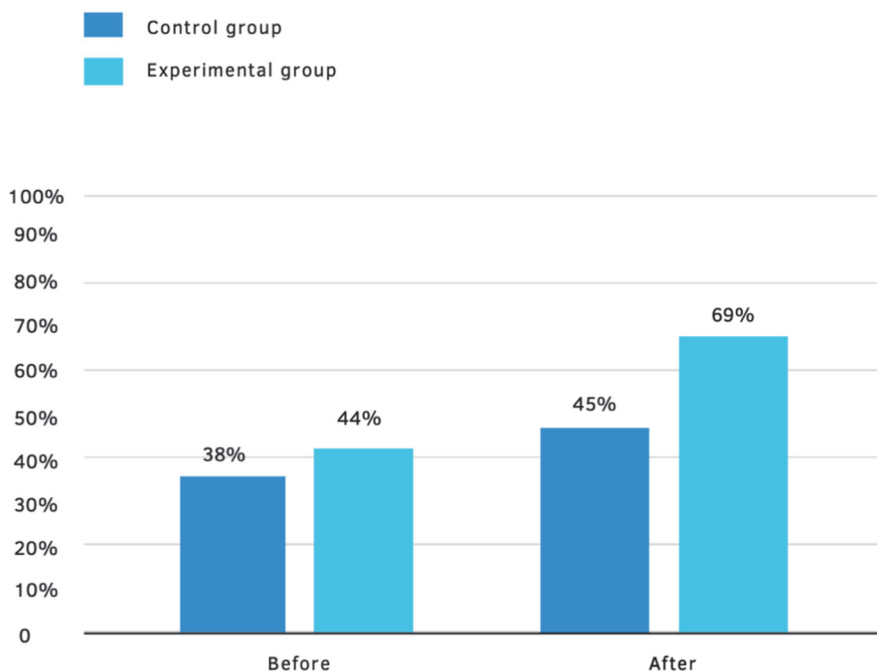


Figure 5. The diagram showing the generalized results of the experiment

The experiment showed that the students of the experimental group demonstrated a significant advantage in the development of transfer skills as well as creative and critical thinking compared to the students who made up the control group. The students who conducted the inquiry using the materials of the e-course passed the control diagnostics better. It was revealed that the students of the ex-

perimental group formed a deeper understanding of the studied material. In addition, according to expert assessments of teachers who conducted an interdisciplinary inquiry with their students, an increase in motivation and involvement in the learning process of students was demonstrated.

Conclusion. A professional development e-course for teachers on how to integrate an interdisciplinary approach into the learning process, materials developed during the course, selected online services have shown their effectiveness. To be more precise, the application of an interdisciplinary approach in narrowly focused lessons, the collaborative planning of teachers, the use of convenient online services in the learning process can significantly increase the effectiveness of students in school disciplines, develop transfer skills, as well as creative and critical thinking, better understand subjects and their diversity, apply the experience gained to solve real life issues, student involvement in the learning process. It is reasonable to develop a cycle and a planner for interdisciplinary inquiry, which allow structuring the educational process in this context, as well as the choice of online services, which contributes to the development of multimodality of students and increase the process of informatization of schools. An effective method is when the participants of the online course are involved in practical activities and take a role of students who develop a particular inquiry, use a cycle and planner, try online services. The developed e-course for teachers on how to integrate an interdisciplinary approach into the learning process, using selected online services, can play a significant role in the development of approaches for informatization of teaching at schools, as well as the implementation and realization of an interdisciplinary approach.

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ПЕДАГОГИКА И ДИДАКТИКА ИНФОРМАТИЗАЦИИ PEDAGOGY AND DIDACTICS IN INFORMATIZATION

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УДК 378.1

Научная статья / Research article

Использование флэш-карт как средства развития вербальной креативности студентов

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Аннотация. Проблема и цель. Развитие языкового разнообразия, распространение творческих идей при иноязычном общении – ключевые направления международной деятельности, поддерживаемые на уровне ООН. Важным условием эффективности любого диалога является вербальная креативность. Подготовка личности к профессиональному творческому мышлению, преодолению словесных стереотипов происходит в профессионально-ориентированной коммуникации. Предлагается в преподавании для развития вербальной креативности студентов использовать интерактивные ресурсы флэш-карт. **Методология.** Обучение с помощью флэш-карт основывается на методе Лейтнера. Флэш-карты как тематические карточки с изображением предметов (понятий) используются для развития речи (словарный запас, морфология, словообразование, синтаксис, звуковая сторона речи) и для психологических процессов, ведущих к новым результатам (беглость, оригинальность, гибкость). Проводится специально разработанное тестирование, включающее блоки «Словарный запас», «Морфология», «Словообразование», «Синтаксис», «Звуковая сторона речи», «Фигурный тест Торренса». Экспериментальное исследование выполнено в Вятском государственном университете при изучении курсов «Электронные ресурсы в профессиональной деятельности», «Иностранный язык». Задействованы 60 студентов первого курса по направлению подготовки «Психология» (бакалавриат). Для создания флэш-карт применяется ресурс Lexilize. Статистическая обработка результатов произведена с помощью критерия хи-квадрат Пирсона. **Результаты.** Студенты изучают сервисы по созданию флэш-карт, применяют их для обработки нового материала, запоминания и представления понятий, словообразования в разнообразных контекстах. Выявлены статистически достоверные различия в качественных изменениях, произошедших в системе по уровням развития вербальной креативности. **Заключение.** Описаны особенности представленного варианта применения флэш-карт в обучении: сочетание с другими средствами (мобильными приложениями, тренажерами, инфографикой) и традиционными формами передачи информации; межпредметные связи. Сформулированы правила, выполнение которых обеспечивает эффективность использования флэш-карт для развития вербальной креативности.

Ключевые слова: творчество, языковое многообразие, лингводидактика, креативность речи, интерактивный сервис, Lexilize

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The use of flash cards in teaching as a means of developing students' verbal creativity

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Abstract. *Problem and goal.* Development of linguistic diversity, creative ideas in foreign language communication are key areas of international activity supported at the level of the United Nations. An important condition for effectiveness of any dialogue is verbal creativity. Preparation of the individual for professional creative thinking, for overcoming verbal stereotypes takes place in professionally-oriented communication. The authors suggest using interactive resources of flash cards in teaching to develop students' verbal creativity. *Methodology.* Teaching a foreign language using flash cards is based on the Leitner method. Flash cards as thematic cards depicting objects (concepts) are also used for development of speech (vocabulary, morphology, word formation, syntax, pronunciation), and psychological processes leading to new results (fluency, originality, flexibility). The testing developed by the authors is carried out, it includes the parts "Vocabulary," "Morphology," "Word formation," "Syntax," "Pronunciation," "Tolerance figure test." An experimental study was conducted at Vyatka State University during the study of the disciplines "Electronic resources in the professional activity," "Foreign language." 60 first-year students studying psychology (bachelor degree level) are involved. The Lexilize resource is used to create flash cards. Statistical processing of the results was performed using Pearson's chi-square test. *Results.* Students study services for creating flash cards, use them to process new material, memorize and present concepts, word formation in a variety of contexts. Statistically significant differences in the qualitative changes that occurred in the system according to the levels of development of verbal creativity were revealed. *Conclusion.* The features of the presented version of using flash cards when teaching are described: combination with other means (mobile applications, simulators, infographics) and traditional forms of information transfer; interdisciplinary connections. Rules are formulated, implementation of which ensures effectiveness of using flash cards for development of verbal creativity.

Keywords: creativity, linguistic diversity, linguodidactics, speech creativity, interactive service, Lexilize

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Проблема и цель. Генеральная Ассамблея ООН провозгласила период с 2022 по 2032 г. Международным десятилетием языков коренных народов мира. Это событие, во-первых, направлено на то, чтобы мобилизовать ре-

сурсы для их сохранения, возрождения и продвижения¹. Во-вторых, провозглашение «десятилетия языков мира» является одним из важных результатов деятельности ЮНЕСКО в направлении активизации международного сотрудничества, стимулирования диалога наций. В-третьих, разработаны рекомендации, регулирующие как именно государства должны содействовать развитию информационной среды для глубокого анализа современных проблем и тенденций развития языков мира, для внедрения научных разработок в образовательный процесс.

В рамках реализации этих рекомендаций проходят международные мероприятия по разработке новых подходов к развитию иноязычного общения. Например, тренинг по формированию навыков креативного и инновационного мышления, организованный Кластерным Бюро ЮНЕСКО в Алматы для сотрудников Молодежных ресурсных центров. В рамках тренинга рассматривались концепции творческого мышления в цифровом мире, изучались эффективные техники генерации идей и нестандартного решения задач средствами информационных технологий.

И. Сур, М. Атеш на экспериментальных данных доказывают, что изучение лингвистических дисциплин способствует повышению уровню развития у студентов креативных способностей, обогащению внутреннего мира и повышению самооценки [1]. Одновременно с этим, в Международную программу по оценке образовательных достижений учащихся (PISA) в 2021 г. впервые в качестве одного из ведущих компонентов вводится оценка креативного мышления². В рамках исследования особую группу составляют «задания на вербальное самовыражение».

Одно из направлений работы педагога-психолога в современной образовательной среде предполагает деятельность по развитию способностей нахождения за минимальное время максимально точных и эффективных речевых средств для результативного общения с человеком любого возраста, интеллектуального уровня, материального и социального статуса. По мнению Н.В. Верхорубовой, богатство речи, словарного запаса является, проявлением речевой креативности [2]. Эта способность человека в работе, согласно Е.Ю. Завершневой, рассматривается как умение легко и свободно аргументировать, влиять на людей и вести их за собой [3]. Т.А. Барышева доказывает, что развитие речевой креативности – важное условие формирования творческого, инновационного мышления [4].

Х. Ван изучает особенности развития и совершенствования творческого мышления при изучении иностранного языка, а именно речевого процесса [5]. Он рассматривает творческое мышление через единство развития его как в качественно-содержательном, так и в процессуальном направлениях. Методика развития творческого мышления при обучении должна опираться на следующие принципы: деятельность, индивидуальность, последовательность, поэтапность, цикличность, психологический комфорт, сотрудничество.

¹ UNESCO: building peace in the minds of men and women. Towards the international decade of indigenous languages. Available from: <https://ru.unesco.org/idil2022-2032> (accessed: 25.02.2022).

² Programme for International Student Assessment. Available from: <https://www.oecd.org/pisa/> (accessed: 25.02.2022).

Дж.Л. Ортега-Мартин и соавт. разработали и представили понятие «креативизация», подразумевающая методическую и теоретическую категорию в процессе изучения иностранного языка [6]. Понятие «креативизация» охватывает концептуальные идеи и основные принципы, подходы к активизации творческого мышления.

Формирование вербальной креативности как «способности преодолевать словесные стереотипы на конечном этапе мыслительного синтеза и широты поля ассоциаций» является, по мысли Е.В. Дудоровой и С.В. Шумковой, одной из актуальных задач системы высшего образования в России [7]. Подготовка высококвалифицированного специалиста, востребованного на международном рынке труда, предполагает ориентированность на обучение выпускника, не только владеющего системой специальных знаний по учебным дисциплинам, но и способного преобразовывать окружающую действительность [8]. Иностранный язык входит в базовый цикл гуманитарных дисциплин, изучаемых на многих уровнях образования, в том числе на этапе высшего образования. Это, как обосновывают Н. Йемез и К. Дикилиташ, означает, что перед педагогом встает задача формирования у обучающихся как коммуникативных умений (аудирования, говорения, чтения и письма), языковых навыков (фонетических, лексических, грамматических), так и социокультурной осведомленности [9].

Я. Ин, Д. Марчеллин и Г. Виджая в своем исследовании описывают путь развития нового цифрового дидактического средства – флэш-карты [10]. Ими рассматриваются разнообразные примеры: использование стикеров с иностранными переводами (приклеивались на предметы дома); возможности презентации или плакатов в формате «*.pdf»; средства для мобильных устройств. Они обосновывают утверждение, что сегодня преподаватели могут и должны предлагать своим студентам такой эффективный цифровой инструмент для запоминания, развития творческого мышления, как флэш-карта.

С. Малик и соавт. отмечают, что в современном мире компьютерных технологий существуют программы для запоминания, основанные на методе Лейтнера [11]. При этом программное средство использует показатели «забывание», «повторение»; ведет подробную статистику; «перекладывает» карточки из одной ячейки в другую [12]. Эти особенности необходимо учитывать при проектировании образовательной среды на основе цифровых технологий, при реализации дидактического потенциала интерактивных средств. Полезно использовать опыт внеклассной работы (например, факультативов, центров развития, киностудий) для создания обучающих фильмов или флэш-карт [13].

Анализ перечисленных научных трудов позволяет выявить *проблему*, связанную с необходимостью дополнительного изучения вопросов развития вербальной креативности студентов в цифровой образовательной среде. Представлено исследование, направленное на обоснование эффективности флэш-карт при обучении студентов как средства развития их вербальной креативности.

Методология. Применялись следующие методы: теоретический анализ и обобщение литературы при обзоре научных теорий по креативности; выделение основных критериев, условий и современных средств для разви-

тия вербальной креативности. В исследовании использовались флэш-карты различного назначения: для настольных игр (Shooter, Tic Tac), квестов (Role Play cards, Black cab), мобильных телефонов (Quizlet, Anki и Lexilize Flashcards), модификации на компьютере (Free Printable Flash Card Maker). Например, Role Play cards – набор из 60 карточек для развития навыков разговорной речи на уроках английского языка. Каждая карточка предлагает ситуацию, в которой действующими лицами являются два студента/две группы людей.

Проанализированы различные цифровые сервисы для создания собственных флэш-карт: онлайн-генератор³, мобильное приложение⁴, Quizlet, Anki и др. Особенностью Quizlet является то, что сервис можно использовать в нескольких режимах: закрепление материала и объединение карточек («модулей») в курсы. После изучения новой теории, можно на время искать пары карточек, пройти тест или вводить ответ самостоятельно. Anki – самый простой в подготовке набора карточек. Во время заучивания слов можно использовать доску, делать заметки и сохранять. Потом скачивать все на телефон и работать оффлайн.

Lexilize Flashcards предлагает эффектный пользовательский интерфейс, различные игры («Догадайся», «Вспомни» и «Создай пару»). Можно придумать свою игру для запоминания. После того, как ученик выучит новый набор слов, приложение через какое-то время предлагает повторить старый материал.

В качестве критериев для отбора использованы следующие критерии: тип технологии (облачная/онлайн или оффлайн), финансовая основа (бесплатная/коммерческая), функциональные возможности (типы интерактивных заданий, возможность создавать свои карты и их распечатывать), интерфейс и дизайн. На основе аналитической работы выбран сервис Lexilize Flashcards. Его достоинства: работа без Интернета; автоматическое произношение всех изучаемых слов и фраз; заучивание только «своих» слов и фраз с системой интервальных повторений; импорт слов из файлов Excel; поддержка 118 языков; неязыковые категории (медицина, математика, история) и др.

Работа с флэш-картами проектируется с учетом принципов системно-деятельностного подхода к обучению: при составлении набора слов происходит понимание взаимосвязей, принципов и алгоритмов словообразования; активизируются внимание и память; развивается воображение; формируются навыки систематического контроля и самоконтроля.

Для получения актуальных сведений об эффективности применения флэш-карт при обучении как средства развития вербальной креативности студентов применяются эмпирические методы:

– наблюдение за коммуникацией всех участников взаимодействия (например, за одну минуту объяснить простое слово);

³ Kids Flashcards. Бесплатный онлайн-генератор развивающих карточек для обучающих занятий. URL: <https://kids-flashcards.com/ru/online-flashcards-maker> (дата обращения: 25.02.2022).

⁴ Lexilize Flashcards. Приложение для изучения слов – всегда в кармане! URL: <https://lexilize.com/ru/> (дата обращения: 25.02.2022).

- анализ ответов в ситуации профессионального общения (переговоры, трудоустройство, заключение контракта);
- обсуждение результатов работы с флэш-картами (каким образом соединены две карточки между собой или как изображение на карте соотносится со словом);
- количество слов/фраз, использованных студентом, при работе с флэш-картой в процессе изучения материала;
- время на запоминание новых слов;
- объем и соответствие использованных функциональных возможностей сервисов по созданию флэш-карт для развития вербальной креативности и т. д.

Для оценки входных условий использовано тестирование, включающее следующие блоки «Словарный запас» (60 баллов), «Морфология» (10 баллов), «Словообразование» (10 баллов), «Синтаксис» (12 баллов), «Звуковая сторона речи» (12), «фигурный тест Элиса Пола Торренса». Также применяются вспомогательные методы компьютерной обработки данных: оформление в виде таблиц, диаграмм, графиков, презентаций и pdf-файлов.

В фигурном тесте Торренса используются три задания, ответы на которые оформляются в виде рисунков и подписей к ним. Далее анализировались баллы по критериям «беглость», «оригинальность», «абстрактность названия», «сопротивление замыканию» и «разработанность». Общая сумма была поделена на пять.

Итак, в результате первоначальной диагностики каждый студент набирал от 30 до 174 баллов. Для определения уровня сформированности вербальной креативности (по сумме всех шести блоков) были введены уровни «плохо» (от 30 до 49 баллов), «ниже нормы» (от 50 до 89 баллов), «норма» (от 90 до 149 баллов), «выше нормы» (от 150 до 173 баллов), «отлично» (более 174 баллов).

Экспериментальное исследование проведено на базе Вятского государственного университета при изучении курсов «Электронные ресурсы в профессиональной деятельности» и «Иностранный язык». Были задействованы 60 студентов с первого курса по направлению 37.03.01 «Психология» (уровень подготовки – бакалавриат). Средний возраст респондентов составил 19 лет (78 % девушек и 12 % юношей).

Статистическая обработка результатов выполнена при помощи критерия χ^2 (хи-квадрат) Пирсона.

Результаты и обсуждение. Всеобщая Декларация о культурном разнообразии, принятая ЮНЕСКО⁵, направлена не только на защиту исчезающих языков, но и определяет спектр мероприятий, которые страны/государства, должны реализовывать: сохранение языкового наследия человечества, распространение творческих идей; поощрение языкового разнообразия, воспитание уважения к родному языку, популяризация изучения нескольких языков. В ходе аналитической работы с литературой обосновано, что:

⁵ Всеобщая декларация ЮНЕСКО о культурном разнообразии. URL: https://www.un.org/ru/documents/decl_conv/declarations/cultural_diversity.shtml (дата обращения: 25.02.2022).

- развитие языкового разнообразия, содействие распространению творческих идей, включение цифровых ресурсов в обучение иностранным языкам – инициативы, поддерживаемые на уровне ЮНЕСКО;
- наличие креативного мышления определяет многие профессиональные компетенции будущих специалистов;
- креативность речи – способность личности к творческому мышлению;
- обучение иностранному языку обладает мощным дидактическим потенциалом для развития вербальной креативности;
- в современном образовательном пространстве появляются новые цифровые средства, которые создают дополнительные условия для развития креативности в целом и вербальной креативности в частности.

Основная цель эксперимента заключалась в проверке эффективности использования флэш-карт для развития вербальной креативности студентов. На подготовительном этапе эксперимента педагогом были проанализированы современные достижения лингводидактики относительно потенциала цифровых сервисов, интерактивных средств для обучения, а также определено, что развитие креативности при изучении языка предполагает подготовку личности к творческому мышлению. В качестве средств для обеспечения дополнительных условий по развитию вербальной креативности принято решение применять флэш-карты, которые могут использоваться и в аудитории, и в онлайн-режиме, и при индивидуальном обучении.

Обучающимся на этапе первоначальной диагностики предлагалось ответить на вопросы методик из шести блоков (описаны в методологии исследования). Результаты измерения, проведенного до начала эксперимента, представлены в таблице.

Результаты измерений по уровню развития вербальной креативности

Уровень	Группы			
	Экспериментальная (30 студентов)		Контрольная (30 студентов)	
	До эксперимента	После эксперимента	До эксперимента	После эксперимента
Плохо	3	1	3	2
Ниже нормы	6	2	7	8
Норма	14	8	13	12
Выше нормы	5	8	5	5
Отлично	2	11	2	3

The results of measurements on the level of development of verbal creativity

Level	Groups			
	Experimental (30 students)		Control (30 students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Bad	3	1	3	2
Below the norm	6	2	7	8
Norm	14	8	13	12
Above the norm	5	8	5	5
Excellent	2	11	2	3

Второй этап эксперимента посвящен изменению структуры занятий в соответствии с целью исследования. Преподаватель в рамках дисциплины

«Электронные ресурсы в профессиональной деятельности» изучал цифровой сервис для создания флэш-карт/использования готового набора. Затем на занятиях по иностранному языку изучались разделы лексики и грамматики.

На третьем этапе исследования при организации практической работы, научно-исследовательской и творческой деятельности обучающимся было предложено оформить в виде набора флэш-карт изученные понятия, новые слова и устойчивые выражения. В качестве компьютерной программы студент мог использовать Lexilize Flashcards, но также был свободен в своем выборе и мог применить другой цифровой сервис.

Флэш-карты – тематические карточки с изображением предметов или понятий, представленные в электронном виде. Эффективность использования флэш-карт для развития вербальной креативности проверялась при обучении специалистов, чья будущая профессиональная деятельность предполагает решение задач в сфере образования, здравоохранения, культуры, спорта, управления, социальной помощи населению.

Вербальная составляющая креативности измеряется как с точки зрения развития речи (словарный запас, морфология, словообразование, синтаксис, звуковая стороны речи и др.), так и с позиции психологических процессов, ведущих к новым результатам (фигурный тест Торренса).

По логике программы исследования на занятиях по дисциплине «Электронные ресурсы в профессиональной деятельности» студенты изучали сервисы для работы с флэш-картами. Примеры заданий, которые они выполняли в программной среде:

1. Составьте наборы слов по теме/категории в виде текстового документа и в формате электронного листа.
2. Установите приложение для работы с флэш-картами.
3. Изучите интерфейс и функциональные возможности: выбор родного языка и языка для изучения, выбор типа подписки (бесплатно/премиум), изучение готовых категорий слов и добавление новых, редактирование слов.
4. Оформите флэш-карты для изучения нового материала (например, для изучения биографии ученого-психолога, списка новых профессий).
5. Выполните игровые задания по закреплению и систематизации: игры «Догадайся!», «Вспомни», «Найди пару».
6. Примените наборы карточек в конкретной ситуации общения (консультация психолога, разрешение конфликтов и т. п.).

Конкретные практические результаты, которые отмечали окончание практической деятельности в сервисе по работе с флэш-картами:

- 1) теоретические знания об интерактивных средствах в профессиональной деятельности;
- 2) формирование умений использовать готовые флэш-карты и создавать собственные. Понимание практической ценности продуктов данного сервиса для решения будущих профессиональных задач;
- 3) собственные наборы флэш-карт, отражающее специфику предмета.

Далее обучающиеся экспериментальной группы применяли флэш-карты в изучении иностранного языка. Рассмотрим пример упражнения на основе флэш-карт для развития креативности речи. Педагог рисует звезду и у каждого конца выкладывает флэш-карта. Задача участника – объяснить сущность

предмета, явления с помощью своих флэш-карт. Например: «Психолог» – это специалист, который получил высшее гуманитарное образование по направлению подготовки «Психология»; «Психолог» – это Зигмунд Фрейд. Такая игра способствует умению объяснять слова на английском языке и на поздних этапах обучения.

Пример другого (комбинированного) упражнения «Что взять с собой на необитаемый остров». Для студентов педагогом подготавливается набор флэш-карт, из которых они должны выбрать только три. Эти флэш-карты – символы тех предметов, которые они обязательно возьмут с собой на воображаемый остров. Участники также могут аргументировать, почему сделали именно такой выбор. Сначала обучающиеся принимают решение самостоятельно. Затем они объединяются в пары, где необходимо единогласно решить, какие именно флэш-карты (предметы) стоит взять с собой. Далее идет работа в мини-группах по 4 человека, затем – по 8 и т. д. (в зависимости от размера класса). В итоге коллектив должен принять решение единогласно.

Студенты из контрольной группы изучали программные средства для создания флэш-карт в рамках дисциплины «Электронные ресурсы в профессиональной деятельности». Однако специально-организованной деятельности по включению флэш-карт для развития беглости, гибкости и оригинальности речи на занятиях по иностранному языку не было. Обучающиеся контрольной группы изучали материал по упражнениям и заданиям из рабочих программ. Пример упражнения: на бумажном листе/в электронном виде обучающимся предъявлялись слова. Студенты из контрольной группы должны были объяснить, с чем связано каждое слово. Например: профессия – это дело (трудовая деятельность), которым занимается человек; профессия – это дело, занимаясь которым человек получает средства к существованию; профессия – специальность; профессия – Родину защищать.

На фиксирующей стадии эксперимента вновь проводилось тестирование по методикам из шести блоков (эти данные также представлены в таблице).

В данном случае гипотезы формулируются следующим образом.

H0: уровень вербальной креативности в экспериментальной группе статистически равен уровню обучающихся в контрольной; H1: уровень в экспериментальной группе выше уровня контрольной группы. Далее в онлайн-ресурсе подсчитаны значения критерия до ($\chi_{\text{набл.1}}^2$) и после ($\chi_{\text{набл.2}}^2$) эксперимента. Для $\alpha = 0,05$ по таблицам распределения $\chi_{\text{крит}}^2$ равно 9,488. Таким образом, $\chi_{\text{набл.1}}^2 < \chi_{\text{крит}}^2$ ($0,114 < 9,488$), а $\chi_{\text{набл.2}}^2 > \chi_{\text{крит}}^2$ ($9,997 > 9,488$). Следовательно, сдвиг в сторону повышения уровня вербальной креативности обучающихся экспериментальной группы, можно считать неслучайным.

Выполняя количественный анализ полученных данных, можно сделать вывод, что после завершения эксперимента у 37 % студентов в экспериментальной группе уровень сформированности вербальной креативности оказался «высоким» (11 обучающихся из 30), в то время как первоначально он был равен 7 % (2 респондента из 30). Количество обучающихся с уровнями «ниже нормы» и «плохо» существенно понизилось с 30 до 10 %. Для контрольной группы зафиксировано следующее: показатель по уровню «отлично» качественно изменился с 7 до 10 %, а по уровню «плохо» – с 10 до 7 %.

Из функциональных возможностей сервисов по созданию интерактивных карточек и наборов флэш-карт, оказывающих положительный дидактический эффект на развитие вербальной креативности, участники эксперимента отметили: использование аккаунтов всемирных социальных сетей; возможность повторения слов, импорта из электронных таблиц; создание своих категорий слов; работа на компьютере и в мобильном приложении. Также в обсуждении были выделены следующие направления для совершенствования сервиса:

- на карточках со словом на изучаемом языке изменить месторасположение кнопки для озвучивания слов;
- настроить приложение так, чтобы демонстрировалась сначала одна сторона карточки, а потом другая. То есть сначала пользователь переводит с русского на английский, а затем с английского на русский.

Выделены следующие дидактические возможности флэш-карт применительно к обучению в условиях развития современной цифровой образовательной среды: активное участие в процессе изучения иностранного языка; дидактические игры с включением цифровых сервисов; развитие творческого мышления, речи, интеллекта; систематизация и обобщение материала; новые формы контроля; возможность учиться самостоятельно.

Последнее приобретает особую значимость в условиях подготовки высококвалифицированных специалистов будущего. Действительно, участники экспериментальной группы получали дополнительные условия для тренировки концентрации внимания и памяти, воспитания самомотивации, развития критического мышления, получения опыта самостоятельного планирования работы.

Материалы исследования соответствуют принципам ООН и ЮНЕСКО относительно необходимости развития языкового разнообразия, содействия распространению творческих идей, включению цифровых ресурсов в обучение. Кроме того, практические результаты исследования могут применяться в рамках международных мероприятий по внедрению новых подходов для развития иноязычного общения (например, в тренингах, конференциях по обмену опытом). Сформулированные выводы дополняют заключения С. Лаи и соавт. относительно потенциала флэш-карт для индивидуального подхода и групповой работы [14]. Кроме того, полученные результаты расширяют представления М. Ван Дийк и соавт. относительно спектра дидактических средств для развития креативности речи [15].

Заключение. В представленном исследовании креативность рассматривается применительно к речи как умение говорить оригинально, нестандартно, интересно. И, как следствие, вербальная составляющая креативности измеряется как с точки зрения развития речи (словарный запас, морфология, словообразование, синтаксис, звуковая сторона речи), так и с позиции психологических процессов, ведущих к новым результатам (беглость, оригинальность, гибкость). Отличительная особенность предложенного подхода состоит в следующем: флэш-карты – это и средство изучения (в курсе «Электронные ресурсы в профессиональной деятельности»), и средство обучения (на занятиях по иностранному языку), и новый инструмент самовыражения. Напри-

мер, с помощью флэш-карт, разработанных в сервисе Lexilize Flashcards, студенты подготовили тематический сюжет по профориентации для абитуриентов.

В других случаях флэш-карты активно применялись на других учебных дисциплинах: моделирование психологических ситуаций, проблем общения, биографические описания. Метод флэш-карт также применялся на занятиях по арт-терапии как поддержка самопознания в комфортной атмосфере.

При обобщении результатов педагогического эксперимента были сформулированы правила, выполнение которых обеспечивает эффективность применения флэш-карт для развития вербальной креативности обучающихся:

1) не рекомендуется механическое зачитывание информации, содержащейся на флэш-карте. Целесообразно использовать игровые приемы, подключать мимику/жесты, приводить аналогию, применять другие визуальные средства (анимацию, скетчи), аргументировать свою позицию;

2) рекомендуется использовать готовые наборы флэш-карт только на начальном этапе обучения. Гораздо эффективнее в плане развития креативности речи – создавать и обогащать свою систему флэш-карт. Прежде чем приступить к разработке такой системы, нужно ответить на ряд вопросов: насколько регулярным будет использование флэш-карт, является ли набор универсальным или узко профессиональным; как следует объединять карточки по категориям; какой период обновления содержания флэш-карт;

3) работа с флэш-картами должна поддерживать личностное и профессиональное развитие;

4) полезно подключать мнемотехнику. Динамические изображения в инфографике положительно влияют на формирование навыка языковой догадки, активизирующей цепочку мыслительных операций. Мнемонику эффективно применять при изучении новых слов (заучивании), преобразовании слов в образы (кодировании), образовании связей между опорными и запоминаемыми образами (запоминание);

5) желательно произносить ответы (надписи на флэш-картах) вслух. Этот прием делает запоминание более ярким, так как подключает аудиальный канал;

6) не следует рассматривать флэш-карты как универсальное дидактическое средство.

Флэш-карты – эффективный инструмент воздействия, стимулирования, активизации учебной деятельности, но не единственный и имеющий определенные ограничения по применению. Оптимальным вариантом представляется объединение этого метода с другими, традиционными или инновационными: тесты, учебники, изучение грамматики и правил с преподавателем в аудитории, общение с носителями языка, обучающие видео.

Таким образом, включение флэш-карт в обучение способствует развитию вербальной креативности студентов. Материалы исследования свидетельствуют о том, что применение флэш-карт при обучении позволяет обеспечить дополнительные условия для развития творческих возможностей человека.

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Research article / Научная статья

Application of information technologies as a significant factor in the formation of conceptual thinking of schoolchildren

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Abstract. *Problem and goal.* The article is aimed at identifying factors in the development of conceptual thinking of schoolchildren in the conditions of informatization of education. The rapid informatization of society and education makes modern teachers look for new ways to form the conceptual thinking of students, while involving the latest information and communication technologies. There is a problem of determining the role and place of conceptual thinking in the evolution of a digital society, identifying effective domestic and foreign electronic educational resources that contribute to the formation of conceptual thinking in children of different ages. *Methodology.* A model for the formation of conceptual thinking of secondary school students based on an electronic course in Spanish has been created. Experimental training of schoolchildren was carried out using educational electronic resources, the development of which was completed on the basis of taking into account the provisions of this model. *Results.* It is experimentally substantiated that the positive dynamics of the formation of the readiness of primary school students to use terminological structures is due to the identified pedagogical conditions, the introduction of the proposed teaching methods and informatization tools. As a result of the experiment, schoolchildren revealed the improvement of conceptual thinking and an increase in motivation for communication. *Conclusion.* The use of the created and tested electronic textbook helps to increase the efficiency of the formation of conceptual thinking in primary school students in the framework of teaching a foreign language. The development of conceptual thinking using a foreign language can be carried out by taking into account the described pedagogical conditions, which provide for the widespread use of modern information technologies.

Keywords: information technologies, conceptual thinking, schoolchildren, information competence, digital competence, electronic educational resource

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Применение информационных технологий как значимый фактор формирования понятийного мышления школьников

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Аннотация. *Проблема и цель.* Выявляются факторы развития понятийного мышления школьников в условиях информатизации образования. Стремительная информатизация общества и образования заставляет современных педагогов искать новые пути формирования понятийного мышления учащихся, привлекая при этом новейшие информационно-коммуникационные технологии. Существует проблема определения роли и места понятийного мышления в эволюционировании цифрового общества, обнаружения эффективных отечественных и зарубежных электронных образовательных ресурсов, способствующих развитию понятийного мышления у детей разного возраста. *Методология.* Разработана модель формирования понятийного мышления учащихся основной школы на основе электронного курса по испанскому языку. Проведено экспериментальное обучение школьников с применением образовательных электронных ресурсов, созданных с учетом положений указанной модели. *Результаты.* Экспериментально обосновано, что положительная динамика сформированности готовности учащихся основной школы к использованию терминологических конструкций обусловлена принятием во внимание имеющихся педагогических условий, внедрением предложенных методов обучения и средств информатизации. В результате эксперимента у школьников зафиксировано развитие понятийного мышления и повышение мотивации к коммуникации. *Заключение.* Использование созданного и апробированного электронного учебного пособия способствует повышению эффективности формирования понятийного мышления у учащихся основной школы в рамках обучения иностранному языку. Развитие понятийного мышления с использованием иностранного языка можно осуществить благодаря учету описанных педагогических условий, предусматривающих широкое применение современных информационных технологий.

Ключевые слова: информационные технологии, понятийное мышление, школьники, информационно-цифровая компетентность, электронный образовательный ресурс

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Problem and goal. The Russian education system has recently been undergoing constant changes. The modernization of the educational process systematically leads each teacher to understand the need to search for such pedagogical technologies that could interest students and motivate them to study the subject. Motivation is the most important component of the structure of educational activity, and developed internal motivation is the main criterion for a person. It lies in the fact that the child enjoys the activity itself, the importance of its immediate result for the individual [1].

The strategy for the development of education directs the activities of teachers and scientists to search for alternative models for the organization of education and the formation of a safe educational environment in the context of informatization. Digital technologies have become essential components of the new educational environment at all levels of the education system, which led to the emergence of new requirements for all participants in the educational process, especially teachers and students [2]. One of the key components of the new formation school formula is an innovative type of education based on the formation of competencies necessary for successful self-realization in society [3], among which are mathematical and information-digital competence. In turn, one of the components of mathematical competence is the culture of logical and algorithmic thinking [4], which, no doubt, plays one of the key roles in the formation of a conscious person who is confident in his judgments and is able to think logically not only within the framework of exact disciplines and apply the skill in any area of its activity. A necessary component of such a skill is conceptual thinking, that is, a certain minimum of logical operations necessary for each intellectual person to operate with basic and fundamental concepts.

The need to master the skill of conceptual thinking of a person in the 21st century is indicated in the digital competence framework of citizens DigComp 2.0. The rapid informatization of society and education makes modern teachers look for new ways to form the conceptual thinking of students, while involving the latest information and communication technologies (ICT) [5].

In this regard, there is a *problem* of determining the role and place of conceptual thinking in the development of a digital society, identifying effective domestic and foreign electronic educational resources that contribute to the development of conceptual thinking in children of different ages. The solution of such a problem will make it possible to substantiate the possibility and expediency of using information technologies to solve pedagogical problems related to the formation and development of conceptual thinking in schoolchildren.

M.K. Akimova, V.T. Kozlova and N.A. Ferens the specificity of conceptual thinking was considered, which consists in operating with concepts, judgments, conclusions based on the laws of logic [6]. Part of the research is devoted to the study of didactic conditions for the formation and development of conceptual thinking and considers various approaches to organizing the formation of conceptual thinking in schoolchildren [7].

O.V. Bulatov and V.I. Koroleva argue that the modernization of the education system is aimed at shaping a person who is able to solve problems in non-standard conditions, flexibly and independently use the acquired knowledge in a variety of life situations. In this regard, the main task of the school is to provide conditions for the development of the personality of each student, the key competencies that form the basis of the ability to learn and the system of fundamental elements of scientific knowledge that underlie the modern scientific picture of the world. Teaching scientific knowledge at school determines the development of scientific concepts. Learning success is directly related to this type of thinking [8].

In the article by V.E. Steinberg emphasizes not only the importance of developing conceptual thinking, but also the need to find effective teaching aids. Regardless of the chosen direction of study, it is important to take into account

the development of conceptual and graphic visual aids in the form of visual didactic regulators. However, the literature review conducted in the article [9] proves a clear lack of research and development in the field of didactics of the conceptual-graphic type. However, the improvement in the functionality of conceptual and graphical tools is explained by the application of the principles of cognitive-visual representation of knowledge and the method of logical-semantic modeling.

As emphasized by S.A. Gilmanov, in the scientific works of psychologists and teachers, the phenomenon of conceptual thinking and the methods of its formation are considered very versatile and deeply. However, there are practically no approaches to the study of this side of conceptual thinking in humanitarian activities, including pedagogy and psychology. The importance of the competent use of concepts in reasoning, in solving intellectual problems is also spoken by experts in the development of critical thinking. This method is also actively used in the practice of foreign language education [10].

The goals of teaching a school course in a foreign language are formulated based on the general goals of the educational process in general educational institutions, as well as on the features of the discipline as a science, its place and role in the life of the modern information society and in the system of sciences [11].

In the curricula for the middle classes of general educational institutions, the goals for the development of conceptual thinking are formulated in the following form:

- development of logical, systemic thinking and the main types of mental activity: the ability to use induction, deduction, analysis, synthesis, draw conclusions, generalizations;
- formation of a theoretical knowledge base of students about the processes of transformation, transmission and use of information, disclosure of the meaning of information processes in the formation of basic concepts;
- development of the ability to solve meaningful problems of different levels of complexity, using well-known theoretical positions and logic within the framework of operating with basic concepts.

One of the recent pedagogical innovations is the use of symbolic systems, the integration of which into the educational process is developing in parallel with the growth of informatization. Modern children are audiovisual by nature, so they remember what they hear by 15%, see by 25%, and when these processes are combined, the level of memorization increases to 65% [7]. In this regard, it becomes possible to widely use ICT for the development of conceptual thinking, memory, imagination, and attention of students in average schools. However, the use of only one type of ICT in teaching a foreign language to children in secondary school may reduce interest in the process. Therefore, it is important to take into account the pedagogical possibilities of the above-described ICT for the development of conceptual thinking (Table 1).

Today, there are many examples of the use of ICT aimed at developing conceptual thinking in a playful way, and world practice shows that the number of relevant resources is constantly growing, their quality is improving, and the audience of users is expanding. The importance of the development of conceptual thinking for a modern person is indicated by the presence of complex electronic resources that allow you to train the logic of thinking at any age to develop the skill of operating with concepts. One of the reasons for this need is the influence of

the same digital technologies, which, in particular, are characterized by huge amounts of information and a decrease in the concentration of users' attention [12].

Table 1

**Possibilities of the main types of ICT in the process of learning
a foreign language of children of secondary school age**

Functions	Type of ICT						
	For studying			For the development of types of speech activity			
	Phonetics	Grammar	Vocabulary	Listening	Reading	Writing	Speaking
E-books	–	+	+	+	+	–	–
Sites	–	+	+	+	+	–	–
E-dictionaries	–	–	+	–	+	+	–
Mobile applications	+	+	+	–	–	–	+
Presentations	+	+	+	+	+	–	–
Video footage	+	–	+	+	–	–	+
Simulators	+	+	+	–	+	+	+
Computer programs	+	+	+	–	+	+	–
Game programs	+	+	+	–	+	+	–

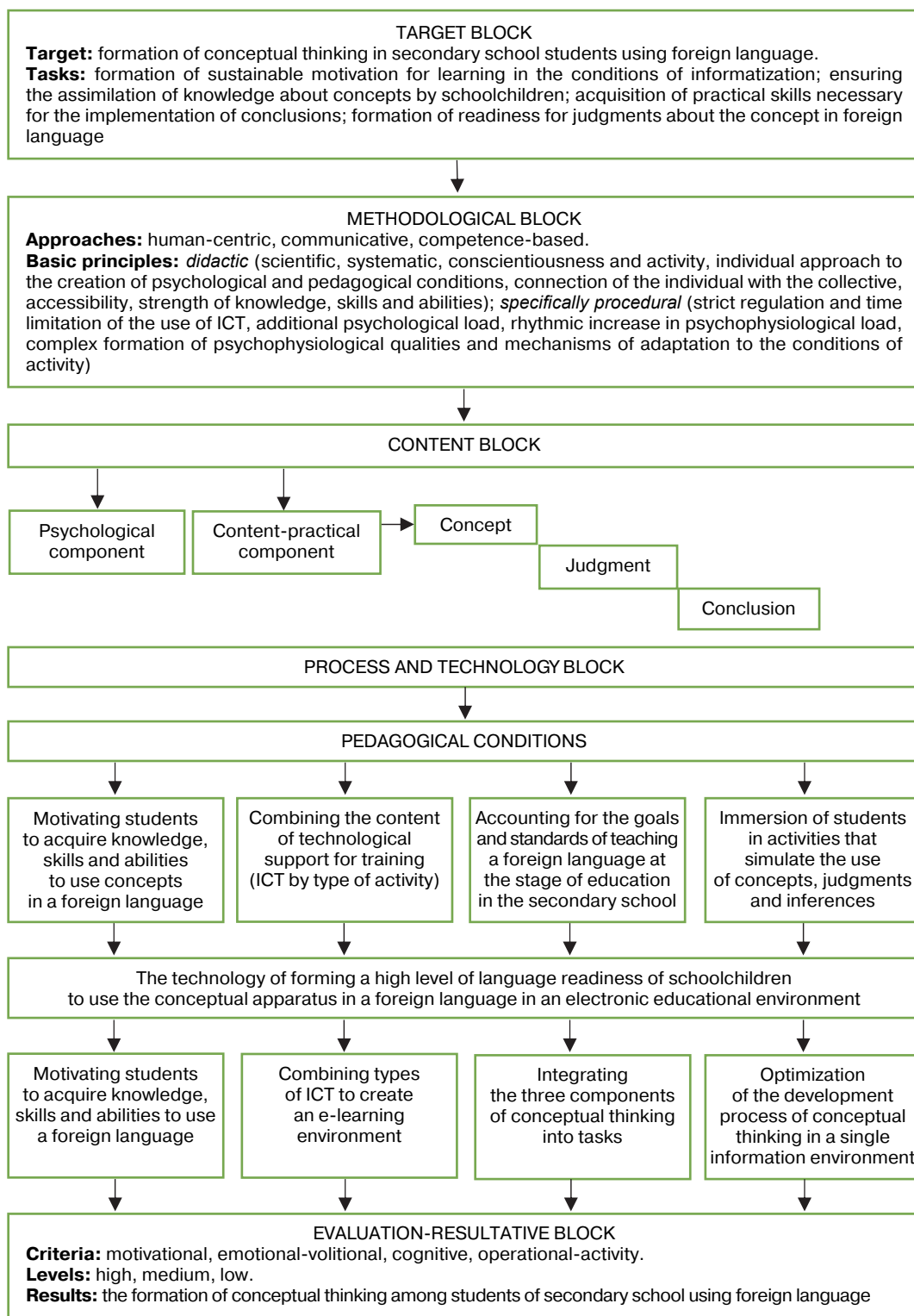
The development of conceptual thinking is devoted to multi-vector sites with databases on basic concepts in any field of science, services with tasks for the development of non-standard thinking, riddles, etc. Note that very often on such resources, tasks are not dynamic or interactive, but are presented in text form, and the answers to them are hidden and submitted after the condition [13].

Of course, the development of conceptual thinking of students of different ages is inextricably linked with the study of basic concepts [14]. Therefore, ICT can be used situationally, during the development of non-standard training sessions or extracurricular activities. For example, the world-famous resource LearningApps,¹ which contains dozens of templates for developing learning tasks, including logic, which has powerful functionality for developing various tasks, will be an excellent tool for a creative teacher [15].

In the course of the study, the assumption is substantiated that the use of sign-symbolic means in the learning process forms the conceptual thinking of students, facilitates the assimilation of material when studying complex concepts.

Methodology. On the basis of the above theoretical provisions, a model for the formation of conceptual thinking of elementary school students was developed on the basis of an electronic course in Spanish. The model of the formation of conceptual thinking of secondary school students in the study of the Spanish language is presented in the form of a schematic representation of the didactic process aimed at forming the conceptual thinking of secondary school students to use information support tools based on both well-known general didactic principles and specific procedural principles. A schematically proposed model of informatization of teaching a foreign language for the formation of conceptual thinking of secondary school students is shown in Figure 1.

¹ LearningApps. Available from: <https://learningapps.org/> (accessed: 14.12.2019).



Model of informatization of teaching a foreign language for the formation of conceptual thinking

This approach can be very useful for people with poor foreign language training, as it provides an opportunity to improve knowledge of a foreign language with an emphasis on acquiring listening and speech skills to learn how to

operate with previously learned concepts. It is especially important to develop a positive motivation for learning a foreign language among students, as well as to form the ability and readiness to use the skills of conceptual thinking in teaching a foreign language [16]. The use of information and communication technologies in practical classes in the discipline “Foreign Language” contributes to a more successful formation of the conceptual thinking of primary school students.

The use of ICT in practical classes in a foreign language includes:

- educational resources of the Internet;
- electronic dictionaries and reference books;
- DVDs and CDs;
- video and audio equipment;
- multimedia presentations.

Results and discussion. Within the framework of this study, the results of an experimental verification of the effectiveness of the use of information technologies for the formation of conceptual thinking in schoolchildren are presented [17]. The analysis of the presented learning technology based on the methodology of modeling educational processes and creating an information educational environment was carried out based on the results of a mathematical assessment of the effectiveness of the results obtained.

Table 2

**Assessment of the levels of formation of oral skills
in the assessment of conceptual thinking by students of grade 5**

Criteria	Indicators	Score		
		3	2	1
Structural organizational chart	1. The ability of students to compose their own statement of three parts	The statement has three clearly distinguished parts: thesis, proof, conclusion	A statement has two parts: a thesis with proof or proof with a conclusion	The statement consists of one part or a list of non-essential arguments
Content characteristic	1. Ability to discover new concepts in one's own statement	The statement includes five or more detailed micro-themes about a new concept (semantic field)	The composition of the statement includes 3–4 abbreviated semes	In the statement, 1–2 semes are outlined, which are represented by separate parts of the concept under consideration
	2. The ability to identify and reveal cause-and-effect relationships in the semantic field	The proof is solid, consistent, detailed. With a sufficient (3–4) number of arguments in which causal, temporal, conditional relationships are transmitted	The proof is sequential, with at least 3 arguments, in which cause-and-effect relationships are conveyed	The statement lists insignificant arguments that reveal cause-and-effect relationships
Ways of connection between sentences and parts of one's own statement	1. Ability to use various types of communication	Between sentences, a causal or parallel relationship is established that unites them	A causal relationship is established between sentences	A formal-logical connection is established between sentences
	2. Availability of language means of communication	Parts of the statement are interconnected by plug-in modal words, unions	Parts of the statement are connected to each other only by conjunctions	Parts of the statement are not connected to each other even by conjunctions
Volume of own statement	1. The presence in the statement of sentences of various composition, and their quantitative and verbal content	The presence in the statement of sentences, among which are complex subordinates of various types, impersonal; the average number of words is 50–40	The presence in the statement of sentences, among which there are complex (reasons), compound; average number of words – up to 35	The presence in the statement of sentences, among which there are simple, compound, or only the contracting part of a complex contract sentence; average number of words – up to 25

The purpose of the study was to determine the forms and level of development of conceptual thinking among 120 students of the 5th grade of general education schools. The students were divided into two groups – experimental (EG) and control (CG). The methodology for assessing the levels of development of language skills in the course of assessing the conceptual thinking of fifth graders is presented in Table 2.

In order to identify the effectiveness of introducing technology into the educational process, proposed by the author as part of the study of a foreign language, classes were organized in an electronic learning environment based on a number of educational principles. In CG No. 1, classes were conducted according to the traditional principle of education: schoolchildren studied according to a program that did not provide for the use and combination of traditional lessons and ICT. In the second EG, classes were conducted according to the proposed communicative-oriented pedagogical language technology, taking into account the human-centric, competence-based and communicative approaches to learning using an electronic manual and applying appropriate pedagogical conditions. The training took place in three stages: propaedeutic, professionally oriented, control.

During the formative stage of the experiment, a retest of the questionnaire and survey was carried out in the CG and the EG to determine the levels of formation of the psychological component according to motivational and emotional-volitional criteria in accordance with the selected methods. Determination of the levels of formation of the content-practical component (cognitive and operational-activity) was carried out through a post-experimental cut.

Let us consider in more detail the results obtained in terms of the level of formation of the psychological and content-practical components of the conceptual thinking of students of the basic school in the CG and the EG after the formative experiment and carry out their comparative characteristics.

So, the levels of formation of the psychological component were the first to be determined using the methodology of L.N. Vavilova [18]. Data on the result is given in the comparative Table 3.

Table 3

**Distribution of students from the CG and the EG
in proportion to the levels of formation of the psychological component of conceptual thinking
according to motivational criteria before and after the formative experiment**

Groups	Levels	Percentage value before the experiment	Percentage value after experiment	Difference, %
CG	High	18	45,5	+27,5
	Middle	72	54,5	-17,5
	Low	10	0	-10
Both		100	100	
EG	High	82	84	2
	Middle	18	16	-2
	Low	0	0	0
Both		100	100	

Analyzing the results on the levels of formation on motivational aspects in the EG, let's summarize that the level of motivation for new knowledge and the state of satisfaction with the skills of inference were at a high level before

the experiment, which amounted to 82% and, accordingly, increased by 2% after the end of the experiment. According to the comparative characteristics of the two groups from the CG and the EG, we have the following results: the percentage value of motivation in the EG is higher by 38.5%.

As part of the post-experimental cut, it was envisaged to perform a repeated comprehensive control work, the results of which are presented in Table 4. As can be seen from that table, the indicator of high and medium levels of formation of the content-practical component of conceptual thinking according to the cognitive criteria of students in the CG was 48 and 44% respectively.

Table 4

Distribution of students from the CG and the EG in proportion to the levels of formation of the content-practical component of conceptual thinking according to cognitive and operational-activity criteria after the formative experiment

Criteria	Levels	CG				EG			
		Qty of students	Average score	Total score	%	Qty of students	Average score	Total score	%
Cognitive	High	16	90	1440	48	28	93	2604	83
	Middle	14	81	1139	44	6	85	510	17
	Low	3	71	213	8	0	0	0	0
CG + EG		33		2791,8	100	34		3114	100
Average score			84,6				91,6		
Operational-activity	High	11	92	1012	32	23	91	2097,2	67
	Middle	18	76	1362,8	54	9	85	765	26
	Low	4	63	252	14	2	70	140	7
CG + EG		33		2871	100	34		3002,2	100
Average score			79,6				88,3		

Students from the EG show a positive dynamics of high-level changes, which amounted to 83% after the experiment through the introduced pedagogical conditions, namely: the combination of the content of the traditional approach and the information environment in the process of developing the conceptual thinking of students; taking into account the goals and standards of the Federal State Educational Standard for language training; “immersion” of students in the e-learning environment. It is necessary to focus on the fact that the average score of the groups of students from the CG and the EG confirmed the average level of readiness in the CG 84.6 points and the high level in the EG 91.6 points, as shown in Table 5.

Table 5

Distribution of students from the CG and the EG in proportion to the levels of formation of the content-practical component of conceptual thinking according to cognitive and operational-activity criteria before and after the formative experiment

Groups	Levels	Before forming experiment, %		After forming experiment, %		Difference, %	
		Cognitive	Operational-activity	Cognitive	Operational-activity		
CG	High	40	33	48	32	+8	-1
	Middle	47	37	44	54	-3	+17
	Low	13	30	8	14	-5	-16
EG	High	58	22	83	67	25	45
	Middle	35	46	17	26	-18	-20
	Low	7	32	0	7	-7	-25

The data in the table show that the high level of formation of the content-practical component of conceptual thinking in terms of cognitive and operational-activity criteria in the EG increased by 25 and 45% respectively, and the average level decreased by 7 and 25%. There were no significant changes in the relatively high level of students in the CG, only an increase of 8% in indicators according to cognitive criteria was recorded, a decrease in the low level by 16% and an increase in the average level by 17% according to the operational criterion were revealed.

Thus, the effectiveness of the process of learning and developing language skills, organized with a communicative-oriented pedagogical language technology for the formation of conceptual thinking of primary school students to use an electronic manual, was verified by determining the levels of formation of the psychological and content-practical components of the conceptual thinking of students in the control and, accordingly, experimental groups. These results are presented in more detail in the summary Table 6.

Table 6

The results of the formation of the psychological and content-practical components of the conceptual thinking of the students of the basic school from the CG and the EG before and after the experiment

Criteria	CG before the experiment		CG after the experiment		Diffe- rence, %	EG before the experiment		EG after the experiment		Diffe- rence, %
	Level	%	Level	%		Level	%	Level	%	
1. Motivational	High	18	High	45.5	+27.5	High	82	High	84	2
	Middle	72	Middle	54.5	-17.5	Middle	18	Middle	16	-2
	Low	10	Low	0	-10	Low	0	Low	0	0
2. Cognitive	High	40	High	48	+8	High	58	High	83	25
	Middle	47	Middle	44	-3	Middle	35	Middle	17	-18
	Low	13	Low	8	-5	Low	7	Low	0	-7
3. Operational- activity	High	33	High	32	-1	High	22	High	67	45
	Middle	37	Middle	54	+17	Middle	46	Middle	26	-20
	Low	30	Low	14	-16	Low	32	Low	7	-25

As can be seen from the presented table, we observe a growth trend in the indicators of the average level of formation of the components of the psychological and content-practical readiness of students in the CG. So, for example, the operational and activity criterion – by 17%. We observe a slight increase in a high level according to the cognitive criterion – (+8%) and the motivational criterion – (+27.5%).

The students of the EG after training on the introduced technology are dominated by a high level of all components of the basic school students to use the skills of conceptual thinking. Thus, the psychological component according to motivational criteria, having a high level in the EG before the experiment, increased by 2% after the experiment.

The effectiveness of the conducted experimental work was verified on the basis of a comparative analysis of quantitative and qualitative changes in the indicators of the experimental and control groups at the beginning of the formative stage of the experiment and after its completion. The results of the study to verify the experimental work on the profile are presented in Table 7.

Table 7

Dynamics of formation levels of conceptual thinking in secondary school students using foreign language before and after the formative experiment

Levels	Control Group					Experimental Group				
	Before the experiment		After the experiment		Increase	Before the experiment		After the experiment		Increase
	Per-sons	%	Per-sons	%	%	Per-sons	%	Per-sons	%	%
High	10	41.50	14	40.75	0.75	19	55.17	25	72.50	+17.33
Middle	15	45.67	16	49.00	+3.33	12	34.83	8	23.33	-11.50
Low	8	12.83	3	10.25	-2.58	3	10.00	1	4.17	-5.83
Total	33	100	33	100		34	100	34	100	

As the data in the table show, according to the results of the ascertaining section, 55.17% of students in the experimental group belonged to a high level of formation of conceptual thinking of students using FL, and after the formative experiment – 72.50%. There was an increase of 17.33%. Decreased by 11.5% indicators of the average level of formation of the indicated readiness from 34.83 to 23.33%. Accordingly, the number of students in the experimental group with a low level of conceptual thinking using FL decreased from 10.00 to 4.17%, with a difference of 5.83%. In the control group, the indicators of the levels of formation of students' conceptual thinking with the use of FL did not undergo significant changes. According to the results of the control section, a high level was inherent in 40.50% of students; the average covered 49%. With a low level after the ascertaining cut, they were 12.83%, and at the end of the formative stage of the experiment – 10.25%, there was a decrease by 2.58%.

Conclusion. After analyzing the principles and methods of creating an experimental manual to enhance the development of conceptual thinking in foreign language lessons, we can come to the following conclusions.

The purpose of creating an electronic manual developed within the framework of this study is the comprehensive formation of the student's skills and abilities in all types of speech activity: speaking, reading, listening and writing. The achievement of this goal should be facilitated, in particular, by a clear structure for studying new concepts in a foreign language: the division of material not only into thematic blocks (lessons), but also the same type of distribution of material within each lesson according to the type of auxiliary means of informatization of education. This approach helps to meet the needs of each student and help him achieve his learning goal.

The analysis of the results of the ascertaining section of the introduced material of the manual on activating the skills of conceptual thinking in the lessons of a foreign language confirmed the effectiveness of the work done. It is proved that the effect of the positive dynamics of the levels of formation of the readiness of primary school students to use the target structures is due to the introduction of reasonable and proven pedagogical conditions, and the experimental methodology of the electronic manual.

An analysis of the results of the formation of students' conceptual thinking using a foreign language (stating cut), found using diagnostic methods (learning motivation of students (L.N. Vavilova), author's test tasks and comprehensive control work, showed that, in general, the vast majority of students have an aver-

age (76.5%) and low (17%) levels of formation of conceptual thinking using foreign language according to criteria (motivational, cognitive, operational and activity).

An experimental verification of the correctness and high efficiency of the pedagogical conditions showed positive changes in the levels of formation of the conceptual thinking of students of the basic school towards communication.

After the formative experiment, the students of the secondary school of the experimental group showed an increase in language readiness to use a foreign language (from 55.17 to 72.50% (+17.33%)), and a decrease in the average level indicators (from 34.83 to 23.33% (–11.50%)) and low (10.00 to 4.17% (–5.83%)). In the control group, the corresponding levels did not change significantly: high (–0.75%), medium (+3.33%), low (2.58%).

The developed methodological recommendations will make it possible to form the professional readiness of primary school students using a foreign language with the help of the proposed communication-oriented and other concept-oriented learning technologies, taking into account the interdisciplinary links presented in the author's manual.

The search for opportunities for teachers to independently create electronic educational resources for the development of conceptual thinking, taking into account the peculiarities of learning using ICT in specific conditions, is an urgent problem, which will be addressed by our further research in this direction.

As a result, it was determined that the formation of conceptual thinking of primary school students using a foreign language can be carried out by providing appropriate pedagogical conditions:

- 1) motivating students to acquire knowledge and skills using a set of adapted learning informatization tools;
- 2) combining the content of the standard teaching methodology and the electronic manual during the communicative and language training of students;
- 3) taking into account the goals and standards of the Federal State Educational Standard for the language training of secondary school students;
- 4) “immersion” of students in the e-learning environment.

Appropriate pedagogical conditions will provide secondary school students with a range of skills that are necessary for the development of conceptual thinking, which will allow them to effectively apply knowledge using a foreign language in a thematic communication environment.

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ВЛИЯНИЕ ТЕХНОЛОГИЙ НА РАЗВИТИЕ ОБРАЗОВАНИЯ

EVOLUTION OF TEACHING AND LEARNING THROUGH TECHNOLOGY

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Research article / Научная статья

Shift from traditional into interactive approach: teaching monologue with the use of information and communication technologies

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Abstract. *Problem and goal.* In modern society, the fundamental priorities are both the continuous renewal and recreation of the language personality of students, and the necessary competencies and abilities for the practical application of what has been learned to solve urgent problems. The concept of the formation of a “secondary language personality” that currently exists in the methodology of foreign language education and training implies the unconditional presence of competencies, the key and most significant of which is communicative. The level of formation of communicative competence is determined by the presence of awareness in the perception of the socio-cultural portrait of the country of a foreign language; social, cultural and ethnic tolerance; speech etiquette and courtesy in communication; possibility of finding ways to resolve conflicts in communication. The above tasks take place to be implemented only if the educational process is created and maintained in the context of a dialogue of cultures. But it is impossible without the introduction of information and digital technologies into the educational process. The purpose of this study is to test the effectiveness and relevance of the application of various methods, techniques and exercises using information technology to develop students’ speech skills (in particular, monologue speech). *Methodology.* The pedagogical experiment consisted of four stages: the organization of the study, the implementation of the experiment, the identification of quantitative and qualitative characteristics of the results of experimental learning, the interpretation of the causes and factors influencing the results. *Results.* The performance of the experimental group is relatively higher than that of the control group. The explanation for these results can be the different degree of performance of groups, the level of motivation of students, as well as the technologies used in the learning process. The data of the study of the quality of monologue speech at the control stage (test-cut of the experimental group) compared with the indicators of the ascertaining stage increased by an average of 10% in all parameters. *Conclusion.* Results of the experimental and control groups



prove that the quality of the classes, the introduction of innovative and information technologies, as well as the motivation of students play an important role in the process of teaching a foreign language.

Keywords: foreign language, new technologies, education, speech, monologue


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Переход от традиционного подхода к интерактивному: обучение монологической речи с использованием информационно-коммуникационных технологий

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Аннотация. *Проблема и цель.* В современном обществе приоритетны непрерывное обновление и рекреация языковой личности обучающихся и наличие необходимых компетенций и способностей практического применения изученного для решения актуальных задач. Общеизвестно, что существующее в настоящее время в методологии иноязычного образования и обучения понятие формирования «вторичной языковой личности» подразумевает наличие компетенций, ключевой и наиболее значимой из которых является коммуникативная. Уровень сформированности коммуникативной компетенции определяется наличием осознанности в восприятии социокультурного портрета страны иностранного языка; социальной, культурной и этнической толерантности; речевого этикета и вежливости в общении; возможности поиска путей разрешения конфликтов в коммуникации. Вышеперечисленные задачи реализуются только при условии создания и ведения учебного процесса в контексте диалога культур. В этой связи следует учитывать, что осуществление диалога культур невозможно без внедрения в образовательный процесс информационных и цифровых технологий. Цель исследования – апробация эффективности и актуальности применения различных методов, приемов и упражнений с использованием информационных технологий для развития речевых навыков (в частности, монологической речи) обучающихся. *Методология.* Педагогический эксперимент состоял из четырех этапов: организация исследования, реализация эксперимента, выявление количественных и качественных характеристик результатов экспериментального обучения, интерпретация причин и факторов, влияющих на полученные результаты. *Результаты.* Показатели экспериментальной группы оказались сравнительно выше показателей контрольной группы. Объяснением могут служить различная степень успеваемости групп, уровень мотивации обучающихся и применяемые в процессе обучения технологии. Установлено, что данные исследования качества монологической речи на контрольном этапе (теста-среза экспериментальной группы) по сравнению с показателями констатирующего этапа увеличились в среднем на 10 % по всем параметрам. *Заключение.* Результаты экспериментальной и контрольной групп доказывают, что ка-

чество проведения занятий, внедрение инновационных и информационных технологий, а также мотивация обучающихся играют немаловажную роль в процессе обучения иностранному языку.

Ключевые слова: иностранный язык, новые технологии, монолог, образование, речь

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Problem and goal. Recognition of the essential destination of learning a foreign language at school, i.e. the accumulation of secondary countenance of a personality in schoolchildren indicates the compilation of not only the aptitude for intercultural communication, but also features that accord to the personality of the student [1].

The traditional approach to learning a foreign language does not completely applicable modern imperatives; accordingly, there is a necessity to assign new teaching methods, it permits students to acquire the ability to autonomously achieve knowledge and clarify communicative efforts [2].

At the current stage, the educational system should be purposed at actualizing a learning system in which the learner would not only know great deal, but that he would achieve to think with the relief of this cognition and cultivate the need for students to enlarge their accomplishment [3].

The recent aim of learning a foreign language is as integrative, concentrated on attaining a practical result in gaining mastery a foreign language, in conjunction with the education, training and maturation of the student's personality, his communication skills: consideration, cognition, imagination and motivation for supplementary language learning [4].

Student learning is punctiliously connected to motivation: learners will attain what they demanding to learn and will have big struggle in learning information in which they are impartial [5]. The actuality that, in both courses, motivating direction increased students' affection may, therefore, have subscribed to the positive consequence of activating enlightenment on student learning [6].

The monologue is consistently stained by speaker's communicative goals and demands [7]. Communicability is the main factor that arranges competence of communication on the logic-semantic degree. The monologue is pertaining to directedness to the addressee and by emotional shading which are apparently imported in linguistic features, along with in structure and arrangement. Developing speech, which is in tool of knowledge and thinking, performs important role in upbringing a well-rounded personality, and it is particularly true about advancing foreign language communication in the shape of monologue beneficial to master the language, which is closely tied with producing cognitive interest [8].

Distension of intercultural communication, assistance and commutation of scientific, professional and ethnic cognition shaped a qualitative modern technology as a communicative professionally-oriented access to teaching foreign languages, depend on teaching of students and signified communicative, ethnic, educational and devotional charges of the national character [9].

Teaching a foreign language mainly aims to learn to contact, realize and conduct the information gained. The point of a computer as part of multicultural approach to a foreign language is stand on two main technological achievements – the conception of and the global Internet multimedia technology. Multimedia technology gives opportunity to integrate various methods of transferring information in a distinct source, and the occupancy of a dynamic environment (Internet) adjusts multimedia a very effective appliance for storing and managing information. Additionally, it should be acknowledged, that visual learners attain effectively in visual representations or visual feature [10–12].

The phrase “Information and Communication Technology” (ICT) has been broadly used in education. Its huge influence attend enormous advances in various aspects of our life together with education. But recently, many aspects have appeared which encourages to affiliate ICTs into classrooms and learning perspectives [13]. Appliance of ICT positively influence the attribute of learning material, prospering speaking and listening in actual communicative level, expand writing and reading skills and advertises the development of different language skills of learners [14].

There are three fields of implying multimedia and the Internet that can turn foreign language learning to a new degree: information, communication and announcement.

The absolute benefit of using the Internet and multimedia is the perform to acquaint heuristic methods into the learning process with their assistance. The pertinence of heuristic learning is as a result of the fact in incudes “the rejection of ready-made knowledge, its reproduction” [15]. The development in the number of information demands modern man ambition, ingenuity, cureless without the capability to work formatively and autonomously. Heuristic arrangement and teaching methods assure that learners make new educational compounds is constantly preceded by the associating with creative work: planning, evaluation, control, consideration.

Methodology. To clarify the effectiveness of the teaching methodology of monologue speech implying communication and information technologies, a disciplined study was carried.

Cleric constituents of this inquiry were consumed in instructional procedure in the course of division training affinity convention in the capacity academic composition “Derivational Schoolhouse No 2” during 7 weeks. At the beginning of 21st of March till 25th of May in 2021. There were organized two learning groups: the preliminary class and the ascendancy class. As the preliminary class the 9thB is chosen and titled as experimental group EG, and 9thC group as an ascendancy class for controlling the group CG. There were organized two English lessons a week. And it comprised 14 hours for whole graduate fellowship. There were contained 4 main levels of analytical investigation. Such as:

- 1) the configuration of the research work;
- 2) performance, accompanying an arranged investigation;

3) assertion, assimilation of determinable and approximate features of the determination;

4) comprehension, a clarification of the incentive to the accomplished consequence.

Results and discussion. There was carried out an inquiry containing 10 students from each group in the first level of experiment. The aim of the survey was to clarify some problems come up with students while producing a monologue speech. This inquiry involved the attendant articles:

– psychological obstruction, i.e. concern of accomplishing a mistake, conveying something outside theme;

– awkwardness coincident with the implementation of the learnt lexical matter.

The accomplished analysis from both classes are distinguished determinable and approximate corresponding. The results are shown in Tables 1 and 2.

Table 1

The amount of learners of preliminary class, facing with sorts of problems while making monologue utterance

Preliminary class	Cognitive problems	The barriers essential to the implementation of the studied lexical component	The problems held by the use of the learnt grammatical constituent
Student 1	√		
Student 2		√	√
Student 3			√
Student 4	√		√
Student 5		√	
Student 6			
Student 7			√
Student 8	√		
Student 9		√	√
Student 10			√
Amount of students encounter problems	3	3	5
In %	30	30	50

Table 2

Learners of ascendancy group challenging with exigency during monologue speech

Ascendancy class	Cognitive problems	The barriers essential to the implementation of the studied lexical component	The problems held by the use of the learnt grammatical constituent
Student 1			√
Student 2		√	
Student 3			√
Student 4	√		√
Student 5		√	
Student 6	√		√
Student 7		√	√
Student 8	√		
Student 9		√	
Student 10			√
Count of learners challenging barriers	3	4	6
In %	30	40	60

On the assumption of the abstracts obtained, in should be assumed that, to a higher stage, EG’s students and the GG’s students cope with appliance of linguistic and phrasal tests.

There were organized check before the analysis at the second level of experimental work. Learners from both group were told to share their opinion to the position “Adults are faulty when they castigate teenagers. They see apart negative effects in them.” On the matter below study “What are you anxious about?” The aim of the pre-experimental test-slice was to generate a monologue speech that faces with the necessities of the curriculum.

In the chain of achieving the projected test, “pauses” in grammatical acquisition, English language phraseology, showing disagreements during the conversable exercises, also verbal dictions appropriate with to the instructional origination. There should not be less than 15 words for 9th form pupils. Aftereffects from the test which was taken before the analysis are determined and shown in Figure 1 and Table 3.

Table 3

The completion from the inquiry before the analysis

Advantages from analyzing discourse utterance	Preliminary class, %	Ascendancy class, %
Contrariety assertion communicative speech	20	20
Percentage of students who did not authorize for the appropriate program	20	30
Count of students who produced grammatical mistakes	40	50
Count of students accomplished lexical faults	40	50

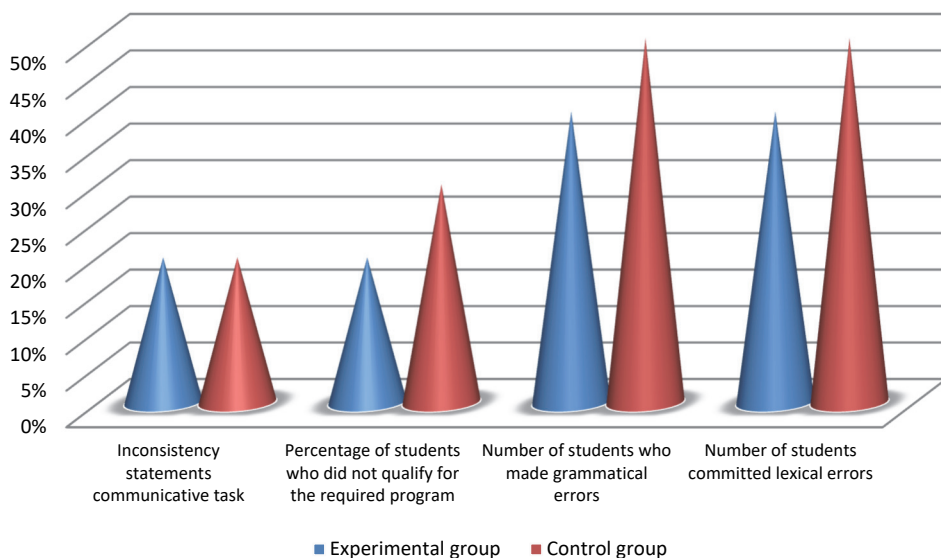


Figure 1. The decisions of the pre-experimental test

The next level of professional analysis pretended the complete exercising of the investigation. At the stage of magnificent lexical entity the pertinence of the approaches of coaching monologue utterance was considerable job of preliminary group’s completion, also it was contemplative checking of learners’ autonomy.

Students’ skills to create a monologue speech, choosing the word order correctly and apply grammatical accurateness was developed through using informational and communication technologies.

Displaying their opinions on the posters in the form of logical-syntactic construction was kind of challenging barriers concurrently the analysis. We can admit that all learners dealt with tasks of this type accurately.

After finishing the exercises, students were asked to persist the charts with two or enhanced points. And by doing that the exercises did not cause any specific pressure, the students comfortably involved their impressions in these arrangements.

As reported by the keywords signified on the diagrams, it was essential for the students to compose situations forward the chain on the accustomed topics. At the time application of these tasks, few EG students erected it struggling to go ahead by sharing expressions, for that clue learners agreeably referring to curiosity of the preceding learners. That situation could be determined with such reason as students had low degree of development in their creative thought, the implementation of the studied grammatical and lexical contents in usage.

The consecutive were donated assignments where learners were asked to attempt to make their individual short speech related to the advised expression. As a consequence show, the students content to involve aspects of argumentation, evaluation, assumption in their speech. Students conjointly inadvertently affected to the use of non-verbal communication: body language, facial explanation, intonation, break-off, giggling, which accomplished and invigorated the ways of verbal communication – phrases. The single disadvantage was that the production of statements effected the students few psychological barriers came along the fear of producing error, saying words outside of the theme. There were additionally minor violations in the expressional performance and correctly assortment of phrases

As before mentioned instruction, magnificent word agreement examples applied in the sample teaching monologue utterance lesson below.

In the stage of distinguishing determinable and approximate features from the conclusion, an ending test part was conducted in the similar classes. The last test reduction was achieved in accordance with the position “Choosing jobs and professions” and was same to the pre-experimental-test reduction completed the situation “Adults are mistaken when they disapprove teenagers. They are apprised of single negative conditions in them.” On the theme “What are you involved about?” against the adequate conclusions of this test slice, learners produce few lexical and grammatical mistakes. There was as well as some discrepancy among the statement and spoken expressions of the curriculum essentials. The proceeds of the last test-slice are showed in Table 4 and Figure 2.

Table 4

The sequences of the ending test

Monologue utterance research benefits	Experimental group, %	Control group, %
Contrariety assertion communicative speech	10	20
Percentage of students who did not authorize for the appropriate program	10	20
Count of students who produced grammatical mistakes	30	40
Count of students accomplished lexical faults	30	50

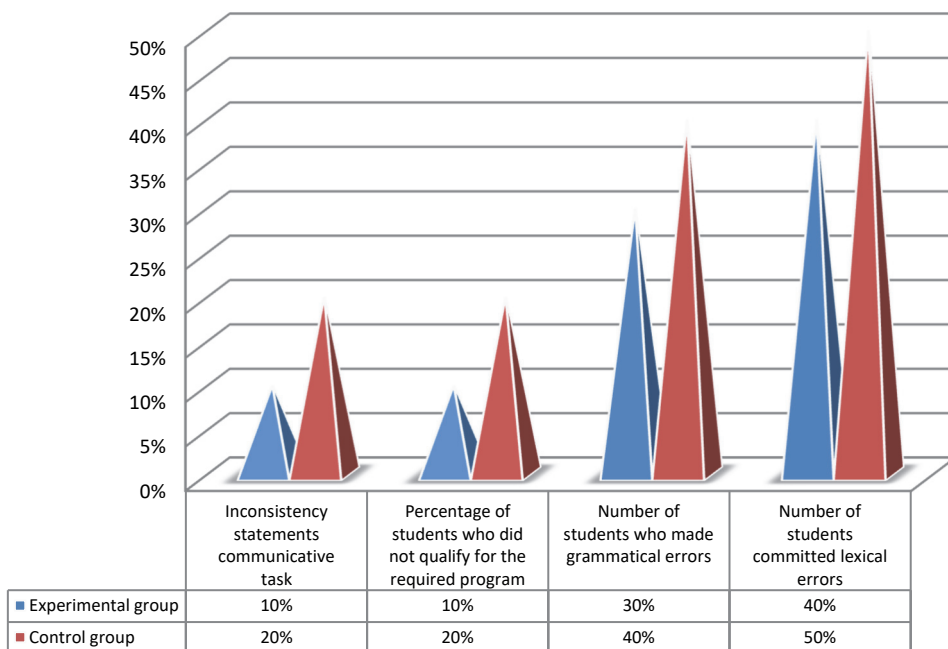


Figure 2. The sequences of the last test

The last level of the examination included the apprehension of the abstracts. After examining the sequences of the work displayed. We can consummate that the EG pointers are more excellent than the CG pointers. These arrangements can be described by the various academic achievement of groups, curiosity in learning process. The frameworks of the study of the monologue utterance from the final check EG equalized with structure of the analyzing discourse utterance of the pre-experimental test-slice elaborated by 10% in all signs. The learners of the EG attempted to completely comprehend the communicative exercise, to apply acceptable associating elements to produce a voluminous speech, different language and speech features within the creative language least determined by the curriculum. The refined data is presented in Table 5.

Table 5

Condensation of the experiment carried out in the EG and CG

Monologue utterance research benefits	Pre-experimental test, %		Last test, %		Advance of developing speech affection, %	
	EG	CG	EG	CG	EG	CG
Contrariety assertion communicative speech	20	20	10	20	10	0
Percentage of students who did not authorize for the appropriate program	20	30	10	20	10	10
Count of students who produced grammatical mistakes	40	50	30	40	10	10
Count of students accomplished lexical faults	40	50	30	50	10	0

Changing of developing speech affection showed in Figure 3.

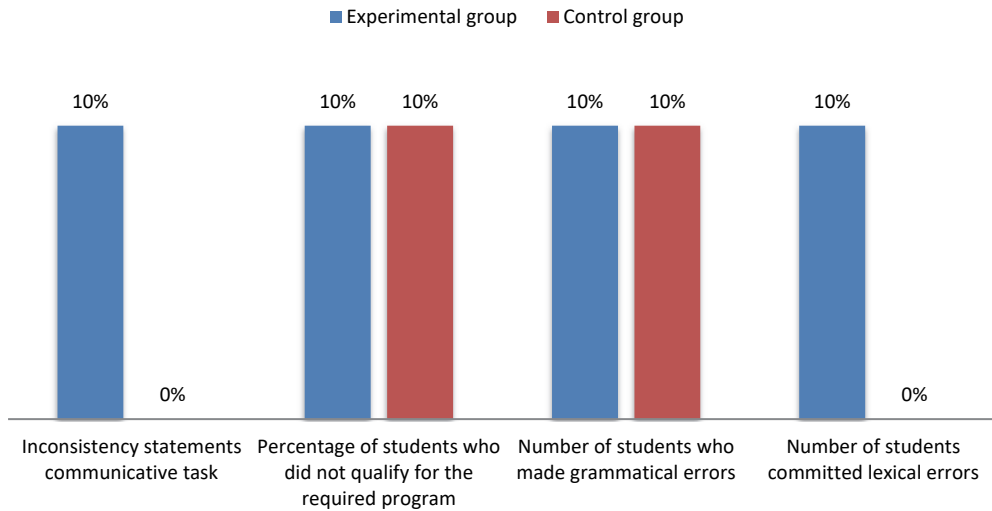


Figure 3. Advance of developing speech feature

As follows, found on data attained, it can be completed that the analytical progress of the abilities of monologue speech provide reducing the different sorts of struggles that learners come across when producing a monologue speech. As a consequence, student achievement advances, foremost a growth in motivation to attain a foreign language.

1. Instruction monologue speech applying information and communication technologies is the entanglement at the level of progress of speech abilities. The monologue speech of this degree is appertaining to the attendant criterions: almost connected aspect, compactness, coherence, semantic integrity, communicative adjustment. The efficient use of tactics of teaching monologue utterance applying information and communication technologies, the realistic function of speech drills, guides products helpful situations for the evolution of positive bearings in learning a foreign language. Learners have a consistent growth of monologue speech competencies, which provides the draft of the lexical-grammatical and vocal alteration of speech, the establishment of abilities and capacities of the logical creation of speech.

2. As displayed by consequences from the professional, the summary of the teaching discourse utterance of the final check of the EG acclaimed with the confinement of the cogitation of the monologue utterance of the inquiry before experiment clarified by 10% in complete symbols. During the procession of the analysis, the learners attempted to display their assumption, perspectives by producing a regular different sorts of obstacles.

Conclusion. In accepted analysis article the method of speaking from the frame of reference of its special attitudes, appliance and elements, the demands to coaching discourse utterance was contemplated.

The direction of particular analysis article was to learn the procedure of coaching discourse utterance on the groundwork of information and communication technologies at in intermediate and senior groups, considering the individuality aspects of the monologue speech, the description of applied and academic bases.

We have accomplished consecutive work by making the inquiry thesis:

1) the arrangement of guiding speaking in the content of an identity based proposition to cultivating a foreign language and promoted the aspect of the perception of “discourse utterance ” was inspected;

2) the cognitive and didactic aspects of coaching discourse utterance in secondary level learners of instruction were learn; learners at this degree of education are capable to autonomously apprehension, manipulate their ideological applications, and know the important affiliations in the assertion;

3) an image of acquiring monologue utterance with the appliance of information and communication technologies in foreign language classes at the intermediate and senior groups was deliberated.

Exercising monologue speech with the adoption of communication and information technologies is the multiplicity at the level of growth of speech abilities.

A figure of monologue utterance teaching was proven with the appliance of information and communication technologies assignments of English at the intermediate and leading stage of education in the formation of carrying on a professional analysis.

The completion of the scholarly analysis performed such the abstracts on the teaching of discourse speech of the last inquiry of the EG distinguished by the learning specifications of the monologue utterance

Of the before inquiry developed through 10% in complete signs. Analogy of the changings of the cultivating the affection in uttering of the EG and CG display such in the acquiring formation, specific in the attaining course imitates an essential role.

Accordingly, for the productive growth of the abilities of monologue utterance, one should notice a disciplinary order of methodical commotion is essential and adequate for profitable comprehend of this kind of speech exercise. Accomplishments of pedagogical and psychological aspects of learners gives opportunity you to arrange learning conferences in comparable way that the learning course produces to developing the inspiration and educational exertions of students.

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Особенности, опыт и преимущества внедрения STEAM-технологии в подготовку учащихся основной школы

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Аннотация. *Постановка проблемы.* Образовательная жизнь современной школы представляет огромное поле для наблюдения и анализа. Разнообразные технологии, применяемые в мире для активизации познавательной активности и увеличения роли самостоятельности в деятельности учащихся, создают новые формы и методы внутри образовательного процесса. STEAM-технологии активно используются в системе дополнительного образования. Однако их применение в основном учебном процессе практически не исследовано. Это связано с трудностью совмещения инновационных подходов с реализацией учебного плана школы. *Методология.* Применялись методы проектирования модели обучения, педагогического эксперимента, наблюдения, беседы, обобщения полученного опыта. Проведен контент-анализ и тематический мониторинг имеющихся публикаций по ключевым словам «STEAM-технологии», «повышение познавательной активности», «создание учебных лабораторий». *Результаты.* Представлены результаты трехлетнего эксперимента по применению образовательной STEAM-технологии в основной школе, нацеленного на анализ и выделение наиболее значимых для практики образцов применения этой технологии. Описаны сущность и особенности образовательной STEAM-технологии, реализованные в рамках исследования способы создания учебных лабораторий, базирующихся на предложенных подходах. Выявлены значимые аспекты применения такой технологии в современной школе. Приведены примеры из практики работы школы, рассмотрены виды лабораторий, цели и содержание обучения, полученные образовательные результаты. *Заключение.* В процессе выполнения исследовательской работы с применением STEAM-технологии в образовательном процессе основной школы выделены наиболее эффективные способы создания учебных лабораторий и выявлены наиболее значимые аспекты применения такой технологии в школе.

Ключевые слова: информационные технологии, STEAM-технология, конвергентный подход, проектная работа

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Features, experience and benefits of implementing STEAM technology in the main school

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Abstract. *Problem statement.* The educational life of the modern school is a huge field for observation and analysis. A variety of technologies used in the world to enhance cognitive activity and increase the role of independence in the activities of students create new forms and methods within the educational process. STEAM technologies are actively used in the system of additional education. However, the use of such technology in the main educational process has not been practically studied. This is due to the difficulty of combining innovative approaches with the implementation of the school curriculum. *Methodology.* The study uses methods for designing a learning model, pedagogical experiment, observation, conversation, and experience generalization. Content analysis and thematic monitoring of existing publications were carried out for the keywords, such as STEAM-technologies, increase of cognitive activity, and creation of educational laboratories. *Results.* The three-year experience of experimental application of educational STEAM-technology in the primary school is considered in order to analyze and highlight the most significant examples of the application of this technology for practice. The essence and features of the educational STEAM technology are described, as well as the ways of creating educational laboratories based on the proposed approaches implemented within the framework of the study. Significant aspects of the use of such technology in the modern school are revealed. Examples from the practice of school work are given, types of laboratories, goals and content of training, and obtained educational results are considered. *Conclusion.* In the process of performing research work using STEAM technology in the educational process of the secondary school, the most effective ways to create educational laboratories and the most significant aspects of the use of such technology in school were identified.

Keywords: information technologies, STEAM technology, convergent approach, project work

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Проблема и цель. В современном мире, немыслимом без применения технологий, искусство, наука и инженерное мышление все больше сближаются и объединяются, переставая противоречить друг другу. А способность к коллаборации и проявлению творческих способностей, умение донести до окружающих смысл своего высказывания в максимально понятной, наглядной форме в любом виде деятельности выходят на первый план среди важных способностей, нуждающихся в развитии в течение жизни [1].

Зачастую науке необходимо визуальное раскрытие смыслов для передачи информации средствами искусства и технологий, а художники используют цифровые технологии и научные формы мышления для самовыражения. Это взаимопроникновение, катализируемое цифровыми технологиями, отвечает и потребностям современного образования в школе. Новым языком бу-

дущего становятся не только возможности речи и письменности, но и возможности быстро создаваемых медиа, доступные уже в настоящем – создание иллюстраций, анимаций, видеографий, моделей. Однако возможности их применения не отменяют развитие в людях творческого мышления и свободы личностного проявления, а лишь являются теми современными инструментами, которые помогают максимально быстро коммуницировать, самовыражаться и достигать результата [2–5].

Развитие таких качеств, как способность увлекаться процессом познания, испытывать исследовательский интерес к предмету обучения, мечтать, воображать, критически анализировать информацию и иметь собственное мнение, воспитание воли и умение распределять ее усилия в течение продолжительного времени, также является актуальным вызовом современности образованию. Желание учиться, экспериментировать, эмпатия, способность спокойно переживать ошибки и пробовать еще раз, не теряя устойчивость, умение донести до окружающих свои мысли и идеи (презентовать себя или содержание) необходимо считать такими же важными результатами обучения, как и академические результаты [6].

Из научных отечественных и зарубежных научных источников следует, что подобные тенденции характеризуют современную образовательную технологию STEAM¹ [7–10].

STEAM – является развитием аббревиатуры STEM, но в нее включается теперь и термин «art» – искусство. И так, S – science – наука. T – technology – технология. E – engineering – инженерия. M – maths – математика. A – art – могут подразумеваться живопись, архитектура, скульптура, музыка и литература. Добавление контекста искусства позволяет расширить области для эксперимента и проявления учащихся в творческой деятельности, кроме того, это дает возможность проявиться тем учащимся, у кого есть таланты в этих сферах.

STEAM – образовательная конвергентная технология, сочетающая в себе несколько предметных областей. Она представляет собой инструмент развития критического мышления, исследовательских компетенций и навыков работы в группе.

Можно констатировать наличие *проблемы* поиска и обоснования эффективности методов обучения школьников, основанных на применении STEAM-технологий.

Методология. В рамках решения указанной проблемы в течение последних трех лет в московской школе № 1788 в экспериментальном порядке реализуется проект, связанный с использованием STEAM-технологий при подготовке учащихся основной школы.

Указанная московская школа представляет собой большой образовательный комплекс, в котором учится около 2700 школьников в четырех зданиях, существенно удаленных друг от друга. Обучающиеся здесь дети являются жителями огромного мегаполиса, зачастую они недавно приехали из удаленных и очень различных по культурной специфике регионов. Для них

¹ Дайджест STEAMS практики в образовании МГПУ. URL: <https://www.mgpu.ru/daigest-steams-praktiki-v-obrazovanii/> (дата обращения: 03.02.2022).

обучение в московской школе становится большим вызовом – нужно адаптироваться и к предметным требованиям, и к новому разнообразному коллективу, к новой культурной среде и устоям. Школьная среда является той экосистемой, которая может помочь ребенку обрести уверенность и успешность в непростом периоде адаптации, а те образовательные технологии, которые реализуются в ней, имеют немаловажное значение для эффективности этой среды.

Сформированный в ходе исследования экспериментальный учебный план, ориентированный на STEAM-технологии, основан на принципах междисциплинарности и прикладного подхода, все направления интегрированы в одну схему.

Большинство проектов в предлагаемом подходе подразумевают групповую командную работу школьников, что благоприятствует таким процессам, как конструктивное взаимодействие между членами команды, воспитывает уважительное отношение участников к мнению друг друга, учит их тому, как спорить и находить решение, как использовать сильные стороны друг друга, как планировать шаги и результаты во времени. Для решения своих сложных задач ученикам приходится искать способы решения, которые часто являются нестандартными и уникальными именно для конкретной группы и конкретного проекта.

Содержание деятельности школьников при таком подходе опирается на существенную творческую составляющую, посвященную искусству и применению новейших информационных технологий. Учащимся предстоит выбрать те средства самовыражения, которые их более всего вдохновляют, разработать общую концепцию и полностью ее воплотить, овладеть техникой ее воплощения от начала и до конца внутри образовательного процесса. Таким образом, учащиеся смогут осознать полноту и важность творческих аспектов процесса созидания, познакомятся с разными способами и техниками в искусстве, по-настоящему будут участвовать в совместной творческой деятельности.

В 2019–2020 и 2020–2021 учебных годах для параллели седьмых классов (490 человек) вышеуказанной школы впервые реализован проект «STEAM» в рамках программы учебного предмета «Технология». Была осуществлена интеграция модулей технологии и инженерии с предметами естественнонаучного цикла – физикой, биологией, географией и предметной областью «искусство». Таким образом, предмет «Технология» был реализован в тесной связи с программами данных предметов, что позволило расширить рамки и глубину их изучения, способствовало формированию системности. При этом основной акцент расставлялся на обучении различным видам деятельности, а не на формировании предметных знаний. Продолжается проект и в 2021–2022 учебном году.

Подготовительной стадией запуска проекта стала постановка учителем, курирующим STEAM-лабораторию, научной проблемы. Школьнику для входа и действия внутри проекта нужно было либо применить те знания, которые у него уже есть, либо получить новые междисциплинарные знания, проявить интерес, упорство к достижению целей, суметь спланировать свою работу,

осуществить необходимое взаимодействие с участниками своей рабочей группы и учителями.

В конце каждого занятия ученики должны были предоставить результат своей работы. Результат может быть очень небольшим, но явно отражающим суть происшедшего на занятии. Каждое занятие включало в себя научную и технологическую составляющую. Следует обратить внимание на то, что роль учителя в этой модели обучения состояла в консультационной поддержке, модерировании, регулировании и мягком сопровождении самостоятельной деятельности детей. Такие роли учителя создают возможности для свободного взаимодействия между всеми участниками процесса, способствуют возникновению необходимых связей и устойчивых способов коммуникации, необходимых для продуктивной работы группы.

Для осуществления данной модели потребовалась общая работа нескольких учителей-предметников естественно-научного цикла, учителей информатики и технологии, а также учителей искусства. В результате их подготовительной методической работы возникло несколько лабораторий с разными названиями и направленностями проектов. Совместная работа учителей продолжалась в течение всего периода обучения, содержала постоянную корректировку планов занятий, выстраивание стратегий для конкретных групп, обсуждение проблемных зон и точек роста конкретной группы и каждого школьника.

В течение года ученики седьмых классов один раз в неделю два урока посвящали работе в STEAM-технологии. В первом периоде обучения школьниками представляются каждую лабораторию, и на стадии запуска каждый ученик пробует свои силы в мини-проекте в каждой лаборатории, определяется с тем, в какой лаборатории он останется для осуществления углубленного обучения.

После самостоятельного выбора лаборатории все учащиеся поделились на группы, в которых работали до конца учебного года. Во время занятий они могли использовать компьютер, переходить из класса в класс, имея доступ ко всем необходимым материалам. За каждой группой школьников был закреплен куратор, который осуществлял функции модератора, консультанта и контролирующего учителя в конце урока.

Результаты и обсуждение. Можно привести примеры лабораторий, которые функционируют в школе. Их деятельность можно рассматривать как масштабный эксперимент, позволяющий сделать значимые выводы.

Лаборатория «Электросамокат». В рамках этой лаборатории учащиеся находят связи между дисциплинами «Физика», «Технология» и «Дизайн», взаимодействуя, экспериментируя, ища нестандартные решения и реализуя свои идеи в реальные физические объекты. Экспериментальным путем ученики приобретают знания о понятиях физических величин и явлений, затем строят информационные модели и производят необходимые для реализации проекта математические расчеты (расчет изменения различных параметров (например, скорости) в зависимости от нагрузки на транспорт, расчет показателей для создания уникального электросамоката в зависимости от физических показателей (рост, вес и т. д.)). После этого приступают к реализации своих идей в технологическом ключе: изготовлению объектов, механизмов

в рамках направления «Деревообработка». Конструируют и изготавливают каркас электросамоката из дерева, а также необходимые системы крепежа, соединяя их с ранее разработанной составляющей – электромотором. Кроме того, каждый объект, созданный школьниками, обладает своим собственным технологическим дизайном и дизайном внешнего вида. Ученикам необходимо продумать эту немаловажную составляющую и также реализовать ее сначала в стадии эскиза и проектирования, а затем во время создания физического объекта.

В результате работы в лаборатории школьники от начала до конца проходят все циклы создания технологического транспортного объекта – от физических экспериментов, гипотез, информационных моделей и математических расчетов, создания эскизов и дизайна до физической реализации – изготовления каркаса из дерева и фанеры, крепежа и электромотора. В итоге они создают реальный объект, который способен перемещать человека в пространстве.

Лаборатория «Дизайн». Объединяет в себе модули информатики и информационных технологий, географии, биологии, физики и других школьных дисциплин с основными идеями дизайна школьного пространства и художественным творчеством. Для работы в проекте детям необходимо изучить в зависимости от выбранного предмета содержание тех учебных единиц, которые потребуются для воплощения их идеи (изучение регионов мира, флоры, фауны, формул физических законов, компьютерных систем и др.), чтобы отобрать необходимый визуальный ряд, который будет являться достоверным, для создания эскизов оформления предметных классов и рекреаций. После создания эскизов учащиеся переходят к выбору материалов для создания дизайна, осваивают различные художественные техники и, возможно, компьютерные средства, необходимые для визуализации изображений. Затем они приступают к масштабированию эскизов и воплощению своих замыслов на реальных или «виртуальных» стенах школы. Результатом работы учащихся становится реальный дизайн учебных классов и рекреаций (рисунок).

Подобная учебная деятельность способствует развитию творческого мышления, воспитывает способность к долгосрочным волевым усилиям, смелости в принятии решений, приобретению практического опыта в творческой деятельности, применения различных информационных технологий и реализации своих задумок в реальности. Кроме того, участники лаборатории получают определенный опыт проявления себя через искусство в социуме, так как они сами и другие ученики теперь видят каждый день результаты их деятельности.

Лаборатория «Геотехнология» позволяет реализовать проект по созданию карты мира, на которой формы рельефа континентов будут выполнены в 3D-формате. Ученики исследуют образование разнообразных горных пород, их залегание, движение тектонических плит, изучение географических объектов путем их макетирования в различных техниках (создают макеты складчатостей своими руками) и художественно оформляют их в соответствии с географическими характеристиками местности.

В своей практической деятельности школьники используют математические свойства подобия, масштабы, картографические проекции, знакомятся с океаническими течениями и глубоководными впадинами.

В результате подобной деятельности происходит обучение проектированию, масштабированию, оформительской деятельности, анализу и презентации результатов. Школьники изучают особенности распределения давления и температур, создают макеты земного шара и географические карты течений.



Лаборатория «Дизайн» как часть проекта по использованию STEAM-технологий в обучении школьников
Laboratory "Design" as part of a project on the use of STEAM technologies in teaching schoolchildren

Лаборатория «Арт-путешествие». В этой лаборатории ученики проникают вглубь истории и культурных особенностей стран мира. При помощи современной компьютерной техники осуществляют поиск, отбор и обработку информации, изучают основы веб-дизайна для создания авторской интернет-страницы с результатами своего исследования, основы работы в графических редакторах и видеоредакторах, создают свой информационный проект

(цифровой слайд, видеоролик и др.) – часть общей книги стран – энциклопедии народов мира. Также участники лаборатории изучают особенности национального искусства и обычаев выбранной страны, создают объекты, стилизованные под эти виды искусства, знакомятся и экспериментируют с кулинарными особенностями в культуре разных стран, собирают и реализуют рецепты и изготавливают кулинарные графические и видеоинструкции для общей книги «Кухни народов мира». Финалом работы в лаборатории является выставка художественно-прикладного творчества учащихся и кулинарный мастер-класс [6].

В результате каждый участник становится исследователем страны, автором страницы общей книги «Культура и кухни мира», приобщается к культуре и искусству изучаемой им и другими школьниками страны, расширяет свой кругозор в области кулинарного искусства, приобретает навыки приготовления блюд, учится представлять информацию в наглядном и доступном виде. Немаловажным является участие в проекте для развития и формирования таких личностных качеств участников, как способность к принятию культур и обычаев, отличных от тех, которые являются для учеников родными [7].

Представление общих результатов деятельности всех лабораторий, как правило, происходит в виде итоговых конференций, на которых каждая группа школьников защищает свой проект, выступая перед остальными учащимися и учениками. Формат представления не ограничивается и может быть творчески определен учениками в процессе создания. Учащиеся приобретают умения представлять результаты своей долговременной работы на публике, делать это в интересной и нестандартной форме (театральные сценки, музыкальный номер, викторина, компьютерная презентация, интерактивные мастермайнды, мастер-классы), обмениваясь опытом и получая обратную живую связь от ученического и учительского сообщества. Наблюдение за результатами товарищей расширяет представления учеников и обогащает их кругозор, возбуждает интерес для проведения последующих экспериментов.

Заключение. Опыт организации вышеуказанных и подобных лабораторий позволяет сделать выводы о наличии существенных отличий образовательного процесса, реализуемого с применением технологии STEAM. В этой связи можно обоснованно выделить проявление свободы выбора, работу в свободном пространстве (в том числе и в смысле физических перемещений по классам), навыки самостоятельного планирования и деятельности в относительно гибком регламенте, понимание того, что необходимо интегрировать разные области знаний для решения жизненных задач, опыт прикладной деятельности, ручного труда, умение взаимодействовать в коллективе и достигать цели в необходимые сроки, представлять свой продукт и доказывать его состоятельность, проявлять себя в творчестве, проектировании, экспериментальной деятельности и исследовании. По сути, это означает, что школьники осуществляют раннюю профориентационную деятельность, которая может помочь выбрать в последующем профиль для более углубленного изучения.

Опыт использования образовательной технологии STEAM демонстрирует появление следующих результатов:

– возникает опыт проектной творческой работы в течение продолжительного времени;

– происходит смена вертикальных отношений учитель – ученик на горизонталь сотрудничества и конструктивного взаимодействия всех участников процесса;

– создаются условия для формирования у учащихся самостоятельного критического мышления;

– предоставляется возможность пребывания учащихся в ситуации создания совместного продукта, который является уникальным;

– возникают возможности взаимопроникновения и взаимообогащения разных научных областей, искусства, дизайна и технологий [11];

– приобретается возможность реализации практико-ориентированной модели, в которой каждый участник получает свой опыт, связанный с активной деятельностной позицией² [12–14].

В области психолого-педагогических результатов следует отметить:

– большую вовлеченность учащихся в процесс обучения;

– сохранение у них вовлеченности и мотивации на протяжении всего времени;

– формирование у участников групп устойчивых связей, обеспечивающих продуктивность взаимодействия;

– проявление и реализацию творческого потенциала учащихся;

– высокий уровень рефлексии у учеников относительно своей работы на традиционных занятиях.

Таким образом, отвечая вызовам времени, образовательная STEAM-технология, внедрение которой, как правило, базируется на масштабном использовании компьютерных средств и систем, становится одним из необходимых образовательных инструментов. Тем не менее важно отметить, что для современного этапа развития образования подобное обучение требует больших усилий от педагогического коллектива и администрации школ, как технологического, так и методического характера.

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ОБУЧЕНИЕ ИНФОРМАТИКЕ TEACHING COMPUTER SCIENCE

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Engineering design as a general area of study of informatics at the school of International Baccalaureate

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Abstract. *Problem and goal.* The features of the work of the direction of engineering design are revealed, taking into account the peculiarities of teaching under the International Baccalaureate program as part of the school curriculum to prepare students for the choice of a future profile of education in high school. Objectives: 1) to analyze the features of the work of this academic subject, taking into account the specifics of teaching the subject group “Design” within the framework of the International Baccalaureate program; 2) describe the features of this direction; 3) sum up the results of the work and development prospects of students studying according to the presented curriculum, taking into account the peculiarities of the implementation of this curriculum. *Methodology.* A set of research methods was used: analysis of regulatory documents, determination of priority tasks for teaching this area, work experience. *Results.* The experience of working with secondary school students within the framework of the presented direction is analyzed, features and opportunities for further work are identified. *Conclusion.* Education taking into account the implementation of the features of the International Baccalaureate program allows students to prepare for the choice of a future profile (future profession), get acquainted with information opportunities, and prove themselves when working with various information technologies at an early stage of education.

Keywords: engineering design, programming, robotics, International Baccalaureate, computer science training

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Инженерный дизайн как эффективное направление изучения информатики в школах Международного бакалавриата

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Аннотация. *Проблема и цель.* Выявляются отличительные черты работы направления инженерного дизайна с учетом особенностей обучения по программе Международного бакалавриата в рамках школьной программы для реализации подготовки учащихся к выбору будущего профиля обучения в старших классах. Цели: 1) проанализировать работу данного учебного предмета, принимая во внимание специфику обучения предметной группы «Дизайн» в рамках программы Международного бакалавриата; 2) описать особенности данного направления; 3) подвести итоги работы и перспективы развития учащихся, обучающихся по представленной учебной программе. *Методология.* Использован комплекс методов исследования: анализ нормативных документов, определение приоритетных задач обучения рассматриваемого направления, опыт работы. *Результаты.* Проанализирован опыт работы с учащимися средней школы в рамках представленного направления, выявлены особенности и перспективы дальнейшей работы. *Заключение.* Обучение с учетом внедрения специальной программы Международного бакалавриата позволяет учащимся подготовиться к выбору будущего профиля (будущей профессии), познакомиться с информационными возможностями, проявить себя при работе с различными информационными технологиями на раннем этапе обучения.

Ключевые слова: инженерный дизайн, программирование, робототехника, Международный бакалавриат, обучение информатике

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Problem and goal. Modern education undergoes significant changes every year to improve and diversify the educational process. Now, not a single training session takes place without the use of information resources that allow diversifying the educational process and help students express themselves in certain areas [1].

In this regard, each educational institution builds its own curriculum, various new areas, subjects, opportunities for cooperation with universities, colleges, etc., appear. Traditional lessons are being replaced by lessons in laboratories, with the use of modern information technologies, involving specialists from various fields. This allows students to immerse themselves in the work environment and feel the significance of the direction they have chosen.

But at the same time, these effective areas of work are different for each educational institution, because the implementation of all projects requires a large

amount of material and physical resources. Therefore, institutions begin to prepare students from an early age for the features of the future curriculum of the school.¹

Hence, the problem for educational institutions is the choice and implementation of effective areas that will be reflected in various academic disciplines.

Methodology. The analysis of the Federal State Educational Standards and the standards of the International Baccalaureate program (as varieties of educational standards) was carried out. Features of work in each standards, similarities, differences, psychological features of work are revealed.

The work in the educational institution “School No 1575,” which implements work according to two standards (middle and high school), is analyzed. A collection of students’ works in various information areas, which are reflected in their implementation in this discipline, was carried out.

Results and discussion. In many educational institutions (in particular, in Moscow), there is an early profiling of classes in various areas: mathematical vertical, engineering, information, humanitarian, media classes, and others [2]. This contributes to the development of early profiling and the choice of a future profession by students.

In this regard, educational institutions find opportunities to participate in various educational programs for the purpose of development, exchange of experience, search for new personnel.

Profile education is a special kind of differentiation and individualization of education. It implies the creation of conditions for the formation of cognitive interest within a certain direction. Many educational institutions are considering division into profiles already from the 8th grade, if the material base of the school allows it [3]. Students can choose one or another profile of study, depending on the curriculum. Most schools are now seeing the emergence of special classes equipped with the necessary equipment, technologies that provide students with the opportunity to get acquainted and immerse themselves in learning with technologies that can later become part of their profession.

In addition, in many educational institutions, training comes with the introduction of elements of the International Baccalaureate program, which also considers various subjects and directions that should help students in determining their future profession. Features of teaching under this program allow students to develop the qualities of independence, critical thinking skills, research skills. These areas are considered in 8 subject groups, where each subject reflects a different area of study: the humanities, languages, creativity, etc.²

¹ Shatrovskaya T. International Baccalaureate at school: what, why and for whom. *Mel.* 2 February 2017. (In Russ.) Available from: https://mel.fm/vospitaniye/sovety/824937-international_baccalaureate (accessed: 20.02.2022).

² The Program of the Main Secondary School. Design Guide. Geneva: Organization of the International Baccalaureate; 2014.

One of these areas is the technical direction, one that is currently gaining immense popularity among students. In the International Baccalaureate, these subjects belong to the “Design” group, which includes the use of various information technologies and resources by students to prepare technical and engineering projects [1].

This academic discipline includes training from grade 5, and is a continuation of the study of computer science at school.

As part of studying at the main school of the educational institution “School No 1575,” the subject “Design” considers the study of the basics of robotics and programming, allowing students to get acquainted with the possibilities of the modern information world from an early age. This subject at the school is called “Engineering Design,” as it is associated with the demand and relevance of education in future engineering classes. Classes are held once a week for each of the directions [4].

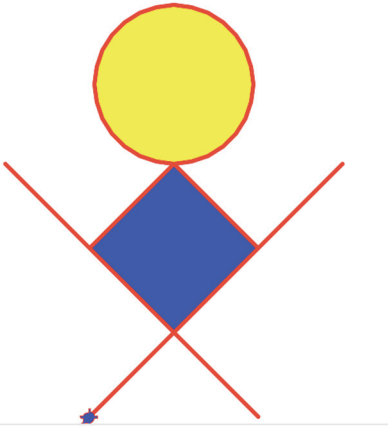


Figure 1. Image created by a 5th grade student in a programming lesson

In programming, students get acquainted with the possibility of writing programs in Python in the IDLE programming environment: solving various mathematical problems, using conditional operators, loops, strings, lists, creating games using the turtle library, etc.³ Due to the fact that in elementary school students receive basic knowledge on the topic “Algorithm” and worked with various Performers, these classes are productive, homework is done with pleasure. In addition, they receive basic knowledge of geometry, get acquainted with various new geometric shapes, their characteristics. Some students think over independent drawings and demonstrate their results among classmates (Figure 1). Students develop logical thinking skills, learn to plan the progress of the task, prepare to create projects within this direction [5].

In the process of completing tasks, students can test, evaluate and improve their knowledge in programming in practice, learn to solve tasks. Demonstrate their technical skills, the ability to explain changes made to their program code and present the solution as a whole, as well as describe their success with the idea and how the solution can be improved. An analysis of the results obtained will give an understanding that the implementation of the goal in creative activity is a time-consuming, but interesting process.

Due to the fact that work is carried out on computers, and training begins from the 5th grade, this contributes to the development of initial computer skills for those who do not have the opportunity to get them at home. Students can work both from phones and tablets [6]. Since this academic year, a virtual laboratory has appeared in the resources of the library of the Moscow Electronic School,

³ Tyrina LV. *Modern technologies in modeling*. 11 February 2016. (In Russ.) Available from: <http://uo-mr-pechora.com.ru/?p=551> (accessed: 20.02.2022).

where you can also work with writing code in various programming languages, with the ability to check and send the program to the teacher [7].

The second area of “Engineering Design” is robotics. Its study is now very promising and important, as it is one of the areas of scientific and technological progress. In these classes, students work with various types of constructors: Lego EV3, Vex and others [8]. They create and program various controlled devices, acting as young scientists, conducting simple studies and recording their results (Figure 2). An analysis of the results obtained will give an understanding that the implementation of the goal in creative activity is a time-consuming, but interesting process.



Figure 2. Educational work of 6th grade students in a robotics lesson

The course is based on a holistic image of the surrounding world, which is refracted through the result of students’ activities. Every year, the requirements for modern engineers, technicians and ordinary users are increasing, in terms of their ability to interact with automated systems. The intensive introduction of artificial assistants into our daily lives requires users to have up-to-date knowledge in the field of informatization.

In the process of completing the task, students update their knowledge on the structure and operation of the simplest mechanisms, learn to distinguish between types of mechanisms and types of levers, and also learn to master additional sources of information on their own. Students must solve problems, which involves the use of their own knowledge and experience, the accuracy and logic of the presentation of thoughts, the ability to use appropriate terminology. Conducting an assessment task in this discipline will enable everyone to feel in the role of a participant and an expert, to consolidate knowledge on the subject. The exchange of views and possible discussions on the results will contribute to the formation of the worldview of the child.

In addition, students receive basic knowledge in working with 3D modeling by working in the Tincercard program. In the later stages of learning, student work focuses on the design problem, which is to solve a specific design situation for a specific audience. At the same time, the results of this work completely de-

pend on the knowledge, skills and abilities that students received at the initial stages of the course.

These activities are giving positive results. Students with a high level of motivation receive additional individual projects and assignments to implement their creative ideas. Students actively participate in the school competition of design and research works “Discovery,” where they can already apply the acquired skills in programming and robotics lessons, solving problems of a different nature [9]. It is noted that every year projects become more complicated and interesting, many students independently study additional possibilities of engineering areas and create complex projects, which are ready-made programs, applications and complex models, both 3D and from other material [10]. In School No 1575 every year there are winners of international competitions, in particular World Skills, which allow talented and interested children to show everything they could learn and improve their skills in working with these areas.⁴ Also, there is an opportunity to prove oneself in the pre-professional Olympiad, which makes it possible to obtain additional USE points [11].

Conclusion. Using the example of the implementation of the project for future engineering and information classes at School No 1575, preparation for which is carried out from elementary or secondary school, it is possible to trace and identify the opportunities for students to choose their future areas of study and work, as well as participate in world-class competitions that provide development prospects. Teaching the discipline “Design” within the framework of the International Baccalaureate program using educational electronic resources contributes to a significant increase in the interest of primary school students in studying this subject area and, in the future, a more conscious choice of the direction of training in the field of informatization.

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⁴ Padikova MV. Project activity at school. *Open Lesson “First of September.”* 2012. (In Russ.) Available from: <http://xn--ilabbnckbmcl9fb.xn--plai%D0%B0%D0%B2%D1%82%D0%BE%D1%80%D1%8B/102-719-890> (accessed: 00.00.0000).

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