UDC 372.851
IRSTI 27.01.45
https://doi.org/10.48371/PEDS.2023.71.4.022

MODEL OF THE DEVELOPMENT OF ALGORITHMIC COMPETENCE OF STUDENTS AT MATHEMATICS LESSONS THROUGH DIGITAL RESOURCES

*Karassyova L.N.[1], Dzhakupova A.N.[2], Abdoldinova G.T.[3]
*[1]doctoral student, Kokshetau University named after Sh. Ualikhanov, Kokshetau, Kazakhstan
e-mail: lyubakarassyova@mail.ru
[2]doctoral student, Kokshetau University named after Sh. Ualikhanov, Kokshetau, Kazakhstan
e-mail: Aimgul.Djakupova@mail.ru
[3]c.p.s., Kazakh University of Technology and Business, Astana, Kazakhstan
e-mail: abdoldinova@mail.ru

Abstract. The article deals with the issues of teaching mathematics in a secondary school. Based on the researches of native and foreign teachers, the concept of algorithmic competence of students and its development through information and communication technologies is considered here and it's based on the researches of native and foreign teachers.

A brief review of scientific papers is also given, the authors of which conduct research in the field of education aimed at developing the algorithmic competence of students in teaching mathematics. The main purpose of the study is to show the importance of developing the algorithmic competence of students with the help of information and communication technologies (ICT). The concept of an interactive geometric environment Geogebra and Desmos graphics calculator ar also considered. It is proposed the educational and thematic planning of the program, named "Designing activities for the development of algorithmic competence of students in mathematics lessons through ICT". The use of this program in the learning process at school can largely have a positive impact on increasing the level of algorithmic competence of students. During the experiment, information was obtained about the level of development of algorithmic competence among students. The data indicate the need to organize work on the application of this program. The results indicate the effectiveness of the proposed program. There are conclusions about the features of the application interactive geometric environment GeoGebra and Desmos graphing calculator.

Key words: algorithmic competence, algorithm, learning process, interactive geometric environment Geogebra, Desmos Graphing Calculator, Construction Problems,school education, mathematics

Basic provisions

In the conditions of active modernization of the education system, the structure and content of general education are being improved. Within the framework of this reform, a special role belongs to modern information technologies. At this stage, this is not a tribute to fashion, but a real necessity. Modern students grow up in a new information space. They learn the basics of computer literacy before they learn to write and read. They are becoming increasingly difficult to surprise with the help of old tricks and teaching methods. As a result, students may lose interest in studying academic disciplines, which cannot but disturb the teacher [1].

Currently, there remains a need to create pedagogical conditions and technologies that ensure the formation of skills to apply knowledge in non-standard situations. There is also an active search for new ways and means to form and develop initiative, flexibility of thinking, independence, the ability to transfer knowledge into the field of practical activity.

Algorithmic thinking skills can be considered one of the necessary skills for everyone in our time. People and society live at a time when they cannot escape the use of information and communication technologies (ICTs). Therefore, they should be ICT literate.

Introduction

Algorithmic competence is a constituent component of competence in the field of information and communication technologies (ICT competence). The concept of "algorithmic competence", presented in the works of L.N. Udovenko, Yu.V. Korchemkina, V.V. Kalitina, M.V. Kondudar can be summarized as the ability to create an algorithm and implement it as a software product.

Algorithmic competence is a set of knowledge of the main algorithms of the course being studied and the ability to use them in solving problems of a certain range, the ability to combine known algorithms and create new ones, the willingness to apply the algorithmization process in various subject areas [2]. In the process of teaching mathematics, the formation of algorithmic competence is dynamic in nature, while observing the principles of "continuity, consistency, continuity and stages."

The analysis of the literature showed that the improvement of the process of teaching students through algorithmization was reflected in the studies of I.N. Antipova, V.A. Dalinger, V.M. Monakhova, Yu.A. Makarenkova, M.P. Lapchik and others L.N. Landa first introduced the definition of an algorithmic approach to learning. The problems of forming the foundations of algorithmic culture were the subject of research by domestic and foreign teachers (E.Zh. Smagulov, A.A. Temerbekova, R. Kaiser, A. Shpek, G. Krummerheuer, S. Kaune, P. Kadunts), who analyzed the educational potential various subject areas - mathematics, physics, chemistry, geography, cultural studies, pedagogy and psychology [3].

The course of school mathematics has quite ample opportunities for the formation, study and application of algorithms, since an algorithmic line is naturally laid in its content. Mathematical material, as it were, forms a meaningful basis for studying the foundations of computer science, that is, it prepares students for the perception of such important concepts of a computer science course as an algorithm and a program.

The student's algorithmic competence is determined by the following criteria: - understanding of the properties and essence of the algorithm; – possession of techniques and means for writing algorithms; – understanding the algorithmic nature of mathematical methods and their applications; - Possession of algorithms used in the school course of mathematics. Work on algorithms helps to develop students' interest in the learning process, students will strive to replace the

proposed algorithm with the simplest one, try to justify the expediency of replacement, and this develops creative and constructive thinking.

Algorithmization of learning presupposes a certain unity between the processes of analysis and synthesis, and actively influences the development of creative thinking. Free creativity can exist only on the basis of conscious algorithms.

Thus, the indicators of algorithmic competence are: - students' knowledge of the definition of the concept of "algorithm"; - students' knowledge of existing types of algorithms; - students' knowledge of the properties of algorithms; - the ability of students to create a new algorithm, write it down and check it; - the ability of students to solve basic typical problems using algorithms; - the ability of students to independently find and correct syntactic and semantic errors in the algorithm [4].

Materials and methods

Theoretical and methodological analysis of scientific literature. General didactic teaching methods (methods for the formation of new knowledge and skills, methods of consolidation, methods of control), analysis. Math modeling. Experiment method.

Results

According to T.F. Sergeeva [5], an interactive geometric environment is a pedagogical software tool that allows you to perform various geometric constructions on a computer, consisting of basic geometric objects and their combinations, as well as to set relationships between these objects. At the same time, when changing some objects, the rest change in real time, while maintaining the specified ratios unchanged. For example, the opposite sides of a parallelogram with any movement of its vertices will remain equal and parallel. T.S. Shirikova [6] introduces another name for such interactive programs - systems of dynamic geometry, which are understood as pedagogical software tools that allow you to perform geometric constructions on a computer in such a way that when one of the geometric objects changes, the rest also change, keeping the relationships set between them unchanged.

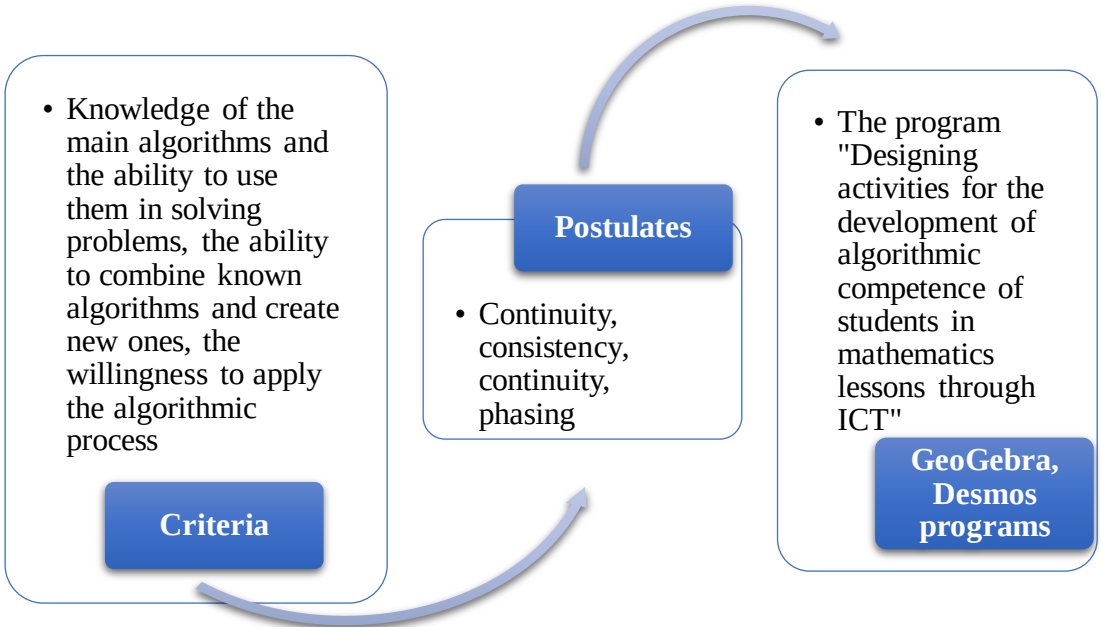


Figure 1 - A model for the development of algorithmic competence of students in mathematics lessons through digital resources.

The main advantage of these programs is the ability to build interactive and dynamic geometric drawings and models.

Dynamic geometric drawings- these are geometric models that contain not just an image, but the entire algorithm on the basis of which this image is built. As a result, the drawing can change when the position of its elements changes, while the relationships between the elements remain unchanged. Therefore, students actually deal not with one geometric figure, but with their combinations.

Interactive geometric drawings- these are drawings that can be changed both by the teacher and the student during and after the completion of the construction, which allows organizing interaction between the teacher and students through such a drawing [7].

Almost any interactive geometric environment allows you to quickly and accurately perform constructions, build models on a plane and in space, as well as conduct research using manual or automatic changes in the position of individual objects or changes in the numerical values of parameters. Of particular popularity among such programs today is the GeoGebra program, which makes it possible to create dynamic drawings, drawings, models for use in teaching geometry, algebra, physics and other subjects. The main idea of this program is an interactive combination of geometric, algebraic and numerical representation. The GeoGebra program allows you to create various structures from points, rays, vectors, segments and lines, allows you to build graphs of various types of functions, which can then be dynamically changed by varying one or more parameters. It also allows the construction of perpendicular and parallel lines, perpendicular bisectors and bisectors of angles, circles, tangents. In this program, you can measure angles, determine the lengths of segments, areas of polygons and closed curves. Thus, thanks to the capabilities of the GeoGebra program, it is useful to use it for

studying the properties of geometric objects, visually solving problems, “discovering” and proving theorems, conducting research, etc.

At the stage of obtaining new knowledge and at the stage of control, mathematics teachers can use the Desmos Internet service. It is an advanced graphing calculator that is written in HTML.5 and implemented as a browser application, and can also work as a mobile application for tablets and smartphones. This makes it possible for almost every participant in the educational process to experiment right in the classroom. Desmos does not require installation on a computer, only a browser is required. Simplicity and intuitive interface allow using the Desmos service in different age groups. The environment allows you to perform various graphic constructions: from the simplest in grades 5-6 to solving problems with parameters in preparation for state exams in grades 9-11 [8].

In grades 7 and 8, when studying the graph of a linear and quadratic function, it is very convenient to use this service to study the influence of the parameters included in the formula on the location of the graph relative to the coordinate axes and on the relative position of the graphs. Graphs are built in seconds, and on one screen you can build an unlimited number of them and choose your own color for each. For example, in grade 7, you can conduct a research mini-project “The influence of parameters k and b on the location of the graph of a linear function y=kx+b”, and in grade 8 - “The influence of parameters a, b, c on the location of the parabola”. To do this, the class is divided into groups and each receives its own part of the task, builds several graphs, analyzes them, puts forward a hypothesis, confirms or refutes it, draws conclusions and introduces classmates to their work. To get started with Desmos.

Discussion

Having experience in a comprehensive school, we have created a program for studying algebra and geometry in the 7th grade, using information and communication technologies, which is designed to review some topics of these subjects once a week, that is, 36 hours a year.

In order to develop the algorithmic competence of students in mathematics lessons through ICT, the objectives of the program were determined:

- to develop interest and positive motivation for studying algebra and geometry at the initial stage;
- to expand and deepen students' ideas about the techniques and methods for solving mathematical problems;
- formation of the skill of working with the dynamic mathematical program Geogebra, the Desmos graphical calculator;
- development of the ability to self-control and concentration, the ability to properly manage the allotted time.

The object of the study is the educational process in a secondary school.

The subject of the study is the ways of forming algorithmic knowledge and skills of students.

The applied form of work is individual, pair, in small groups with the use of the mathematical program GeoGebra, the graphical calculator Desmos allows you to achieve your goals. The class is held once a week.

Age category: from 12 to 13 years old (students of the 7th grade)

Schoolchildren begin to study algebra and geometry at the age of 12-13. This is a transitional age from childhood to early adolescence. During the transitional period, the human brain is enriched with many associative functions. Gradually, a change in thinking takes place: in its concrete-visual content, characteristic of a child of early school age, under the influence of training, the prerequisites for the formation of concepts are created. The teenager begins to use reasoning to clarify cause-and-effect relationships; there is a desire to explain, substantiate, prove. By the end of the transition period, the role of abstract thinking increases significantly, and the readiness for theoretical reasoning increases [9]. It is in the 7th grade that the subject basis is laid for the subsequent study of algebra and geometry. That's why,

The GeoGebra program has a fairly high functionality and capabilities, but at the same time it has a fairly simple, convenient and intuitive interface, which allows it to be used in the educational process, both by a teacher in the classroom and independently by students at home.

One of the problems that students face when solving problems and proving theorems is the construction of drawings: geometric shapes, their elements, combinations of various geometric objects, additional constructions, etc. Quite often, students formally approach the construction of geometric drawings and drawings.

To teach students the correct and meaningful construction of geometric drawings, the GeoGebra program can help, in which, as in a notebook, it is impossible to formally approach the construction of geometric objects. The construction of each drawing, drawing or model in GeoGebra has a clear algorithm and procedure, which contributes to the formation of students' understanding of the construction of various geometric shapes, their elements and combinations [10].

To do this, we have developed algorithms for constructing drawings for geometric shapes and their objects, for basic theorems and some tasks from a school textbook. First, students build geometric drawings according to ready-made proposed algorithms, then they are offered construction algorithms, in which errors are either made, or some stages of construction are omitted. And when students already have experience in building, they are offered tasks for which they must build the drawings on their own.

In the process of mastering each module of the program by students, it is envisaged to conduct pair, group practical work, tests that allow for ongoing and thematic control of students' knowledge and skills. At the end of the study of the program, final practical work is carried out.

The program contains four modules, compiled on the basis of the course of algebra and geometry of the 7th grade of a general education school.

In the first module (10 hours), building skills, methods of defining and examining functions are worked out. The second module (8 hours) contains the section

"Triangles", which deals with the types of triangles, its elements and signs of equality. The lessons of the third module (8 hours) are aimed at considering the relative position of lines. The fourth module (10 hours) includes the topic "Circumference" and geometric constructions. Each module ends with individual practical work. Such forms of control are used as: Google Classroom questionnaire, Aktiviti class Applet, mutual control, Teacher Desmos practical work. For the convenience of using the programs, there are active links: GeoGebra Classic, https://www.desmos.com/calculator?lang=ru
Schematically and partially the program is shown in Table 1.

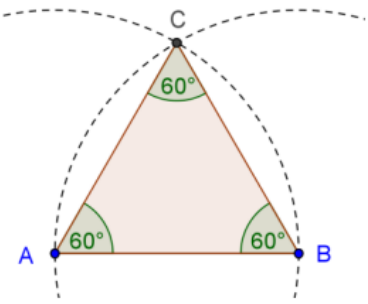
Table 1 - Educational and thematic planning of the program "Designing activities for the development of algorithmic competence of students in mathematics lessons through ICT"

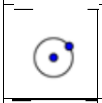
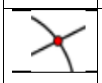
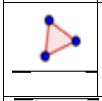
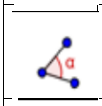
lesson number	*Subject*	*Kind of activity*	*Target*	*form of control*
*Module 1*Function. Function graph. (10h)				
1	Introduction: purpose and content programs, forms of control.	Frontal work, presentation of the program	Introduce students to the purpose and content of the program, briefly talk about the program Geogebra, and Desmos graphics calculator.	Google Classroom questioning
6.7	Function of the form y=ax2, graphs of the function and its properties.	Work in the program GeoGebra Classic (work in a small group)	plot the function y=ax2 (a≠0) and know its properties;	Active class Applet, Practical work
*Module 2.*Triangles. (8h)				
eleven	Triangle and its types.	Working in a graphical calculatorhttps://www.desmos.com/calculator?lang=ru (pair work)	distinguish types of triangles; know the elements of an equilateral, isosceles and right triangle;	Teacher Desmos mutual control
12	Medians, bisectors, heights of a triangle	Working in a graphical calculatorhttps://www.desmos.com/calculator?lang=ru (Individually)	know the definition of median, bisector, height, triangle and depict them;	Teacher Desmos Practical work
*Module 3*Mutual arrangement of straight lines. (8h.)				
20	The sum of the angles of a triangle.	Work in the programGeoGebra Classic (Individually)	apply the theorem on the sum of the interior angles of a triangle and its consequences when solving problems;	Active class training apparatus
23	Signs of equality of right triangles.	Work in the programGeoGebra Classic (Individually)	apply the signs of equality of right-angled triangles in solving problems;	Active class training apparatus
*Module 4*Circle. Geometric constructions. (10h)				
29	Mutual arrangement of a straight line and a circle.	Working in a graphical calculatorhttps://www.desmos.com/calculator?lang=ru (work in a small group)	analyze cases of mutual arrangement of a straight line and a circle;	Teacher Desmos Practical work
34.35	Building tasks.	Working in a graphical calculatorhttps://www.desmos.com/calculator	build an angle equal to the given one, the bisector of the angle, divide the segment in	Teacher Desmos Practical work

		?lang=ru (work in a small group)	half; build a perpendicular bisector to a segment, a line perpendicular to a given line; build a triangle according to given elements;	
36	Final practical work.	Working in a graphical calculatorhttps://www.desmos.com/calculator?lang=ru (Individually)	Check the ZUN of students	Teacher Desmos Practical work, test

Table 2 shows an example of constructing an equilateral triangle. This task also focuses on the sequence of actions and the application of a ready-made algorithm; when solving it, students demonstrate:
– knowledge of the concept of a rectangle, the properties of a rectangle
- the ability to write linear algorithms,
- the ability to apply the algorithm.

Table 2 - Construction of an equilateral triangle



	Create a segment AB.
	Create a circle centered at B. Hint: drag points A and B to check if the circle is connected to them. Construct a circle with center B through A.
	Intersect the two circles to get point C.
	Create a polygon ABC in a counterclockwise direction.
	Hide 2 circles.
	Show the interior angles of the triangle by clicking on the vertices of the triangle. Hint: Clockwise creating a polygon gives you the outer corners.
	Apply displacement to check if the build is correct.

Conclusion

The study led to several important conclusions:

The use of the GeoGebra program and the Desmos graphical calculator in the lessons allows you to: optimize the learning process, using time more rationally at various stages of the lesson; implement a differentiated approach to teaching; carry out individual work using personal computers; reduce emotional stress in the lesson, introducing an element of the game into it, expand the horizons of students; contributes to the development of cognitive activity of students. Predicted effects from the use of this technology: it is possible to increase interest in the subject being studied among poorly performing students; increasing the level of self-esteem; development of self-control skills; motivation to discover and study new things in the field of information technology, the desire to share their knowledge with comrades.

In geometry lessons using the interactive geometric environment GeoGebra and Desmos graphing calculator it is possible to form in students the ability to solve problems, since the program allows not only to build arbitrary geometric shapes, but also shapes with specific data and parameters. For example, with specific side lengths, angles, perimeter or area of a figure, etc. In this case, two goals are realized: visualization of the solution of the problem and application of theorems or their consequences, which are not in the textbook.

Developed using the GeoGebra program and Desmos graphing calculator dynamic models, drawings can be used in the classroom when motivating learning new material, consolidating, solving problems. At the same time, the teacher can use both pre-created models and, together with students, build and explore them step by step. Also, students can independently build dynamic drawings in class (if possible) or as part of homework, solve problems with their help, “discover” and prove theorems, and conduct computer experiments.

Consequently, the competent use of the possibilities of modern information technologies in mathematics lessons performs the following functions: enhances the positive motivation for learning, increases the activity of students' cognitive activity; allows you to conduct lessons at a high aesthetic and emotional level; provides visibility, attraction of a large amount of didactic material;□increases the amount of work performed in the lesson by 1.5–2 times; provides a high degree of differentiation of training (almost individualization);□expands the possibility of independent activity; forms the skills of a truly research activity;□provides access to various reference systems, electronic libraries, other information resources; ensures the formation of the competence of schoolchildren.

Using the GeoGebra interactive geometry environment and Desmos graphing calculator you can not only visualize the process of teaching geometry, make it more visual and interesting, but also prove theorems and solve problems, put forward hypotheses, confirm or disprove them, conduct computer experiments, etc. The use of such dynamic drawings in the educational process forms an algorithmic style of thinking among students, stimulates them to search for research educational and cognitive activities.

REFERENCES

[1] Калжанова Г. М. Модернизация системы образования в Казахстане. //Проблемы и перспективы развития образования: материалы VIII Междунар. науч. конф. (г. Краснодар, февраль 2016 г.). — Краснодар: Новация, 2016. — 94с.

[2] Шкерина Л.В. Измерение и оценивание уровня сформированности профессиональных компетенций студентов – будущих учителей математики: учебное пособие. – Красноярск, 2014.

[3] Y. Smagulov, I. Yessengabylov. Factors in the productive use of information and communication technologies by mathematics teachers //Copyright. - 2021 World Institute for Engineering and Technology Education (WIETE), ABN: 50 135 362 319 Last updated: 21 Nov 2021

[4] Темербекова А. А.Методика обучения математике: учеб. пособие для студ. высш. учеб. заведений /А.А. Темербекова, И.В. Чугунова, Г.А. Байгонакова. – ГорноАлтайск: РИО ГАГУ, 2013. – 352 с.

[5] Сергеева Т.Ф. Основы динамической геометрии / Т.Ф. Сергеева, М.В. Шабанова, С.И. Гроздев. – Москва: АСОУ, 2016. – 152 с.

[6] Ширикова Т.С. Методика обучения учащихся основной школы доказательству теорем при изучении геометрии с использованием GeoGebra. – Архангельск: САФУ им. М.В. Ломоносова, 2014. – 250 с.

[7] Абраменкова Ю.В. Особенности применения интерактивной среды GeoGebra при изучении геометрии в основной школе. Научная электронная библиотека «КиберЛенинка»: сайт. Москва, 2013. – Режим доступа: URL: https://cyberleninka.ru/ [Дата обращения 17.12.2022]

[8] Desmos — замечательный инструмент для учителей математики. — Режим доступа: URL: http://didaktor.ru/ [Дата обращения 11.12.2022]

[9] Балыкбаев Т.О., Алдибаева Т.А. Развитие школьного математического образования Республики Казахстан в условиях реализации компетентностного подхода. Научная электронная библиотека «КиберЛенинка»: сайт. Москва, 2013. – Режим досупа: URL: https://cyberleninka.ru/ [Дата обращения 04.01.2023]

[10] Абдолдинова Г.Т., Бекиш У.А. Формирование и развитие мыслительных способностей студентов посредством содержания элективного курса. //Педагогика современности, 2019. - № 1. - С. 21-24.

REFERENCES

[1] Kalzhanova G. M. Modernizacija sistemy obrazovanija v Kazahstane. Problemy i perspektivy razvitija obrazovanija: materialy VIII Mezhdunar. nauch. konf. (Modernization of the education system in Kazakhstan. Problems and prospects for the development of education: materials of the VIII Intern. scientific conf.) (g. Krasnodar, fevral' 2016 g.). — Krasnodar: Novacija, 2016. — iv, 94s. [in Rus.]

[2] Shkerina L.V. Izmerenie i ocenivanie urovnja sformirovannosti professional'nyh kompetencij studentov – budushhih uchitelej matematiki: uchebnoe posobie (Measuring and evaluating the level of formation of professional competencies of students - future teachers of mathematics: textbook). – Krasnojarsk, 2014. [in Rus.]

[3] Y.Smagulov, I.Yessengabylov. Factors in the productive use of information and communication technologies by mathematics teachers //Copyright © 2021 World Institute for Engineering and Technology Education (WIETE), ABN: 50 135 362 319 Last updated: 21 Nov 2021

[4] Temerbekova A. A. Metodika obuchenija matematike: ucheb. posobie dlja stud. vyssh. ucheb. Zavedenij (Methods of teaching mathematics: textbook. allowance for students. higher textbook establishments) / A.A. Temerbekova, I.V. Chugunova, G.A. Bajgonakova. – GornoAltajsk: RIO GAGU, 2013. – 352 s. [in Rus.]

[5] Sergeeva T.F. Osnovy dinamicheskoj geometrii (Fundamentals of Dynamic Geometry) /T.F. Sergeeva, M.V. Shabanova, S.I. Grozdev. – Moskva: ASOU, 2016. – 152 s. [in Rus.]

[6] Shirikova T.S. Metodika obuchenija uchashhihsja osnovnoj shkoly dokazatel'stvu teorem pri izuchenii geometrii s ispol'zovaniem GeoGebra (Methodology for teaching elementary school students to prove theorems when studying geometry using GeoGebra). – Arhangel'sk: SAFU im. M.V. Lomonosova, 2014. – 250 s. [in Rus.]

[7] Abramenkova Ju.V. Osobennosti primenenija interaktivnoj sredy GeoGebra pri izuchenii geometrii v osnovnoj shkole. Nauchnaja jelektronnaja biblioteka «KiberLeninka»: sajt (Features of the use of the interactive environment GeoGebra in the study of geometry in primary school. Scientific electronic library "CyberLeninka": site). Moskva, 2013. – Rezhim dostupa: URL: https://cyberleninka.ru/ [data obrashhenija 17.12.2022] [in Rus.]

[8] Desmos — zamechatel'nyj instrument dlja uchitelej matematiki (Desmos is a great tool for math teachers). — Rezhim dostupa: URL: http:// didaktor.ru/ [data obrashhenija 11.12.2022] [in Rus.]

[9] Balykbaev T.O., Aldibaeva T.A. Razvitie shkol'nogo matematicheskogo obrazovanija Respubliki Kazahstan v uslovijah realizacii kompetentnostnogo podhoda. Nauchnaja jelektronnaja biblioteka «KiberLeninka»: sajt (Development of school mathematical education in the Republic of Kazakhstan in the context of the implementation of the competence-based approach. Scientific electronic library "CyberLeninka": site). Moskva, 2013. – Rezhim dostupa: URL: https://cyberleninka.ru/ [data obrashhenija 04.01.2023] [in Rus.]

[10] Abdoldinova G.T., Bekish,U.A. Formirovanie i razvitie myslitelnyh sposobnostei studentsov posredstvom soderzhaniaj elektivnogo kursa (Formation and development of mental abilities of students through the content of the elective course). //Pedagogika modernity, 2019, № 1. S. 21-24 [in Rus.]

МАТЕМАТИКА САБАҚТАРЫНДА ОҚУШЫЛАРДЫҢ АЛГОРИТМИЯЛЫҚ ҚҰЗЫРЕТІН ЦИФРЛЫҚ РЕСУРС АРҚЫЛЫ ДАМЫТУ МОДЕЛІ

*Карасёва Л.Н.[1], Джакупова А.Н.[2], Абдолдинова Г.Т.[3]

*[1]докторант, Ш.Уәлиханов атындағы Көкшетау университеті,
Көкшетау, Қазақстан
e-mail: lyubakarassyova@mail.ru

[2]докторант, Ш.Уәлиханов атындағы Көкшетау университеті,
Көкшетау, Қазақстан
e-mail: Aimgul.Djakupova@mail.ru

[3]п.ғ.к., Қазақ технология және бизнес университеті,
Астана, Қазақстан
e-mail: abdoldinova@mail.ru

Аңдатпа. Мақалада жалпы білім беретін мектепте математиканы оқыту мәселелері қарастырылған. Отандық және шетелдік мұғалімдердің зерттеулері негізінде оқушылардың алгоритмдік құзыреті және оны ақпараттық-коммуникациялық технологиялар арқылы дамыту тұжырымдамасы қарастырылған.

Сондай-ақ авторлары математиканы оқытуда оқушылардың алгоритмдік құзыретін дамытуға бағытталған білім беру саласында зерттеулер жүргізетін ғылыми еңбектерге қысқаша шолу жасалды. Зерттеудің негізгі мақсаты – ақпараттық-коммуникациялық технологиялардың (АКТ) көмегімен оқушылардың алгоритмдік құзыретін дамытудың маңыздылығын көрсету. Сонымен қатар Geogebra интерактивті геометриялық ортасы және Desmos графикалық калькуляторы туралы түсінік қарастырылады. «АКТ арқылы математика сабағында оқушылардың алгоритмдік құзыретін дамыту бойынша іс-шараларды жобалау» бағдарламасының оқу-тақырыптық жоспары ұсынылды. Бұл бағдарламаны мектептегі оқу үрдісінде қолдану оқушылардың алгоритмдік құзыреті деңгейін арттыруға көп жағдайда оң әсерін тигізуі мүмкін. Эксперимент барысында оқушылардың алгоритмдік құзыретің даму деңгейі туралы ақпарат алынды. Алынған мәліметтер осы бағдарламаны қолдану бойынша жұмысты ұйымдастыру қажеттілігін көрсетеді. Нәтижелер ұсынылған бағдарламаның тиімділігін көрсетеді. Geogebra интерактивті геометриялық ортасын және Desmos графикалық калькуляторын қолдану ерекшеліктері туралы қорытындылар жасалады.

Тірек сөздер: алгоритмдік құзыреттілік, алгоритм, оқу процесі, Geogebra интерактивті геометриялық ортасы, Desmos графикалық калькуляторы, құрастыру тапсырмалары, мектептегі білім, математика

МОДЕЛЬ РАЗВИТИЯ АЛГОРИТМИЧЕСКОЙ КОМПЕТЕНЦИИ УЧАЩИХСЯ НА УРОКАХ МАТЕМАТИКИ ПОСРЕДСТВОМ ЦИФРОВЫХ РЕСУРСОВ

*Карасёва Л.Н.[1], Джакупова А.Н.[2], Абдолдинова Г.Т.[3]
*[1]докторант, Кокшетауский университет им. Ш. Уалиханова
Кокшетау, Казахстан
e-mail: lyubakarassyova@mail.ru
[2]докторант, Кокшетауский университет им. Ш. Уалиханова
Кокшетау, Казахстан
e-mail: Aimgul.Djakupova@mail.ru
[3]к.п.н., Казахский университет технологии и бизнеса,
Астана, Казахстан
e-mail: abdoldinova@mail.ru

Аннотация. В статье рассмотрены вопросы преподавания математики в общеобразовательной школе. На основе исследований отечественных и зарубежных педагогов, рассматривается понятие алгоритмическая компетенция учащихся и ее развитие посредством информационно-коммуникационных технологий.

Также приведен краткий обзор научных работ, авторы которых проводят исследования в области образования, направленные на развитие алгоритмической компетенции учащихся при обучении математике. Основная цель исследования – показать важность развития алгоритмической компетенции учащихся с помощью информационно-коммуникационных технологий (ИКТ). Также рассмотрено понятие интерактивной геометрической среды Geogebra и графического калькулятора Desmos. Предложено учебно-тематическое планирование программы «Проектирование деятельности по развитию алгоритмической компетенции учащихся на уроках математики посредством ИКТ». Использование данной программы в процессе обучения в школе во многом может оказать положительное влияние на повышение уровня алгоритмической компетенции учащихся. В ходе эксперимента были получены сведения об уровне развития алгоритмической компетенции у учеников. Полученные данные указывают на необходимость организовать работу по применению данной программы. Результаты указывают на эффективность предложенной программы. Сделаны выводы об особенностях применения интерактивной геометрической среды GeoGebra и графического калькулятора Desmos.

Ключевые слова: алгоритмическая компетенция,алгоритм, процесс обучения, интерактивная геометрическая среда Geogebra, графический калькулятор Desmos, задачи на построение, школьное образование, математика

Статья поступила 01.07.2023