



Copyright © 2023 by Cherkas Global University
All rights reserved.
Published in the USA

European Journal of Contemporary Education
E-ISSN 2305-6746
2023. 12(1): 173-187
DOI: 10.13187/ejced.2023.1.173
<https://ejce.cherkasgu.press>

IMPORTANT NOTICE! Any copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of this work in violation of the author(s) rights will be prosecuted in accordance with international law. The use of hyperlinks to the work will not be considered copyright infringement.



Research of the Possibilities of Interactive Simulators in Intercultural Communication for the Formation of Students' Algorithmic Thinking

Marina S. Perevozchikova ^{a,*}, Anna N. Sokolova ^a, Nadezhda V. Gavrilovskaya ^b, Dmitrii M. Benin ^b

^aVyatka State University, Kirov, Russian Federation

^bRussian State Agrarian University – Moscow Timiryazev Agricultural Academy, Russian Federation

Abstract

The requirements for the results of mastering the main educational program by students determine that a digital school graduate must have a culture of thinking, the ability to generalize, analyze, perceive information (including in a foreign language), set a goal and choose ways to achieve it. The development of relevant skills is actively taking place in the lessons of computer science, mathematics, physics, chemistry. Intercultural communication in the study of a foreign language and literature provides certain didactic opportunities for the formation of abilities to perform mental operations, choose the best way to achieve a goal, etc. To form the appropriate skills that determine the essence of algorithmic thinking, the authors propose to include the interactive simulators in the foreign language communicative activity of students. The methodology is based on the analysis of the capabilities of interactive simulators for various purposes: in online games (Lingo Play, Kid Mama), in quests (Learnis), in puzzles, crossword puzzles, and quizzes. The eTreniki online constructor is used (Kokla, Krypton, Morfanki, Kartofan services) to create a game simulator in the classroom.

Research results. The students of the experimental group study services for creating interactive simulators and use them in intercultural communication. In conclusion, the possibilities of interactive simulators for the development of algorithmic thinking of schoolchildren in intercultural communication are formulated: activating cognition, determination of the structure of actions to achieve the goal, evaluation and analysis of the result, etc.

* Corresponding author

E-mail addresses: ms_perevozchikova@vyatsu.ru (M.S. Perevozchikova),
an_sokolova@vyatsu.ru (A.N. Sokolova), gavrilovskayanv@rgau-msha.ru (N.V. Gavrilovskaya),
dbenin@rgau-msha.ru (D.M. Benin)

Keywords: interactive resource, foreign language activity, training game simulator, network communication, sequence of actions, eTreniki.

1. Introduction

The relevance of the study is determined by the following factors:

1. With the support of UNESCO, 2022 has been proclaimed the International Year of Basic Sciences for Sustainable Development. The proposal was supported by the International Union of Theoretical and Applied Physics (IUPAP) and the International Science Council ([IYBSSD2022, 2022](#)). The Russian Academy of Sciences has joined this initiative. As part of the relevant activities, joint events are planned with universities and schools. Their goal is to spread the influence of fundamental knowledge on technology, education and culture.

To meet the high requirements of a changing world, focused on globalization and digitalization, the training of future graduates in modern schools must follow the new standards. In particular, it should include purposeful work on forming the foundations of financial literacy, creative and algorithmic thinking, etc.

2. T.P. Pushkareva, T.A. Stepanova, V.V. Kalitina conclude that when studying the basics of algorithmizing and programming in a modern school, "a very productive age for the formation of algorithmic thinking falls on the 5–6th grades" ([Pushkareva i dr., 2017](#)). In addition, as E.A. Arkhipova notes, modern teenagers get used to gadgets from an early age and easily master new technologies ([Arkhipova, 2019](#)). At the same time, it is the work on the computer, designing and programming "game computer worlds" with the creation of special conditions that can positively affect the development of algorithmic thinking.

3. An important place in the development of intercultural communication skills is given to humanitarian subjects, especially to "Foreign language" ([Belyaev, 2011](#)). The list of significant subject educational results of the disciplines includes such communication skills as: possession of the skills of various types of reading and information processing of the material read; the ability to adequately understand, interpret and comment on texts; the ability to participate in dialogic communication in compliance with the norms of the modern literary language and speech etiquette, etc. ([Veretnova, 2018](#)). In addition, the educational content of foreign languages should be aimed at introducing students not only to a new way of verbal communication, but also to the culture of the people and the national and cultural specifics of behavior in the country of the language being studied.

I.S. Zlobina et al. suggest using interactive simulators and worksheets for the formation of intercultural communicative competence ([Zlobina et al., 2020](#)). The authors point out that the effectiveness of game simulators for educational purposes is determined precisely by the fact that they help to establish direct links between a particular word and its image. In addition, the virtual environment for the interaction of students with the software provides additional conditions for cognitive activity, helps to make the lesson more emotional and entertaining.

At the same time, there are certain methodological difficulties:

- Which interactive simulator to use when teaching a foreign language for the formation of algorithmic thinking and intercultural communication skills;
- How to organize effective educational and cognitive foreign language interaction in an automated environment;
- How to keep and activate the cognitive interest of students using sharing, storage and processing of information.

B.S. Goryachkin and his co-authors note that the danger of the novelty effect and the rapid loss of interest in language training is one of the main didactic problems of the digitalization of education ([Goryachkin i dr., 2021](#)).

The research hypothesis is that the use of computer simulators and interactive electronic manuals in the classroom will provide additional conditions for the development of intercultural communication skills and algorithmic thinking (the ability to operate with images, concepts and categories; willingness to form substantive judgments, inductive and deductive conclusions, etc.).

So, there is an objective requirement for additional study of the development and use of interactive simulators in intercultural communication for the formation of algorithmic thinking.

1.2. Goals and objectives of the study

The purpose of the work is determined from the need to assess the potential of using interactive simulators in intercultural communication to form the foundations of students' algorithmic thinking as an important condition for further self-realization of the individual in the information society.

The objectives of the research are:

- To clarify the essence and potential of game simulators for educational purposes in the context of UNESCO recommendations and the formation of a digital school;
- To consider the concept of "algorithmic thinking", its main components and their significance for human development in terms of intensifying multilingual activities, expanding its creative capabilities;
- To describe the didactic possibilities of a specific gaming service that meets both the needs of the students themselves and the priorities of the digital school.
- To describe the stages of systematic purposeful work on the use of interactive simulators in intercultural communication to form the foundations of the student's algorithmic thinking;
- To experimentally confirm the effectiveness of the proposed training system.

2. Relevance

2.1. Literature review

2.1.1. Review of Russian scientific and pedagogical literature

According to E.V. Tsareva and R.Z. Bogoudinova, the status of a foreign language in Russian society has changed significantly in recent years (Tsareva, Bogoudinova, 2021). The skills and abilities of intercultural communication are no longer a luxury, but a necessity.

In the context of globalization and internationalization of vocational education, multilingualism is an effective means of intercultural communication in the global space (Kalugina, Tarasevich, 2018). The mutual penetration of different cultures and the need to understand the linguistic characteristics of nations lead to the solution of global problems, where language acts as a tool for deep knowledge of the social and cultural meanings of modern social processes. Multilingual training and communication skills of students have become one of the basic requirements for job seekers from employers. It follows that the training of specialists with knowledge of several foreign languages and capable of intercultural communication is becoming an important task for educational organizations (Zlobina et al., 2020).

Today, a completely new methodology for learning foreign languages is being formed, which purpose is the formation of communicative competence – to teach to communicate, speak, understand and respect another culture. A foreign language, be it English, German or any other, should not be perceived by students as an academic discipline, or a subject, but should take a higher position – as an integral part of modern life, as a means of communication (Belyaev, 2011).

P. S. Sorokin and Y. A. Vyatskaya also note that the development of science and technology is unthinkable without a wide exchange of special information between people speaking different languages (Sorokin, Vyatskaya, 2022). Specialists in a wide variety of industries must constantly monitor everything new that appears abroad and extract information useful for their professional activities. For this, according to S. V. Elovskaya, each educated specialist should have a knowledge of a foreign language (Elovskaya, 2018).

N. Ushakova and ed. come to a reasonable conclusion that the study of foreign languages is an important aspect of the life of a modern person (Ushakova et al., 2022). It contributes not only to acquaintance with the culture and traditions of other countries, but also provides an opportunity for the development of thinking, imagination and memory.

At the same time, as noted by E. V. Soboleva et al., the communication of modern adolescents (representatives of Generation Z) is becoming computerized. The share of virtual (including intercultural) communication among young people dominates over real (Soboleva et al., 2021). This affects people's behavior. Many young people have difficulty communicating in real life. This is especially true for graduates of modern schools, who are so absorbed by the computer and communication in social networks that in ordinary situations they simply get lost.

On the other hand, according to the conclusions of E.V. Arkhipova, a modern student should be able to determine the goal of the upcoming activity, predict the result and adequately evaluate it,

think critically, structure the knowledge gained, be able to move from the particular to the general and vice versa, and etc. (Arkhipova, 2019).

The initiator of the introduction of an algorithmic line in elementary school mathematics was N.Ya. Vilenkin, a famous Soviet mathematician, the author of textbooks on mathematics for school. He argued that in the age of "smart machines" children need to be prepared from elementary school to work with them (Vilenkin, Drobyshev, 1988). This preparation, in his opinion, should consist in the formation of algorithmic thinking.

O. Kalugina, N. Tarasevich note that with the modernization of the education system in the Russian Federation, the use of modern educational technologies in the practical activities of English language teachers aimed at creating a new intellectual product with educational potential has become relevant (Kalugina, Tarasevich, 2018).

L.V. Parunina, A. V. Babikova prove on experimental data that one of the technologies that make it possible to achieve educational results in accordance with the requirements of the Federal State Educational Standards of basic general education is, for example, the technology of developing critical thinking (Parunina, Babikova, 2020). A variant of its implementation is the "Compilation of an algorithm" technique.

Algorithmic thinking is a set of mental actions and techniques aimed at solving problems, as a result of which an algorithm is created, which is a specific product of human activity (Soboleva et al., 2021).

R.M. Gorbatyuk, V.V. Kabak note that the main components of algorithmic thinking are: structural analysis of the problem; the ability to build information models to describe objects and systems, the ability to organize the search for information necessary to solve the task, breaking a large task into small ones, planning possible situations and reactions to them, understanding and using formal ways of writing a solution (drawing up an algorithm) (Gorbatyuk, Kabak, 2019).

In order to indicate the importance of the analyzed problem, one should also highlight the proposal of L.V. Parunina, A.V. Babikova on the possibilities of game forms of learning to involve young people in scientific and innovative activities (Parunina, Babikova, 2020). One of the international educational projects for learning English is LinguaLeo.

I.S. Zlobina et al. notice that it is not always worth following innovations only because of their ability to increase the emotional background, external brightness (Zlobina et al., 2020). It is necessary to strike a balance between the quality of education and the attractiveness of the tools, their own pedagogical skills and the technologies used. Under these conditions, digital services will be indispensable, allowing:

- In an interactive game form to build up intercultural communication skills in accordance with the standards and requirements of society;
- To contribute to the resolution of such personal problems of students as lack of confidence in their abilities, overcoming the language barrier, lack of consciousness among students in teaching types of speech activity.

2.1.2. Foreign studies review

The leaders of UNESCO, in the Science Report (which subtitle is "The race against time for smarter development"), formulated directions for global transformations in the field of science and technology (IYBSSD2022, 2022). These areas are in line with the sustainable development goals defined by the UN. In addition, they set the vector for Russian education and science. According to E. Eriksson et al., it is impossible to ensure advanced development in any of the fields without science (Eriksson et al., 2020).

B. D. Kane, K. C. Keene, S. Reynolds determine that the current problem of modern didactics is the problem of strengthening the communication and activity approach in teaching subjects (Kane et al., 2022). This approach, according to J. Zhang et al. involves the activation of all types of speech activity (reading, writing, listening, speaking) in their unity and relationship when studying any educational discipline (Zhang et al., 2022).

K. Kager et al. indicate that the challenges of globalization and digitalization determine the need for modifications for the system of training future specialists, and reforms should begin with changes in the educational environment of the school (Kager et al., 2022).

J. Martin, T. Nakayama point out that knowledge of the intercultural communication basics is one of the necessary skills for a modern graduate (Martin, Nakayama, 2006). This is dictated by

the processes of globalization in the information world as a whole and changes in the life of society in particular. A competitive specialist understands the realities of another country, its traditions and culture. There is no denying, the authors note, that the study of the culture of a foreign language contributes to the better development of the language itself.

M. Rottenhofer et al. suggest applying computer science tools in language learning (Rottenhofer et al., 2022). According to the authors, the theory and practice of teaching a language using computer technology becomes an organic part of the general methodology for teaching a language. The modern stage of the development of computer linguistics is characterized by the understanding that computerization, without solving all the problems of language learning, can make the process of foreign-language communication much more efficient. To do this, the teacher needs to provide opportunities and restrictions on the use of computers in teaching the language, know the specifics of computer learning tools, navigate the criteria for assessing their quality, and master the methodology for integrating information technologies into the educational process (Tucker, 2022). Rottenhofer, M. et al. explore the possibilities of forming skills such as pattern recognition, decomposition, abstraction, generalization (i. e., components of algorithmic thinking) in the process of learning English and Spanish (Rottenhofer et al., 2022).

The inclusion of computer technology in education from an early age shifts the focus of traditional learning from reading, writing, and arithmetic skills to the development of academic literacy through "execution, use, and thinking" (Eriksson et al., 2020).

N. Nurhayati et al. conclude that due to experiments conducted by psychologists and methodologists, it was noted that each person gets information and manages it differently (Nurhayati et al., 2022). From a practical point of view, different learning styles are reflected in a specific classroom space, when applying different cognitive approaches and models to the study of a certain discipline. These approaches are called learning strategies. The author's methodological version assumes that students focus on the characteristics of a foreign language and seek to absorb them consciously and rationally. This approach requires planning and a clear organization of learning activities based on an analysis of all aspects of the structure of the language being studied. In other words, it requires the development of skills that form the basis of algorithmic thinking.

Educational tasks play an important role in the development of mental activity. They are means of mastering the scientific knowledge system and formation of skills to solve problems of an applied nature. For active mental activity, various tasks are very useful, the process of solving which is characterized by high mental stress, independent search, evidence, and reasoning. Solving problems maximally mobilizes and develops such mental operations as analysis and synthesis, abstraction, comparison, concretization, generalization, and teaches students the optimal use of these operations in their cognitive activity (Silva et al., 2019). The formation of the listed skills, according to B. Steffen, A. Murtovi forms the basis algorithmic thinking of students (Steffen, Murtovi, 2021).

Research of R. Barac et al. allow us to reasonably assert that the use of interactive resources in teaching a language makes it possible to provide additional conditions for the development of a person's creative abilities (Barac et al., 2014). These capabilities (abilities), according to the findings of A. Whitfield, are manifested in thinking, feelings, speech and other activities (speaking, listening, reading, writing) (Whitfield, 2022).

I. Damopolii et al. offer an approach that is important for the ongoing research: to include innovative digital technologies in intercultural communication – comics and augmented reality (Damopolii et al., 2022). The authors substantiate that new game forms of interaction, computer support for foreign language communication are indispensable for mastering the system of mental techniques aimed at solving problems. I. Damopolii et al. noticed that the same students willingly worked with comics, but with a bored look they completed tasks on a series of story images. Comics are such a means of foreign language communication that best meets the needs of a modern student. This refers to the general psychological requirements: the speed of moving attention, grasping the "surface" of the text (Damopolii et al., 2022). As well as the needs of the cognitive plan: cognition through active involvement in the completion of the text, through game forms of working with text, through visual-figurative, and not just logical text-oriented perception. In modern learning conditions, the use of electronic resources with simulators in foreign language classes seems to be both promising and necessary.

At the same time, both Russian and foreign researchers note that the use of interactive simulators and online services as aids in foreign language communication is mostly considered only as elements of gamification. Wherein, their didactic potential is significantly reduced and lost.

The analysis of the scientific works listed above allows us to identify the problem associated with the need for additional study of the use of interactive simulators in intercultural communication to form the foundations of the algorithmic thinking of digital school students.

3. Materials and methods

3.1. Theoretical and empirical methods

The following methods were used in the work: analysis and generalization of literature when reviewing scientific theories on the development of algorithmic thinking; determining contemporary software tools for the formation of purposefulness, objectivity and accuracy, logical and consistent planning and performing one's actions, the ability to clearly and concisely express one's thoughts when working with educational texts.

The study used interactive simulators for various purposes: for online games (Lingo Play, Kid Mama), for quests (Learnis), for mobile phones (Alice Resort, Kotovasia), Etreniki online constructor (<https://etreniki.ru/>), rebuses, charades, crossword puzzles, metagrams and puzzles with riddles, quizzes.

Criteria for analysis: type of resource (online/offline), free/commercial, functionality, interface and design. Based on the analytical work, a service for creating online constructors (<https://etreniki.ru/>) was chosen.

Its advantages are: an intuitive interface, free domestic software, the ability to create small web applications using a browser (game simulators, the interdisciplinary nature of the tasks being developed, a creative platform for digital school teachers, the ability to edit font size, taking into account age-related perceptions and style schoolchildren's thinking).

To implement a system-activity approach in teaching a foreign language, the "cinquain" technique is used.

To obtain up-to-date information on the effectiveness of the use of interactive game simulators for the development of students' algorithmic thinking in intercultural communication, empirical methods are used: observation of foreign language communication of all participants in the interaction (for example, in word formation); analysis of the speed and quality of "drag and drop" game blocks; discussion of the results of work with simulators (for example, when you need to find the form of a verb in the past tense or designate a morpheme in which a letter is missing).

To assess the input conditions, testing was used, including the following units: "Foreign language" (50 points), "Foreign literature" (50 points), "Basic algorithmic constructions" (50 points). For each correctly completed task in the test, the student receives 1 point. Auxiliary methods for processing information and data were used: tabular design, infographics, presentations and files in the «*.pdf» format.

So, as a result of the initial diagnosis, each student scored from 0 to 150 points. To determine the level of formation of algorithmic thinking (according to the sum of all 3 units), the levels "low" (from 0 to 69 points (inclusive)), "medium" (from 70 to 133 points (inclusive)), "high" (more than 134 points) were introduced. points).

Statistical processing of the results was performed using the Pearson's chi-square test – χ^2 .

3.2. The base of research

The main purpose of the experiment was to test the effectiveness of the integration of interactive game simulators into intercultural communication for the development of students' algorithmic thinking.

The study was conducted at school No. 10 named after. K. E. Tsiolkovsky of the city of Kirov at the lessons of a foreign language (English) and computer science. 46 schoolchildren of the sixth grade took part in the experiment. The average age of the respondents was 12 years (50 % girls and 50 % boys).

The integration of gaming interactive simulators into intercultural communication was carried out in the same classrooms of the school, using the same equipment and software.

The materials of the test were developed by the authors in accordance with the current standard of basic general education.

3.3. Stages of research

At the preparatory stage of the experiment, the authors analyzed the modern achievements of linguodidactics regarding the potential of digital services, interactive learning tools. It was also revealed that online constructors have didactic potential to support pupils at all stages of their educational, intellectual, research and creative activities.

Various digital services for creating your own game interactive simulators are also analyzed: online constructors (<https://etreniki.ru/>, <https://ruskiyonline.com/>, <http://kid-mama.ru/category/trenazhery/onlajn-trenazhery-po-russkomu-yazyku/>), mobile application Kitty Scramble (<https://cleverappsg.com/game/scramble>).

The following criteria were used for selection: type of resource (online/offline), financial basis (free/commercial), functionality (didactic material, types of tests, options for use at lesson stages, support for individual/frontal/group work at the discretion of the teacher), interface and design.

It was determined that the development of algorithmic thinking involves the formation of skills to accurately follow the rule, a specific sequence of actions. In order to implement the findings in the classroom in a foreign language, it was decided to study in detail the service for creating online constructors (<https://etreniki.ru/>) in the course of school computer science.

Schoolchildren at the stage of initial diagnosis were asked to answer the questions of testing, including the following units "Foreign language" (50 points), "Foreign literature" (50 points), "Basic algorithmic constructions" (50 points). Examples of questions for each unit are presented below (clause 4.3.1).

Thus, it was possible to collect data on 46 students, from which experimental and control groups were formed (23 students each).

The identity of the experimental and control groups is achieved by pairwise alignment of students with significant variables: theoretical knowledge of a foreign language; cognitive activity of students in intercultural communication; the ability to find the sequence of actions necessary to solve the problem; ability to highlight a series of constituent subtasks in a common task; user skills in game services. For each selected test subject, another test subject having the same combination of relevant characteristics is selected in the control group.

The results are presented in [Table 1](#).

The second stage of the experiment was devoted to changing the structure of classes in accordance with the purpose of the study. The teacher at the lessons of computer science studied with schoolchildren a service for creating online constructors (<https://etreniki.ru/>). The capabilities of the simulators "Kokla", "Krypton", "Morfanki", "UFO", "Kartofan" were considered in detail.

The third stage of the study. Then, topics were studied in accordance with the educational and methodological complex at foreign language lessons. When organizing practical work, research and creative activities, students were offered the studied concepts, new spelling rules, and the actions of the characters of literary works to check/design using an online constructor.

4. Results

4.1. The essence of the concept of "algorithmic thinking", its main components and their significance for human development in terms of the intensification of multilingual activities

Algorithmic thinking and a systematic approach are meta-subject skills that are useful to form in pupils as early as possible. At the same time, students do not have to become developers or big-data analysts in the future. The acquired knowledge will help graduates to get the profession demanded by Industry 4.0 in the future and become a highly qualified specialist in the digital society.

Algorithmic thinking is characterized by the following features: the ability to find the sequence of actions necessary to solve the problem; identifying a number of simpler subtasks in the general problem, the solution of which will lead to the solution of the original problem.

Independent (or – at first – with the help of a teacher) compilation of algorithms can not only help pupils learn the order of reasoning or analysis of the grammatical properties of any linguistic phenomenon, but also contribute to the development of analytical skills, the ability to see cause-and-effect relationships and interdependence relationships.

After the review of the literature, it is substantiated that it is the work with educational texts (analysis, critical assessment) that presents a particular difficulty for representatives of

Generation Z (Gerasimova et al., 2021). This is due to the fact that the "clip" of their thinking is primarily aimed at searching for key words, concepts, without relying on formal and semantic features that characterize the text. The actions of the characters in a work of art, the facts of the text are not analyzed, analogies/associations are not taken into account when drawing conclusions.

Certainly, the work on the algorithm in intercultural communication cannot compete with the performance of creative tasks that activate thinking, encourage independent activity, search. However, these two types of activities, complementing each other, can qualitatively improve the work on the formation of language competencies. The advantage of the algorithm is a release of resources and time for solving creative problems. Spontaneous literacy is an automatic, non-conscious, expedient procedure for applying the rules of a foreign language. The step-by-step method of search actions in solving linguistic problems is called an algorithm.

In the current study, the students' work with interactive simulators is considered as an intellectually directed and entertaining-cognitive activity, subordinate to a certain sequence of actions (steps of the algorithm).

4.2. The potential of game simulators for educational purposes in the context of UNESCO recommendations and the development of a digital school

The operation of interactive simulators implies both foreign language communication and activities with additional educational content. The latter include various digital educational resources – any educational information presented on digital media.

Thus, in a foreign language lesson, with the inclusion of purposeful work with interactive simulators, a system of conditions can be formed. This system is oriented:

- to achieve a specific level of foreign language competence, including the prerequisites for the personal development of students, due to the social and spatial-subject environment;
- to use digital tools, interactive techniques and innovative learning technologies in the educational process;
- to develop skills and abilities for analyzing initial data, establishing relationships between the objects of the problem, constructing a solution scheme, interpreting the solutions obtained for the original problem, compiling tasks according to ready-made models.

An online constructor is a network resource in which an ordinary user without special knowledge can launch an interactive game simulator or create his own. To realize the didactic potential of interactive simulators in terms of the formation of algorithmic thinking and the support of foreign language communication, it was decided to use the eTreniki service to create online constructors (<https://etreniki.ru/>).

Work in the online constructor environment is carried out taking into account the principles of a system-activity approach to learning: when compiling a set of words, there is an understanding of the relationships, principles and algorithms of word formation; attention and memory are activated; imagination develops; skills are formed to quickly navigate in a rapid flow of information (for example, the arrival of game blocks in the Kokla simulator).

The resulting interactive simulators can be used in the classroom, online, and in individual training.

4.3. Stages of systematic purposeful work on the use of interactive simulators in intercultural communication to form the foundations of the pupils' algorithmic thinking

According to the logic of the research program, in the lessons of computer science schoolchildren studied the possibilities and limitations of the service. eTreniki is an online service that allows to create electronic educational resources for training typical learning skills and foreign language skills. This electronic designer is affordable for any teacher because it does not require any special training, and it will be enough to have basic skills in using a personal computer. As a result, small web applications can be configured for use in the classroom and in the extracurricular activities of students.

Stage I. In computer science classes, students studied the possibilities of creating five types of simulators (Kartofan, Kokla, Krypton, Morfunk and UFO). Let's consider them.

"Kartofan" are simulators in which it is necessary to correlate text fragments with specific points on the map. For example, correctly identify the names of the towers of the Moscow Kremlin. Correct answers will be highlighted in green, incorrect answers in red.

The Kokla type of simulator is used to practice the mental operations of grouping and classifying. It has the ability to set some entities (phenomena, objects, processes, etc.) and a number of categories (groups, types, classes) in accordance with which these entities should be placed. For example, it is required to divide English verbs into two groups (regular and irregular) by tilting a bamboo stick.

"Krypton" allows you to create simulators in which you need to guess words on any topic (for example, the topic is the capitals of the world). In this case, the letters in the words are randomly arranged and you need to drag and drop letters to arrange them in a certain order.

With the help of the Morfanki constructor, you can create simulators for practicing the skills of morphemic parsing of words (highlight the ending, root, prefix, word stem, suffixes). The constructor of this type has a very nice and friendly interface.

The "UFO" constructor can be used to develop simulators of the "third extra" or "fourth extra" type, when in any group of objects, it is necessary to determine one object that differs from all other objects by a certain attribute.

Stage II. In foreign language classes the study of theoretical material took place. For example, forming tag-questions according to the rule. The students analyzed the algorithm (as a sequence of actions), following which a correct question can be asked.

Necessary theory. Tag-questions consist of two parts: the main part – before the comma, and the "tail" – after the comma. Typically problem for students is matching the "tail" to the main part that already exists. Example: "They are at home (main part), _____ (tag)?".

A short algorithm (sequence of actions) is as follows:

1. The auxiliary verb is defined and it is used in the in the first place in the tag after the comma. If the main sentence is positive, then the auxiliary verb is negative. If the main sentence is negative, then the auxiliary verb is positive.

2. The subject of the main sentence is defined, if it is not expressed by a pronoun, then the pronoun for the subject is found. The pronoun is put after the auxiliary word.

3. The question mark is put at the end of the tag-question.

Further examples for consolidation are considered.

4.3 Experimental evaluation

4.3.1. The ascertaining stage of the experiment

To assess the input conditions, specially designed control and measuring materials were used.

The test tasks were formulated according to the following principles:

- Assessment of the quality of theoretical knowledge in a foreign language;
- Assessment of the cognitive activity of students in intercultural communication;
- Assessment of the formation of skills to find the sequence of actions necessary to solve the problem; allocate a series of constituent subtasks in the general task; planning of possible communicative situations and reactions of the performer of them; understanding and use of formal ways of writing a solution (drawing up an algorithm).

- Assessment of user skills in playing services for solving problems of educational, cognitive and communicative activities.

Examples of test jobs.

The first unit ("Foreign language").

1. At the end of interrogative sentences, put a question mark, at the end of affirmative sentences – a period ("They want to go to the embankment", "Does she like to skate", "Can we go down to the subway", etc.).

2. Make an algorithm for writing cinquain (example topics: family, sights, travel).

3. Petya compiled a sequence of actions for writing a cinquain. Is this sequence of actions an algorithm? Make the appropriate changes and determine what will happen as a result.

Modifications of this task.

3.1. Compose a short story on the finished cinquain (use of words and phrases that make up the cinquain).

3.2. A cinquain on the topic "Railway" is given. It is necessary to find words and phrases that do not correspond to the theme of the cinquain in the lines.

The second unit ("Foreign literature").

1. A fragment of text from a literary work is given (for example, from the fairy tale "Cinderella" by Charles Perrault). Is it possible to swap the first and last paragraphs of this text? Why?

2. To find out who committed the theft, follow the given instructions using operations on text fragments.

A. In the snow, 1 track stretched from the holly at the edge of the clearing to 2. They seemed to go further into the garden, but they broke off there. Copy to appropriate position: 1 – chain; 2 – balcony doors.

B. "Very smart", Inspector 4 said under his breath. He entered the office and 3 on everyone's shoes. "How cleverly the criminal escaped!" grumbled Major Hog. Copy to appropriate position: 3 – carefully looked; 4 – Blair.

C. "My 5!" she exclaimed, "They stole my 5!" "Everyone, stay where you are!" shouted 6, running out through the balcony doors. Copy to appropriate position: 5 – «diamonds»; 6 – «Inspector Blair». D. It was a dark and stormy night. Four people sat and played 7 in 8's room. Copy to appropriate position: 7 – cards; 8 – Major Hog.

E. Suddenly the light went out, and 9 screamed. When the light was turned on again, 10 was lying on the floor and clutching her throat with her hands. Copy to appropriate position: 9 – someone; 10 – Mrs. Pimple.

F. "Not so smart", said 11, looking at the criminal's snow-covered boots. In an instant, he snapped the handcuffs on 12's wrists and fished a sparkling necklace out of his pocket. Copy to appropriate position: 11 – Inspector Blair; 12 – Major Hog

Exercise. Rearrange the fragments in the following order: D E C A B F. Delete all instructions and their numbers in the text.

3. There is a sequence – an order of actions for Sherlock Holmes, who is looking for a clue in the story "The Adventure of the Dancing Men" by Arthur Conan Doyle. Arrange the investigator's actions in such an order that he can find the meanings for each symbol.

The third unit ("Basic algorithmic constructions").

1. Listen in English to the song "If there was no winter" from the "Prostokvashino" Soviet cartoon. Make up an algorithm according to the words of the song that describes what fun the guys will be deprived of if there is no snowy and cold winter.

2. There is a sequence – the procedure for launching the Paint program. Arrange the actions in such an order that the user can actually open the graphics editor.

3. Make an algorithm for crossing the road at a traffic light.

Therefore, it was possible to collect data on 46 students, from which experimental and control groups were formed (23 students each).

Each student scored from 0 to 150 points. To determine the level of formation of algorithmic thinking (according to the sum of all 3 units), the levels "low" (from 0 to 69 points (inclusive)), "medium" (from 70 to 133 points (inclusive)), "high" (more than 134 points) were introduced. According to the results of measurements, the quality of students' training was determined in terms of the formation of skills and abilities that form the basis of algorithmic thinking. The experimental group consisted of 50 % girls and 50 % boys.

4.3.2. Forming stage of the experiment

This stage of the experiment was devoted to planning and organizing purposeful work on the use of interactive simulators in intercultural communication to form the foundations of students' algorithmic thinking.

Also, this stage of the study is the training of schoolchildren (in the experimental group) based on the materials of the "Foreign Language" course, during which they used simulators from the online constructor.

Task examples are given below.

1. Develop an interactive simulator that allows you to determine whether the verb is auxiliary or not.

2. Develop an interactive simulator that allows you to fill in the gaps in the text with separating questions.

3. Develop an interactive simulator that allows you to exclude from the given sentences the one that is not a separating question.

Key task. Compile an instruction (algorithm) in Russian and English for a friend/acquaintance. In the instructions, describe the sequence of actions for registration, the course of work with the online constructor. Be sure to: have the instruction both in Russian and in English.

After the simulators were created, the students exchanged them by link and completed each other's tasks. If the schoolchildren did not manage to answer all the questions correctly the first time, then a special lesson "Correction of mistakes" was provided. As part of this lesson, the students with the teacher again returned to the words and sentences where mistakes were made. The spelling of new words, work with auxiliary verbs, the replacement of pronouns, the meaning of concepts in dictionaries were analyzed in detail.

Schoolchildren of the control and experimental groups were trained on the materials of the work program in English for the 6th grade, developed on the basis of an exemplary program in English and the educational and methodological complex of Yu.E. Vaulina, J. Dooley, O.E. Podolyako, V. Evans for 5–9th grades (Vaulina et al., 2016). A distinctive feature of this program is the regular use of ICT in order to deepen knowledge of regional studies and immerse in the language environment. In addition, the materials contain poems and songs that help emotional, involuntary and simultaneous memorization of not only active vocabulary, but also new grammatical structures.

Examples of exercises for students in the control group.

1. Write a sequence of actions and a list of questions in order to find out which films your classmates prefer. It is obligatory to use at least 5 disjunctive questions in the survey.

2. Little Frankie writes a letter to Santa Claus. It is necessary to read the text of the letter and indicate what little Frankie asks Santa Claus to do/not do. Make up disjunctive questions to the highlighted sentences.

However, students from the control group were not specially involved in the gaming activities for the creation/use of online simulators.

4.3.3. Control stage of the experiment

To test the effectiveness of the proposed system of training in terms of developing the skills that form the basis of algorithmic thinking, another control test of 3 units was carried out. The number of tasks and the principles of their compilation corresponded to those described earlier (clause 4.3.1).

As a result of the diagnostic measure for the course, each student again scored from 0 to 150 points.

The control measurement data before and after the experiment are presented in Table 1.

Table 1. The results of measurements on the level of development of algorithmic thinking

Level	Groups			
	Experimental (23 pupils)		Control (23 pupils)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	3	11	4	5
Medium	6	9	5	7
Low	14	3	14	11

In this case, the hypotheses are formulated as follows.

Ho: the level of algorithmic thinking in the experimental group is statistically equal to the level of students in the control group; H1: The level in the experimental group is higher than the level of the control group. Further, in the online resource (<https://medstatistic.ru/calculators/calchit.html>), the values of the criterion were calculated before (χ^2 observable 1) and

after (χ^2 observable 2) the experiment. For $\alpha = 0.05$, according to the distribution tables, χ^2_{crit} is 0.234. Thus, $\chi^2_{obs.1} < \chi^2_{crit}$ ($0.234 < 5.991$), and $\chi^2_{obs.2} > \chi^2_{crit}$ ($7.071 > 5.991$). Therefore, the shift towards an increase in the level of algorithmic thinking of the students of the experimental group can be considered non-random.

5. Limitations

Possible limitations on the research:

1. The sample of students was not random: the experimental and control groups were formed in such a way that each group was guaranteed to have the same knowledge, skills and abilities that form the basis of algorithmic thinking. In the course of diagnostics, the results of the input control measure were taken into account.

2. The selection of participants for the experiment and the sample size are justified by the specifics of the study, the availability of digital technologies for the inclusion of interactive game simulators in foreign language communication.

4. Throughout the experiment, practical activities on the use of interactive simulators in intercultural communication to form the foundations of the students' algorithmic thinking were carried out by the same teacher, on the same software equipment, in school classrooms.

5. The implementation took into account the main didactic principles underlying learning using ICT tools: adaptability, interactivity and individuality of learning, integrated use of software, expediency, optimal use of information and communication technologies.

6. Discussion

Performing a quantitative analysis of the data obtained, we can conclude that after the completion of the experiment, 48 % of schoolchildren in the experimental group had a "high" level of formation of algorithmic thinking (11 students out of 23) while initially this percentage was 13 % (3 respondents out of 23). The number of pupils with a "low" level has significantly decreased from 61 % to 13 %. For the control group, the following was recorded: the indicator for the "high" level qualitatively changed from 17 % to 12 %, and for the "low" level – from 61 % to 48 %.

When discussing the didactic potential of game services and online constructors, it was found that the described system of actions for the use of interactive game simulators in foreign language lessons has real opportunities for:

- Formation of algorithmic thinking skills;
- Gaining experience in project research and educational and intercultural activities;
- Application of theoretical information from the rules for designing the work of interactive online simulators;
- Modeling of work in demanded professions.

The following questions were highlighted for detailed class discussion both in computer science classes and in English classes:

1. What type of electronic educational resources can be attributed to "eTreniki"?
2. List the types of simulators that can be created using the eTreniki constructors.
3. Give a description of the constructors of each type according to the following plan:
 - a. Didactic functions of the simulator created using this type of constructor;
 - b. The possibility of using the simulator created with the help of this constructor in a situation of foreign language communication (give examples).
4. Create one new simulator for each type of constructors in relation to the learned rule or plot of the work.

In other words, the pedagogical experiment proved that intercultural communication in the digital educational environment contributes to the formation of algorithmic thinking due to interactivity, operational feedback, access to various sources of information, multimedia content, etc.

The obtained conclusions about the didactic potential of new digital technologies in relation to improving the quality of foreign language teaching, the formation of thinking confirm and supplement the results of the work of I. Damopolii et al (Damopolii et al., 2022). Since this team mainly considered the development of critical thinking. A significant result of the study is the description of the basic ideas of the approach, expanding the ideas of I. S. Zlobina et al. about the possibilities of interactive resources for mastering the skills of various types of reading and information processing of the material read; ability to adequately understand, interpret educational texts, etc. (Zlobina et al., 2020).

Further research may be aimed at disseminating the proposed approach to the formation of algorithmic thinking by means of interactive resources when teaching other school subjects.

7. Conclusion

The significance of the present study lies in the following:

- The possibility and expediency of forming the foreign language communicative competence and skills of intellectual activity demanded by modern society by means of information technologies in teaching English as a foreign language in basic school is substantiated;
- A system of intercultural educational and cognitive activities has been developed, aimed at forming the foundations of algorithmic thinking among primary school students.

The paper specifies the essence of the concepts of "interactive game simulator", "online constructor", taking into account the specifics of their application in intercultural communication. The authors substantiate the conclusion that interactive game simulators, as new tools for learning and cognition, open up wide opportunities both for changing traditional activities (reading, writing, communication) and for developing higher mental functions and processes (attention, memory, will, thinking) in today's digital environment. The study on experimental data proves that a foreign language is the basis for the development of algorithmic thinking, imagination, intellectual and creative abilities of students.

The potential of interactive gaming simulators is described by the authors using the eTreniki online constructor as an example: Kokla, Krypton, Morfanki, UFO, Kartofan services.

As key features of the use of interactive gaming simulators, expanding the range of educational and cognitive influences, for the formation of algorithmic thinking, enriching the practice of foreign language oral and written speech, the authors highlight the following:

- Intensification of interconnection, data exchange and intercultural cooperation;
- Activation of work with various types of information (text, links, maps, images, tables, etc.);
- Gamification of complex intellectual activity for programming the work of simulators according to the rules of a foreign language or the plot of a literary work;
- A combination of various forms of educational and cognitive activity;
- Taking into account the specifics of thinking and interests of modern teenagers.

The use of ready-made interactive game simulators and the design of their work according to the rules of a foreign language or the plot of a literary work not only corresponds to the priorities in the field of digital technologies, but also makes it possible to convincingly show the didactic potential of game mechanics, in particular, for the formation of algorithmic thinking.

8. Acknowledgements

The article was made with support of the Ministry of Science and Higher Education of the Russian Federation in accordance with agreement No 075-15-2022-317 date April 20, 2022, on providing a grant in the form of subsidies from the Federal budget of Russian Federation. The grant was provided for state support for the creation and development of a World-class Scientific Center "Agrotechnologies for the Future".

References

Arkhipova, 2019 – Arkhipova, E.V. (2019). "Klipovoe myshlenie" i aksiologicheskie problemy usvoeniya rodnoj rechi uchashchimisya na urokah russkogo yazyka ["Clip thinking" and axiological problems of mastering native speech by students in Russian language lessons]. *Kognitivno-kommunikativnyj podhod v obuchenii russkomu yazyku i literature v shkole i vuze. Sbornik nauchnyh statej i metodicheskijh rekomendatsij po materialam Vserossijskoj nauchno-prakticheskoj konferentsii*, 7-11. [Electronic resource]. URL: <https://elibrary.ru/item.asp?id=41417333> [in Russian]

Barac et al., 2014 – Barac, R., Bialystok, E., Castro, D. C., Sanchez, M. (2014). The cognitive development of young dual language learners: A critical review. *Early Childhood Research Quarterly*. 29(4): 699-714. DOI: 10.1016/j.ecresq.2014.02.003

Belyaev, 2011 – Belyaev, B.V. (2011). O sootnoshenii yazyka i rechi v processe obucheniya inostrannomu yazyku [On the relationship of language and speech in the process of learning a foreign language]. *Inostrannyye yazyki v shkole*. 8: 3-10. [in Russian]

Damopolii et al., 2022 – *Damopolii, I., Paiki, F. F., Nunaki, J.H.* (2022). The development of comic book as marker of augmented reality to raise students' critical thinking. *TEM Journal*, 11(1): 348-355. DOI: 10.18421/TEM111-44

Elovskaya, 2018 – *Elovskaya, S.V.* (2018). Ispol'zovanie interaktivnykh obrazovatel'nykh tekhnologiy pri obuchenii inostrannomu yazyku v vuze [The use of interactive educational technologies in teaching a foreign language at university]. *Vestnik Tambovskogo universiteta. Seriya: Gumanitarnye nauki*. 23(176): 39-45. DOI: 10.20310/1810-0201-2018-23-176-39-45. [in Russian]

Eriksson et al., 2020 – *Eriksson, E., Rivera, M. B., Hedin, B., Pargman, D., Hasselquist, H.* (2020). Systems thinking exercises in computing education: Broadening the scope of ICT and sustainability. *Paper presented at the ACM International Conference Proceeding Series*: 170-176. DOI: 10.1145/3401335.3401670

Gerasimova et al., 2021 – *Gerasimova, E.K., Gavrilovskaya, N.V., Soboleva, E.V., Suvorova, T.N.* (2021). Issledovanie usloviy vklyucheniya elementov gejmifikatsii v izuchenie osnov algoritimizatsii i programmirovaniya dlya povysheniya kachestva obrazovatel'nykh rezul'tatov obuchayushchihhsya [Investigation conditions for inclusion of gamification elements in study of the basics of algorithmization and programming to improve the quality of educational results of pupils]. *Perspektivy nauki i obrazovaniya*. 4(52): 461-477. DOI: 10.32744/pse.2021.4.31 [in Russian]

Gorbatyuk, Kabak, 2019 – *Gorbatyuk, R.M., Kabak, V.V.* (2019). Ispol'zovanie informatsionnoy sistemy algostudy v processe formirovaniya algoritmicheskogo myshleniya budushchih inzhenerov-pedagogov v oblasti komp'yuternykh tekhnologiy [Using the algostudy information system in the process of forming the algorithmic thinking of future engineers-teachers in the field of computer technology]. *Informatsionnye tekhnologii i sredstva obucheniya*, 69(1): 124-138. [in Russian]

Goryachkin i dr., 2021 – *Goryachkin, B.S., Galichy, D.A., Chains, V.S., Burashnikov V.V., Krutova, T.Y.* (2021). Effektivnost' ispol'zovaniya chat-botov v obrazovatel'nom processe [The effectiveness of using chatbots in the educational process]. *E-Scio*. 4 (55): 529-551. [Electronic resource]. URL: elibrary_45804845_57685830.pdf (date of access: 03.03.2022). [in Russian]

IYBSSD2022, 2022 – *IYBSSD2022*. We are all invited to celebrate basic sciences for sustainable development. [Electronic resource]. URL: <https://www.iybssd2022.org/en/home/> (date of access: 25.02.2022).

Kager et al., 2022 – *Kager, K., Jurczok, A., Bolli, S., Vock, M.* (2022). “We were thinking too much like adults”: Examining the development of teachers' critical and collaborative reflection in lesson study discussions. *Teaching and Teacher Education*. 113. DOI: 10.1016/j.tate.2022.103683

Kalugina, Tarasevich, 2018 – *Kalugina, O., Tarasevich, N.* (2018). Smart technology integration into EFL teaching at the non-linguistic higher school. *XLinguae*. 11: 8-18. DOI: 10.18355/XL.2018.11.01XL.02

Kane et al., 2022 – *Kane, B.D., Keene, K.C., Reynolds, S.* (2022). Collaborative literary reasoning as a support for preservice english language arts teachers' learning about disciplinary literacy. *English Teaching*, 21(1): 84-97. DOI:10.1108/ETPC-06-2021-0065

Martin, Nakayama, 2006 – *Martin, J.N., Nakayama, T.K.* (2006). Intercultural Communication in Contexts. [Electronic resource]. URL: http://library.lgaki.info:404/2021/Martin_Intercultural.pdf (date of access: 20.08.2022)

Nurhayati et al., 2022 – *Nurhayati, N., Silitonga, L.M., Subiyanto, A., Murti, A.T., Wu, T.* (2022). Computational thinking approach: Its impact on students' English writing skills. DOI: 10.1007/978-3-031-15273-3_47

Parunina, Babikova, 2020 – *Parunina, L.V., Babikova A.V.* (2020). Iгры V.V. Voskobovicha kak sredstvo razvitiya algoritmicheskogo myshleniya doshkol'nikov [Games of V.V. Voskobovich as a means of developing algorithmic thinking in preschoolers]. *Vospitanie i obuchenie detej mladshego vozrasta*. 8: 371-372. [Electronic resource]. URL: <https://elibrary.ru/item.asp?id=46223646> [in Russian]

Pushkareva et al., 2017 – *Pushkareva, T.P., Stepanova T.A., Kalitina, V.V.* (2017). Didakticheskie sredstva razvitiya algoritmicheskogo stilya myshleniya studentov [Didactic means of developing students' algorithmic thinking style]. *Obrazovanie i nauka*. 19(9): 126-143. DOI 10.17853/1994-5639-2017-9-126-143 [in Russian]

Rottenhofer et al., 2022 – Rottenhofer, M., Kuka, L., Leitner, S., Sabitzer, B. (2022). Using computational thinking to facilitate language learning: A survey of students' strategy use in austrian secondary schools. *IAFOR Journal of Education*. 10(2): 51-70. DOI: 10.22492/ije.10.2.03

Silva et al., 2019 – Silva, D.B., Aguiar, R.D.L., Duconlo, D.S., Silla, C.N. (2019). Recent studies about teaching algorithms (CS1) and data structures (CS2) for computer science students. *Paper presented at the Proceedings – Frontiers in Education Conference, FIE*. DOI: 10.1109/FIE43999.2019.9028702

Soboleva et al., 2021 – Soboleva, E.V., Suvorova, T.N., Grinshkun, A.V., Bocharov, M.I. (2021). Applying Gamification in Learning the Basics of Algorithmization and Programming to Improve the Quality of Students' Educational Results. *European Journal of Contemporary Education*. 10(4): 987-1002. DOI: 10.13187/ejced.2021.4.987

Sorokin, Vyatskaya, 2022 – Sorokin, P.S., Vyatskaya, Y.A. (2022). Mezhdunarodnaya ekspertnaya povestka v obrazovanii: klyucheveye harakteristiki i problemnye zony [International expert agenda in education: key characteristics and problem areas]. *Obrazovanie i Nauka*. 24(1): 11-52. DOI: 10.17853/1994-5639-2022-1-11-52 [in Russian]

Steffen, Murtovi, 2021 – Steffen, B., Murtovi, A. (2021). Generative program analysis and beyond: The power of domain-specific languages (invited paper). DOI: 10.1007/978-3-030-67067-2_3

Tsareva, Bogoudinova, 2021 – Tsareva, E.E., Bogoudinova, R.Z. (2021). Mul'tiyazychnost' kak sredstvo formirovaniya sociokul'turnoj kompetentnosti studentov v inzhenernom vuze [Multilingualism as a means of forming the socio-cultural competence of students at an engineering university]. *KNITU*, 140. [Electronic resource]. URL: <https://www.studentlibrary.ru/book/ISBN9785788230016.html> (date of access: 29.10.2022). [in Russian]

Tucker, 2022 – Tucker, A. (2022). Reading texts, reading people: Cognitive literary science and pedagogy. *Arts and Humanities in Higher Education*. 21(1): 94-110. DOI: 10.1177/14740222211013757

Ushakova et al., 2022 – Ushakova, N., Aleksieienko, T., Kushnir, I., Zozulia, I., Uvarova, T. (2022). Storytelling technique in teaching ukrainian as a foreign language remotely. *Theory and Practice in Language Studies*, 12(4): 629-638. DOI:10.17507/tpls.1204.02

Vaulina et al., 2016 – Vaulina, Yu.E., Dooley, J., Podolyako, O.E., Evans V. (2016). Uchebno-metodicheskij komplekt «Anglijskij v fokuse» dlya 5-9 klassov [Educational and methodical kit "English in focus" for grades 5-9]. *Express Publish: Prosveshchenie*. [Electronic resource]. URL: <https://schoolguide.ru/index.php/midschool-foreign/english-spotlight.html> (date of access: 25.08.2022) [in Russian]

Veretnova, 2018 – Veretnova, Yu.A. (2018). Metodika obucheniya uchashchihsya 6-7 klassov disciplinam hudozhestvenno-esteticheskogo cikla na osnove algoritmicheskogo podhoda. [Methods of teaching 6th- and 7th-grade students the disciplines of the artistic and aesthetic cycle based on the algorithmic approach]. *Vestnik Krasnoyarskogo gosudarstvennogo pedagogicheskogo universiteta im. V.P. Astafeva*, 1(43): 190-198. DOI: 10.25146/1995-0861-2018-43-1-52 [in Russian]

Vilenkin, Drobyshev, 1988 – Vilenkin, N.Ya., Drobyshev, Yu.A. (1988). Vospitanie algoritmicheskogo myshleniya na urokah matematiki [Education of algorithmic thinking in mathematics lessons]. *Nachal'naya shkola*. 12. [Electronic resource]. URL: <https://vunivere.ru/work5573> (date of access: 25.02.2022) [in Russian]

Whitfield, 2022 – Whitfield, A. (2022). Unspoken assumptions, deep holes and boundless expectations the dialogical tensions in teaching short stories. *Language and Dialogue*. 12(1): 110-129. DOI: 10.1075/ld.00114.whi

Zhang et al., 2022 – Zhang, J., Wang, C., Muthu, A., Varatharaju, V.M. (2022). Computer multimedia assisted language and literature teaching using heuristic hidden markov model and statistical language model. *Computers and Electrical Engineering*. 98. DOI: 10.1016/j.compeleceng.2022.107715

Zlobina et al., 2020 – Zlobina, I.S., Rezepova, N.V., Utkina, N.V., Sergejeva, N.A., Rublova, O.S. (2020). Study of the influence of interactive gaming resources on the formation of scientific terminology and foreign language competence. *Science for Education Today*. 3: 144-163. DOI: 10.15293/2658-6762.2003.08