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THE USE OF MULTIMEDIA TECHNOLOGIES IN ROBOTICS LESSONS AS THE DEVELOPMENT OF COGNITIVE ACTIVITY

In the environment of educational robotics, the introduction of new pedagogical technologies is relevant. Robotics is at the junction of promising fields of knowledge: mechanics, electronics, automation, assembly, programming, circuit engineering and technical design. The purpose of the article is to analyze the methodology of teaching the basics of robotics using multimedia technologies at each stage of education and the use of multimedia software in the classroom. The authors of the article have developed Digital educational resources for the study of robotics. These resources are an auxiliary tool for the diversity of the lesson. With the help of this software product, robotics training becomes more accessible and convenient. Multimedia allows you to combine verbal and visual-sensory information, which helps to increase the motivation of students, create certain learning parameters and develop cognitive activity.

When organizing educational material, the teacher should focus on the activation of cognitive activity of students. In the classroom, not all students turn on active cognitive activity. Active teaching methods are used to purposefully influence this activity. The very name contains the essence of the active method – it is not simple memorization, but the active intellectual activity of students.

The result of scientific and methodological research was the design and development, approbation of the DER with the help of which it becomes possible to conduct lessons using multimedia technologies.

Key words: educational robotics, multimedia technologies, cognitive activity, digital educational resources.

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Робототехника сабақтарында танымдық іс-әрекетті дамыту ретінде мультимедиялық технологияларды қолдану

Білім беру робототехникасы ортасында жаңа педагогикалық технологияларды енгізу оқыту әдістемесінің өзекті мәселесіне айналды. Робототехника білімнің перспективалық салалары: механика, электроника, автоматтандыру, құрастыру, бағдарламалау, схема-техника және техникалық жобалаудың тоғысында орналасқан.

Мақаланың мақсаты – білім берудің әр кезеңінде мультимедиялық технологияларды пайдалана отырып, робототехника негіздерін оқыту әдістемесін және сабақта мультимедиялық бағдарламалық құралдарды пайдалануды талдау. Зерттеу әдістері талдау, синтез, әңгімелесу және Алматы қаласындағы № 30 гимназия оқушылары мен мұғалімдеріне сауалнама алынды.

Мақала авторлары робототехниканы зерттеуге арналған сандық білім беру ресурстарын әзірледі. Бұл ресурстар – сабақтың әртүрлілігіне көмекші құрал. Осы бағдарламалық өнімнің көмегімен робототехниканы оқыту қолжетімді және ыңғайлы болады. Мультимедиа ауызша және визуалды-сенсорлық ақпаратты біріктіруге мүмкіндік береді, бұл оқушылардың ынтасын арттыруға, оқытудың белгілі бір параметрлерін жасауға және танымдық белсенділікті дамытуға көмектеседі.

Оқу материалын ұйымдастыру кезінде мұғалім оқушылардың танымдық белсенділігін арттыруға назар аударуы керек. Сабақтарда барлық оқушы белсенді танымдық әрекетке қатыса бермейді. Бұл әрекетке мақсатты әсер ету үшін белсенді оқыту әдістері қолданылады. Атаудың өзінде белсенді әдістің мәні жатыр. Бұл – қарапайым есте сақтау емес, оқушылардың белсенді зияткерлік белсенділігі. Ғылыми-әдістемелік зерттеулердің нәтижесі цифрлық ресурстарды құрастыру және әзірлеу, тестілеу болды, оның көмегімен мультимедиялық технологияларды пайдалана отырып сабақ өткізуге болады.

Бұл зерттеудің нәтижесі – мультимедиялық технологияларды қолдана отырып сабақ өткізуге мүмкіндік беретін цифрлық оқу орталығы.

Түйін сөздер: білім беру робототехникасы, мультимедиа технологиялары, танымдық қызмет, цифрлық білім беру ресурстары.

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Использование мультимедийных технологий на уроках по робототехнике как развитие познавательной деятельности

Внедрение новых педагогических технологий обучения робототехнике стало актуальной проблемой методики преподавания. Робототехника находится на стыке перспективных областей знаний: механика, электроника, автоматизация, сборка, программирование, схемо-техника и техническое проектирование.

Целью статьи является анализ методики обучения по основам робототехники с использованием мультимедийных технологий на каждом этапе обучения и применения мультимедийного программного обеспечения на уроках. Методами исследования были анализ, синтез, беседа, опрос школьников и учителей гимназии №30 г.Алматы.

Авторами статьи были разработаны Цифровые образовательные ресурсы для изучения робототехники. Данные ресурсы являются вспомогательным средством для разнообразия методов проведения уроков. С помощью этого программного продукта обучение робототехнике становится более доступным и удобным. Мультимедиа позволяет сочетать вербальную и визуально-сенсорную информацию, что помогает повысить мотивацию учащихся, создать определенные параметры обучения и развить познавательную активность. При организации учебного материала преподаватель должен акцентировать внимание на активизацию познавательной деятельности обучающихся. На занятиях не у всех учащихся включается активная познавательная деятельность. Для целенаправленного влияния на учебную деятельность школьников используются активные методы обучения. Сущность активного метода связана не только с простым запоминание, но и с активной интеллектуальной деятельностью учеников.

Результатом научно-методического исследования стали проектирование и разработка, апробация ЦОР, с помощью которого появляется возможность проводить уроки с использованием мультимедийных технологий.

Ключевые слова: образовательная робототехника, мультимедиа технологии, познавательная деятельность, цифровые образовательные ресурсы.

Introduction

In the modern world, the scope of application of robotics in various spheres of human activity is very wide and does not cease to grow.

The main task of modern education is to create an environment that allows a young person to reach their potential. This allows him to act freely, knowing this environment and the world around him. The new role of the teacher is to organize and equip the appropriate educational environment and motivate the student to learn and cognitive activity.

The use of robots significantly reduces human participation in complex and dangerous work. Modern society is in dire need of qualified specialists in this field. Secondary school should play an important role here. Robotics training allows students to develop communication skills, since robots are mainly created in a group, they learn to make independent and non-standard decisions, develop creative thinking.

Educational robotics is just beginning to take shape in Kazakhstan. Robotics is a new direction actively implemented by educational institutions of Kazakhstan (The state program, 2011-2013:16) [1]. But an analysis of the current state of education shows that the school does not have materials and resources for self-study of robotics. Unfortunately, only some educational institutions of the country are equipped with new LEGO educational kits, about 20 thousand Kazakhstani boys and girls can engage in robotics with the help of 400 classes-kits purchased with sponsorship funds (E.A. Kiseleva, 2015a:36) [2]. These are just the first steps in the development of this interesting and promising direction. The rest of the students can study only in computer classes, with the exception of some educational institutions that have access to an equipped laboratory classroom. But there is a need to improve the methodological aspects for teaching the basics of robotics at school in order to obtain a more effective result. It is necessary to develop a methodology for teaching

the basics of robotics using multimedia technologies and create appropriate software support.

Studying the basics of robotics develops children's interest in exact sciences and technology, forms analytical thinking, structural thinking combined with a rich imagination.

Materials and methods

The educational goals of robotics at different stages of training should be different. Therefore, depending on the age of students, it is necessary to use a technological environment of different levels, apply differentiated methods.

Robotics is an applied science engaged in the development of automated technical systems (E.A. Kiseleva, 2015b:42) [2].

Educational robotics combines two vectors of activity: the educational vector and the technological vector.

The basis of movement in each direction is a specific technological task, the solution of which is formed in the student's cognitive-active plane, consisting, on the one hand, in the desire to acquire the theoretical knowledge necessary to solve the problem, attracting the achievements of broad sciences, and on the other hand, solving the technological problem in the final product.

The hypothesis of the study is that if we use the developed digital educational resource in lessons on the study of the basics of robotics using multimedia technologies, then:

• students' interest in work and their activity will increase dramatically;

• the development of algorithmic style of thinking will be traced, the ability to make optimal decisions will be formed, to act variatively;

• the teacher will be freed from a lot of routine work, the opportunity for creative activity will be presented on the basis of the results obtained.

At the first stage of the study, the analysis of school documentation reflecting the pedagogical process was carried out, the source of information were textbooks on computer science for the 5th grade and educational and methodological complexes for teachers, technological equipment of the school.

At the second stage of the study, the requirements for a digital educational resource were identified, taking into account the individual characteristics of children of the appropriate age, their preferences when studying the material.

The authors of the article analyzed the experience of teaching the basics of robotics and identified pedagogical conditions for the effective use of such experience. The synthesis of pedagogical experience of using modern information technology as a means of improving professional efficiency, conversations with teachers on this research problem was carried out.

The result of the research is methodological developments in the areas of Robotics, the creation of a digital educational resource (DCS), with the help of which it is possible to conduct lessons using multimedia technologies. The data center is developed on the iSpringSuite platform.

Literature review

In modern research, various approaches to teaching methods and the introduction of robotics into the educational process are considered, methods of teaching robotics are being developed and updated.

V. V. Tarapata., N. N. Samylkina in their book "Robotics at school: methodology of the projects program" give a technological map of the "Informatics" lesson on robotics in which the role of the teacher in robotics is clearly presented. When teaching robotics, the role of the teacher was more advisory than authoritarian (Tarapata, V. V., 2014:55-66)[3].

K. A. Wegner in his article on the topic "Introduction of the basics of robotics in a modern school" Conducted an analysis of the introduction of the basics of robotics in educational institutions of secondary (full) general education. This article discusses new approaches in teaching robotics to schoolchildren based on the use of Lego WeDo, Lego Mindstorms constructors (Wegner, K. A., 2013:17-19) [4].

Dahin A. N. "Pedagogy of robotics as an emerging innovation of school technology" this article provides for the implementation of elements of parallel programming according to the methodological implementation system (Dakhin, A. N. , 2015:157-161)[5].

Scaradozzi D., Sorbi L., Pedale A., Vergine C., Valzano M. these authors consider the questions "Teaching robotics in elementary school: an innovative approach". Many researchers and teachers agree that the inclusion of science, technology, engineering and mathematics in early education provides strong motivation and a significant improvement in learning speed. Most curricula in elementary schools include a number of concepts that cover science and mathematics, but less effort is put into teaching problem solving, computer science, engi-

neering and robotics. The use of robotic systems and the introduction of robotics as an academic subject can bring the opportunity to pass on the basics of technology to children and give them other human and organizational values (David Scaradozzi, Laura Sorbi, Anna Pedale, CinziaVergine, MariantoniettaValzano, 2015:1-4)[6].

Frangou S., Papanikolaou K., Aravecchia L., Montel L., Ionita S., Arlegui J., Pina A., Menegatti E., Moro M., Fava N., Monfalcon S., Pagello I. the authors in their article analyze the topic "Representative examples of the introduction of educational robotics in school based on a constructivist approach". Educational robotics (OR) systems consist of building materials and software tools that allow you to create and program various robots, from smart cars to chimney sweeps. Robots have sensors and mechanisms similar to motors. They collect data from their environment and use it as parameters. An important feature of this technology is that it can be used very simply to build a model and program it, while users can create extremely complex applications (StassiniFrangou, KyparissiaPapanikolaou, LilianeAravecchia, Luc Montel, SilviuIonita, Javier Arlegui, Alfredo Pina, EmanueleMenegatti, Michele Moro, Nello Fava, Stefano Monfalcon, Irene Pagello, 2008:3-4)[7].

Results and discussion

Robotics classes provide a unique opportunity to gain skills and knowledge in many complex technical disciplines in an exciting way using multimedia technologies such as video, audio information, animation. Mastering such multimedia training classes develops not only the logical thinking of the student, but also mathematical and algorithmic abilities, understanding of electronic systems, develops the ability to solve problems in various ways, forms such important qualities as imagination, logic, design abilities. Robotics lessons with the use of multimedia support of various levels of complexity and any achievements in the school curriculum are suitable for children.

In comparison with traditional training, the use of multimedia technologies has such advantages as:

• use of color graphics, animation, sound, hypertext;

• possibility of constant updating;

• has low costs for publication and reproduction;

• the ability to place interactive web elements in it, for example, tests or a workbook;

The use of multimedia technologies allows you to motivate students to classes and set them up in the right way, and also combines verbal and visual-sensory information.

If only the teacher works in the classroom, the students are passive, i.e. inactive, indifferent, indifferent to everything that happens in the classroom, such a lesson has no value.

When using multimedia resources, it is necessary to strive for such an organization of cognitive activity for the assimilation of content, in which students not only acquire new knowledge and skills, but also achieve a high level of development of their cognitive powers. The student must be included in cognitive activity, which is aimed at achieving the goal that unites the teacher and the student – the formation of a creative personality. The task of every teacher is to teach young people to think creatively, to prepare them for life, for practical work. Creative thinking is manifested when solving problems.

The use of information multimedia technologies makes the learning process more technologically advanced and more effective. The main advantage of the introduction of multimedia technologies is the interest of students, their willingness to be creative, the need to gain new knowledge and a sense of independence. Multimedia technologies allow you to do lessons that are not similar to each other. This sense of constant novelty contributes to the interest in learning.

To activate the students, an analog of a dialogue was used, in which students must answer one question and continue to study the topic (Fig. 2).

When teaching the basics of robotics, you can use interactive programs such as Lego Digital Designer. This is a virtual three-dimensional construction platform on a computer. The platform is free and licensed, which is the main advantage of this program (Lukyanova N.V., ZhantasovaZh.Z., 2015:15)[8-9].

The proposed digital educational resource uses the Lego Digital Designer constructor when studying the topic "Types of robots and their application" in the 5th grade, unlike the lessons offered in existing textbooks, where tasks for self-completion on this topic are more theoretical in nature.

In order for children to have an idea of the types of robots, they are offered the opportunity to create a 3D robot design step by step, choose a virtual space for it and not only save the created model in the library, but also print it out. The student can not only assemble the necessary robot according to the instructions, but also design the instructions of the new robot himself.

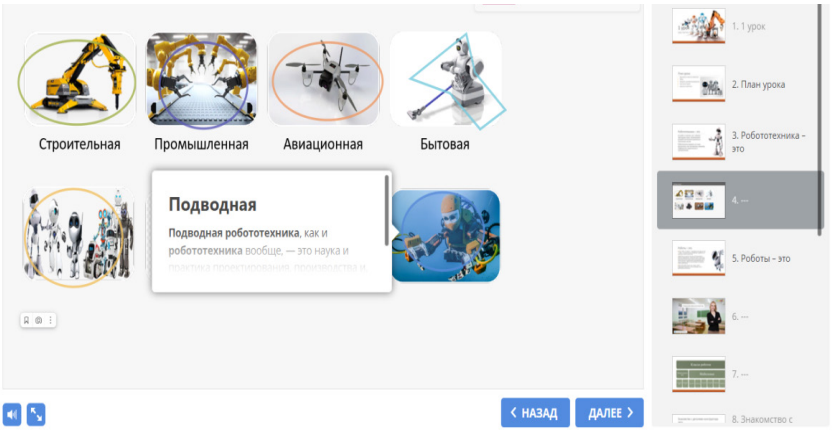

Figure 1 – Visual demonstration of the types of robots

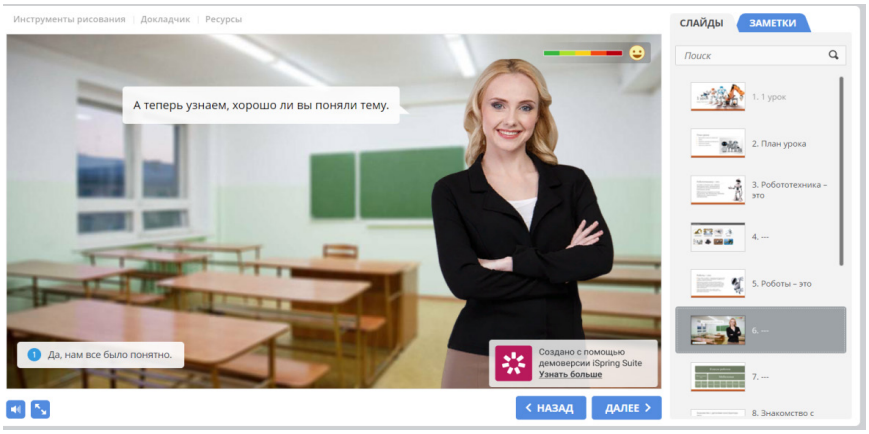

Figure 2 – Checking students

These LEGO construction activities develop logic, increase systematic thinking, and develop creativity in the classroom. All this also affects the degree of awareness in the decisions made. Children gain knowledge not only about how robots work, but also about also how existing systems function. This skill will help them in the future when designing their own systems in any industry, because there are a set of rules and restrictions in any kind of activity. Even if the child does not become an engineer, and he does not need the ability to control a robot, then understanding how an automatic device works and design experience will definitely be useful in other activities, no matter what profession the child chooses in the future.

The digital educational resource introduces the details of the constructor with the help of a video demonstration, so that in the future, when designing, students have an idea about the details of the constructor (Fig.3).

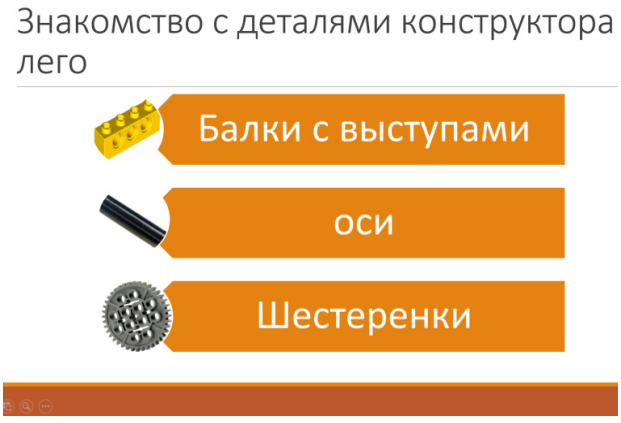

Figure 3 – Video tutorial fragment

At the end of the lesson, following the scheme, they must assemble their first constructor, which is quite simple and understandable for the first time (Fig.4).

There are tasks for self-completion with instructions on the process of building a robot.

To consolidate knowledge on the topic “Types of robots and their application”, a minitest was created based on materials that were embedded in a Digital educational resource. To take the test, students must enter their name and email address.

During the training, students will also get acquainted with robot competitions. In one of the lessons I explain the rules of the competition, how to design robots for a specific competition. This lesson plan is shown in Figure 5.

The next stage of the lesson is the development of a key algorithm for robot behavior and the development of a mechanical design of the robot (Fig.6).

At the next stage, the labeled image function was used to consider the behavioral model of robots (Fig. 7).

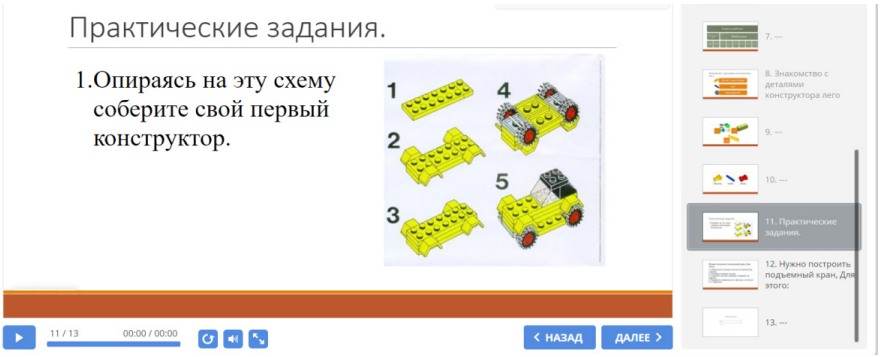

Figure 4 – Multimedia instructions for performing the exercise

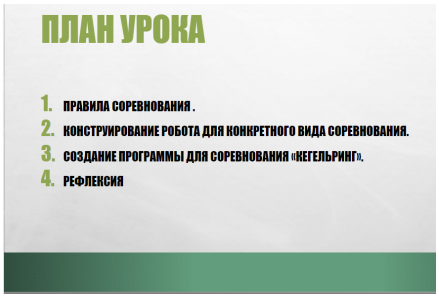

Figure 5 – Lesson plan on “Kegelring”

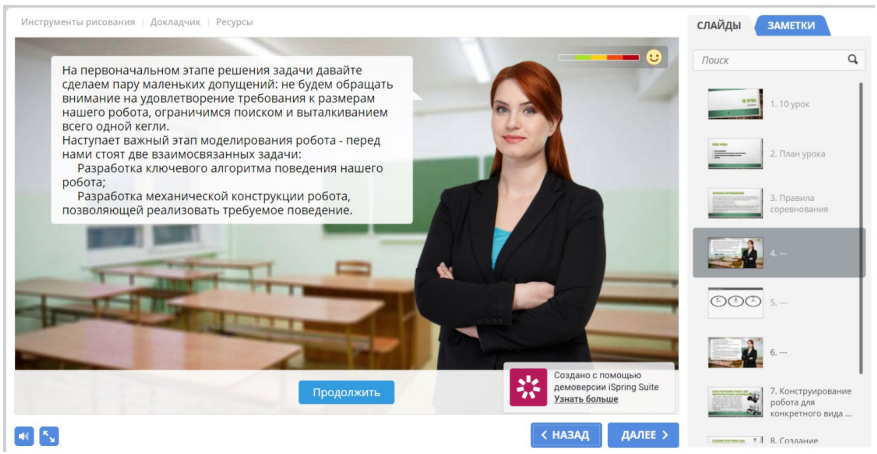

Figure 6 – Algorithm development

Using the tab function, a step-by-step instruction for assembling a robot for Sumo competitions was implemented (Fig.8). The step-by-step instruction was voiced and clearly shown in the figures. For 5th grade students, this instruction is quite understandable.

The finished program of a sumo wrestler must consistently search for an opponent in an infinite cycle, and then attack the opponent. At the end of the lesson, the Sumo algorithm and program for robots were described (Fig.9).

The program that we discussed with you in this lesson implements only one direct power algorithm of the sumo robot behavior. It implies that in a direct power confrontation, the robot must certainly defeat its opponent. But our training robot, of course, does not look at all like a muscular sumo wrestler. In order to confidently perform in this competition, it is necessary to pay the closest attention, first of all, to the design of the robot, to create a strong, protected platform, with the help of additional driving wheels or tracks to increase the grip on the ring surface.

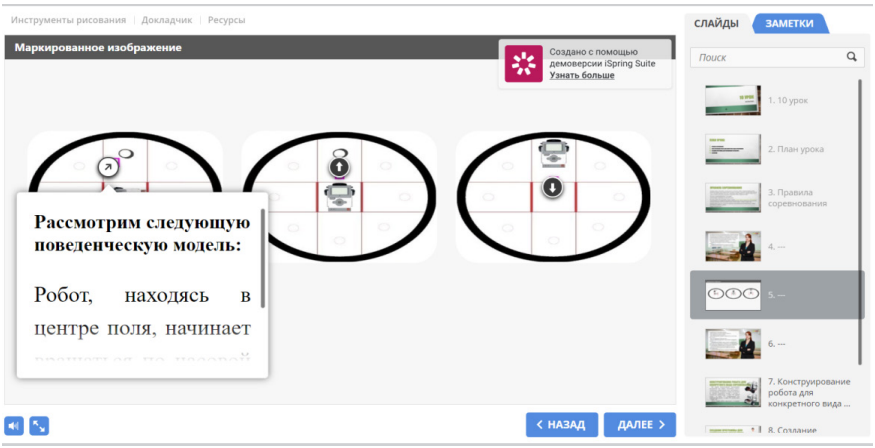

Figure 7 – Behavioral model

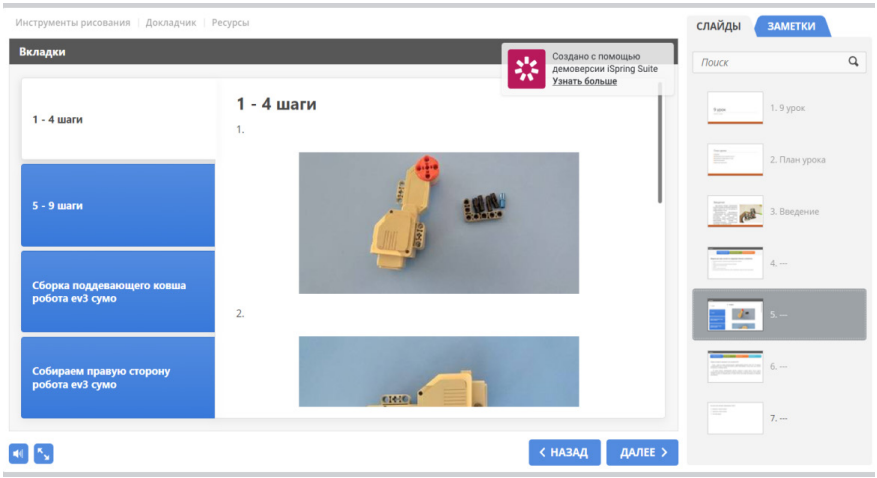

Figure 8 – Step-by-step instructions

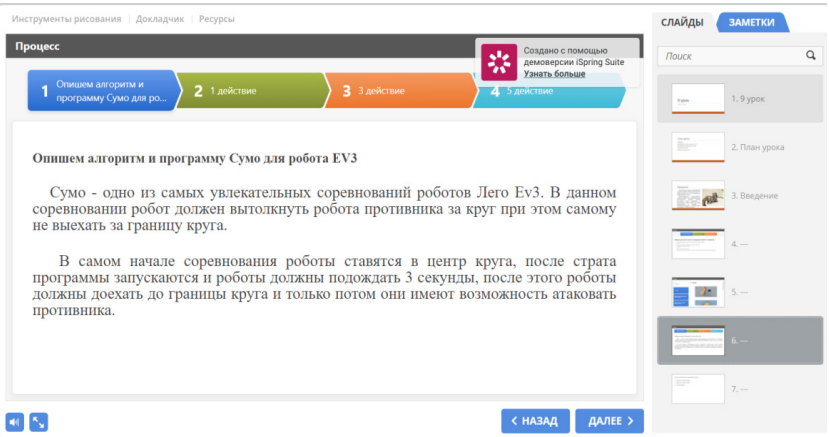

Figure 9 – is a multimedia description of the Sumo algorithm and program

Survey

Conducted a survey of students and teachers of KSU "D.Snegin Gymnasium №30" to identify the real state and level of knowledge formation in teaching robotics. The results of the survey of some questions are shown in Figure 10-12.

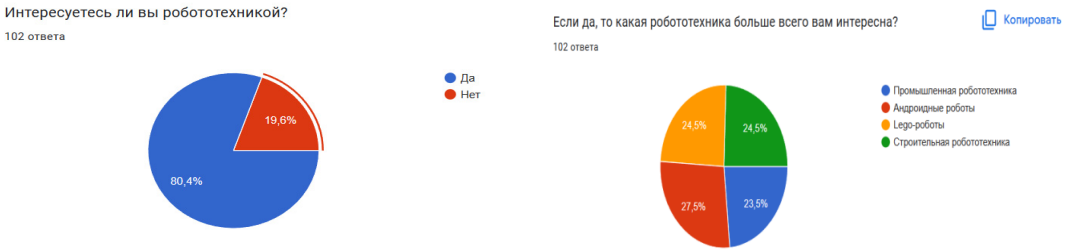

Figure 10

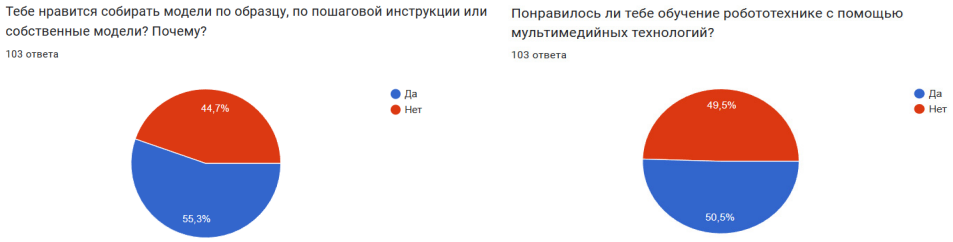

Figure 11

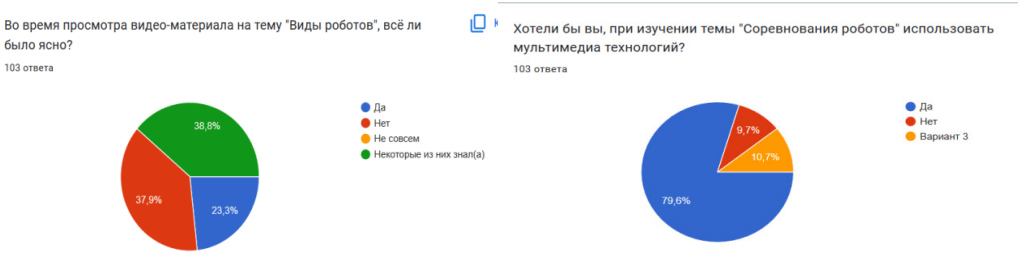

Figure 12

Table 1 – Calculation of the t-criterion

№	Number of people who passed the survey	Number of questions	Deviation from the average value	Deviation square	
	(x_i)	(y_i)	$X_i - \ddot{x}\ y_i - \ddot{y}$	$(x_i - \ddot{x})^2$	$(y_i - \ddot{y})^2$
1	53	25	-1261	2.25	1
2	50	27	-1367	2.25	1

$$S = \frac{\sqrt{\sum(xi - \ddot{x})^2 + \sum(yi - \ddot{y})^2}}{(n-1)*n} = \sqrt{\frac{6.5}{2}} = 1.8$$

$$t_{experiment} = \frac{[\ddot{x} - \ddot{y}]}{S} = \frac{|51.5 - 26|}{1.8} = 14.17$$

$k_{(number\ of\ degrees\ of\ freedom)} = 2n-2 = 2*2 - 2 = 2$

At the significance level:

$\alpha = 0.05$

$t_{cr} = (2;0,05) = 4,3$

We get:

$T_{experiment} > t_{cr}$

$14.17 > 4.3$

The calculation of how close our samples are to each other was made using the Student's t-criterion.

Table 2 – SWOT analysis of the lesson conducted

Strengths	**Weaknesses**	**Opportunities**	**Threats**
• Robotics is a launching pad for schoolchildren "burning" with technical sciences; • A good robotics curriculum will allow students to develop leadership skills • Robotics can teach students how to work on different technological and information platforms • Robotics teaches you to work in a team • diagnosis of learning success • taking into account age characteristics, the techniques used for the development of critical thinking contributed to the activation of students' mental activity • throughout the lesson they develop perseverance. • Its result: the degree of assimilation of the material by students • Objectivity of assessments	• Establishing a variety of connections with reality • lack of conditions and equipment in many secondary schools for conducting robotics classes • lack of methodological and theoretical basis	• Students develop critical thinking, learn to work in a group and develop concentration • Preparing for competitions opens up a new world of programming and designing robots. • Designing robots is an effective tool for the development of preschool children	• Weak material and methodological base of the school and class • Prolonged work with designers can harm a child's health, it is important to take this point into account when teaching robotics

Conclusion

In the process of preparing the platform, a theoretical analysis of teaching the basics of Robotics was carried out. Based on this analysis, the authors of the project were:

• Methodological developments on the sections of Robotics have been developed;

• The development environments of multimedia structures for training were studied. The result of this study is a digital learning center with the help of which it is possible to conduct lessons using multimedia technologies.

• Developed a methodology for teaching the basics of robotics using systematic application of multimedia technologies.

• Competitions for robots have been studied. Types, rules and analysis of the robot assembly algorithm for specific competitions like “Kegelring” and “Sumo”.

• Based on the survey results, it is possible to understand the interest of students and teachers in robotics, and it is also possible to trace how insufficiently informed the survey participants are.

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