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APPLICATION OF ONLINE TOOLS IN DESIGN AND CONDUCT OF CHEMISTRY LESSONS

The article reveals relevant issues related to the organization of teaching using online tools, Internet resources, shows the possibility of including electronic educational resources in the main educational programs of general education. The article also presents a list of network resources that are most common in the professional environment and among schoolchildren of different age groups, substantiates the importance of studying the educational capabilities of the network and developing the design of training sessions in order to increase the motivation of schoolchildren to study the subject. The authors describe models of network lessons and algorithms for designing chemistry lessons using the Flipped Classroom technology, case technology, as well as a practical lesson, a research lesson using Internet resources.

It isshown that due to the increased role of the computer and the Internet in the school, the use of a computer makes the lesson more attractive, memorable, and therefore today teachers use digital educational resources more often in the teaching process. Digital educational resources include photographs, text documents, video clips, sound recordings, various models, virtual reality and interactive simulation objects, symbolic objects and other educational materials necessary for organizing the teaching process. It is noted that the use of online tools in chemistry lessons makes the lesson interesting, but their use should be methodologically justified. Platforms such as the National Educational Database, Kundelik, Platonus, BilimLand, etc. have been developed and are successfully operating remotely.

Keywords: online tools, Internet resources, chemistry lesson design, online lesson models, Flipped Classroom technology, case technology, practical lesson, research lesson.

Introduction

The Internet is playing an increasingly important role in our lives. And if in the recent past, only learning using electronic services or distance education was carried out via the Internet (as resources for self-education), then in the conditions of a difficult epidemiological situation and a forced transition (even for a short time interval) to online learning, the problem of defining online education on basic educational programs (BEP) has acquired particular relevance. At the same time, it should be noted that earlier, both teachers and schoolchildren began to turn to the Internet source as a resource for self-education and preparation for lessons. According to the monitoring of the economic situation and health of the population, the vast majority of adolescents from 12 to 17 (85 %) used the Internet for educational purposes, while 89 % used the worldwide telecommunications network for entertainment purposes. A smaller percentage of adolescents use the Internet for communication and games [1].

The given data allow us to conclude that it is important to study the educational opportunities of the network, to search for the most optimal models for embedding Internet resources in the BEP, to develop the pedagogical design of such training sessions in order to increase the motivation of schoolchildren to study the subject, provide other formats and tools for mastering new content.

Materials and methods

In our opinion, it is important for the teacher to know the available foreign and domestic network resources. Below is a list of the most common both in the professional environment and among schoolchildren of different age groups:

– aggregators-resources in which the material is systematized and endowed with the ability to search for material, both theoretical and practical (among foreign resources, one can single out such resources as: SkilledUp, EMMA, etc.; Russian network resources of this type include: Eclass, Edumarket, Myuniversity, etc.);

– content sites where you can find help information, as well as applications or textbooks (Wikipedia);

– sites with training and testing video lessons (OpenCourseWare, Khan Academy, Get a Class, Znayka.ru, Postnauka, etc.);

– resources with online courses, originally aimed at an adult audience, but today they also provide courses for schoolchildren (edX, Universarium, Lectorium, Stepic, Coursmos, InterUrok, Foxford, etc.);

– platforms with social networking functions that allow to work together on projects, communicate on educational topics or exchange experiences (OpenStudy, GlobalLab, Stamford, Marabaca, etc.);

– interactive textbooks, simulators (Knewton, BitClass, Uchi.ru, YaKlass, etc.);

– video games and simulations (Jumpstart, Matific, Global Conflicts, LateNite Labs, Labster, InBrain, InCell etc.);

– online courses, services and applications for preparing for exams (KhanAcademy, Examer, Maximum, SmartFox, etc.) [2].

All this diversity can and should be built into the teaching process by the teacher both within the framework of training sessions and as a resource navigation for self-preparation and development.

During the study, the following methods were used: theoretical - analysis of scientific and pedagogical literature on the research problem, modeling, systemic and integrative approaches; empirical - observation, diagnostic and formative experiments, survey and diagnostic methods (questionnaires, tests, control works).

To test the hypothesis of the study, to prove the results of the observation, various statistical methods were used [3], the most common of which are the McNamara criterion, the G-test of signs. When comparing research results, the McNamara criterion is used, for example, this criterion can be applied if the results of the experiment are measured on a scale of names that has only two categories (true-false, yes-no). G-test of signs is used to compare experimental data.

Results and discussion

An analysis of the psychological and pedagogical literature shows that, despite the sufficient variety of scientific papers on the use of online tools for the development of technical creativity in schoolchildren, it has not been sufficiently studied.

At the same time, teachers often have questions about how to design a lesson using the resources of the Internet, what models can be effective depending on the conditions and pedagogical ideas of the teacher. Below we consider possible models for organizing a chemistry lesson:

1. The Flipped Classroom Chemistry Model, founded by Aaron Sams and Jonathan Bergman. Being chemistry teachers, the founders of this model began to use it as a collection of lectures for those schoolchildren who often skip classes. The model turned out to be effective, so A. Sams and D. Bergman singled it out as a new educational direction.

This technology can be effectively used by a chemistry teacher when designing a teaching process using Internet resources. When designing such a lesson, the following steps can be distinguished:

The advantage of these systems is that they allow organizing online communication, taking into account the age and individual capabilities of schoolchildren, to make prompt adjustments to the use of one or another tool.

As part of the rapidly growing popularity of online schools (Internet lesson, Foxford, Online School No. 1, etc.), direct interaction between the schoolchild -

teacher – classmates is provided, and permanent feedback is given. The undoubted advantage of online schools is to provide the schoolchild with the opportunity to choose the most convenient time for classes, view the lesson in the recording. These opportunities have, of course, an advantage over the traditional formats of the lesson.

The undoubted advantage of Internet resources is the high variability of tasks for control, in the choice of which schoolchildren can also take part. Test tasks can be completed using the resources of MES, NES, Yandex-tutorial, Online tests, interactive tasks: OnlineTestPad (https://onlinetestpad.com/ru), TestWizard (https://www.testwizard.ru/), Cross (http://cross.highcat.org/ru_RU/#), Crossword Factory (https://www.puzzlecup.com/crossword-ru/), Wizer (https://wizer.me/), ClassMaker (https ://www.classmarker.com/) Master Test (http://master-test.net/), Test Constructor (https://konstruktortestov.ru/).

Algorithm for organizing a lesson in the framework of using the «Flipped Classroom» technology:

1 Preparation of video materials and other resources (selection from the existing list on the network or preparation of copyright online lessons (for creative teachers).

2 Independent review of the proposed materials by schoolchildren at home.

The advantages of this type of work are:

– individual rate of mastering the material by schoolchildren;

– no time limits;

– the possibility of productive interaction within the framework of the teacher-schoolchild-classmates model in the online format.

3 The next stage of the lesson is a discussion on the network of completed tasks.

At this stage, it is recommended to differentiate the class into groups in accordance with the levels of training, preferences in the type of activity, etc. Then organize a discussion of the work of each group, followed by the presentation of the outcomes of the work of the groups to all schoolchildren (on interactive platforms).

4 Self-examination, control by the teacher, correction of learning outcomes of schoolchildren.

2. Model of a network lesson in chemistry using case technology.

Cases are an effective tool for the formation of practical experience, independent solution of problems from real life or production, beliefs in the applied aspect of the formed educational knowledge and professional self-determination [4]. In this regard, we consider it appropriate to offer cases in the learning process using network resources (you can use ready-made cases or develop original ones).

The following model of a network lesson-practice in chemistry «Lesson-practice» is aimed at solving educational problems related to the verification, proof and use of natural science knowledge, that is, their practical application. A practical lesson can be organized in the form of a practical lesson or workshop [5].

Next, we present an algorithm for organizing a lesson-practical work, the purpose of which is to consolidate knowledge and develop methods of learning activities. The algorithm includes five stages:

1 At the preparatory stage, schoolchildren independently prepare for the lesson, draw up a workbook accordingly.

2 At the stage of updating the basic knowledge and methods of activity, the teacher carries out work on updating, using the necessary questions and tasks for this; At this stage, schoolchildren can ask questions to the teacher. Here the teacher checks that the schoolchildren follow the safety rules.

3 At the stage of formulating the goal and the requirements for presenting the outcomes of the work, the teacher, together with the schoolchildren, forms a problematic goal, and the teacher explains the possible forms of presenting the outcomes of the work.

4 Direct implementation of practical work in two versions: at home or in a virtual laboratory. If for some reason the schoolchild cannot complete the practical work in these two options, then watching video experiments can serve as an alternative. At this stage, the outcomes are also presented.

5 Presentation of outcomes on an interactive platform.

Currently, the Republic of Kazakhstan is developing recommendations for establishing uniform requirements for information systems, allowing to establish a unified approach for integration with information systems [6–7].

The need to develop educational online services is certainly updated by the current epidemiological global situation, which has taken education to a new level. Platforms such as the National Educational Database, Kundelik, Platonus, BilimLand, etc. have been developed and are successfully operating remotely.

As for the operation of electronic educational systems, at present the electronic system «Kundelik» is synchronized with online platforms on which schoolchildren and teachers work remotely. As part of distance learning, a unique experience of working in synchronous and asynchronous formats was acquired, and advanced training courses were held for teachers to improve their work using IT technologies.

The Ministry of Education and Science of the Republic of Kazakhstan, together with NJSC «Talap», is working to provide educational institutions with digital content. To date, a catalog with more than 20 thousand digital resources has been formed on the basis of NJSC «Talap». This catalog is constantly updated with new information, links to educational and methodological resources.

Consider online tools for monitoring schoolchildren' knowledge. The forms of control used by teachers are very diverse. The use of online tools opens up a whole range of opportunities for us that were not available to us using traditional methods and teaching tools.

Today, electronic test systems have made a real revolution in learning. They helped to improve the assessment of schoolchildren' knowledge. Today's online testing systems help to monitor the progress of each schoolchild, avoiding complex calculations. Today, tools for creating electronic tests are becoming clearer and more convenient for both schoolchildren and teachers. For more efficient work, there are services that allow you to independently develop your own tests [8].

For our work, we chose the Google Forms platform (drive.google.com.), we created and tested online tests on the topics: «Main classes of inorganic compounds», «Basic laws of chemistry», «Metals», «Non-metals», «Halogens». To identify the attitude of schoolchildren to online tests, a survey was conducted, answering the question: «Is this form of tests more convenient than the traditional (paper version)?» Four answers were offered.

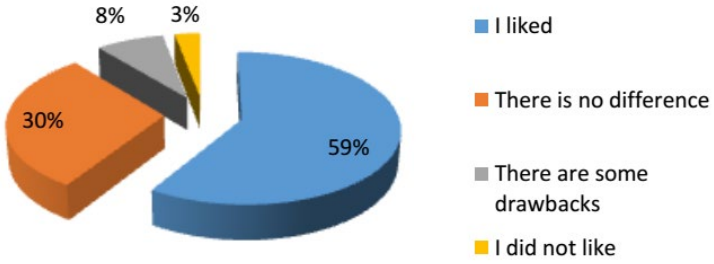

Figure 1

According to the survey results, it was revealed that this form of knowledge testing proved to be positive and has a number of advantages:

– automated verification and delivery of results;

– consuming time and using the remaining time to analyze the results;

– saving resources, electronic tests are less economically costly than paper ones.

To organize and conduct the teaching process, classes should be filled with interactive, multimedia, online tools.

The use of online tools in teaching chemistry ensures the implementation of the main didactic opportunities in the teaching process, namely: the correct formulation of the cognitive task; assimilation of educational material; use of the obtained results, feedback and control [9–10].

To determine the effectiveness of the introduction of online tools in the learning process for schoolchildren in 9a (control) grades, 9b (experimental) grades (number of schoolchildren – 25, 25, respectively), the following indicators were identified:

1 Subject learning outcomes.

2 Personal characteristics that develop in the process of teaching chemistry.

Subject learning outcomes are based on criteria such as teaching chemistry course content, mastery of chemistry term and language, and academic achievement.

The control of the received knowledge was carried out by means of testing. The total number of tested is 50 people. The calculation of the correct answers was made, according to the results of which 72 % of schoolchildren in the experimental group correctly answered simple questions, and 48 % of schoolchildren in the control group. 44 % of schoolchildren in the experimental group correctly answered questions of the medium level, and 36% of schoolchildren in the control group. Difficult questions were correctly answered in the experimental group by 40%, and in the control group by 24% of schoolchildren (Figure 2).

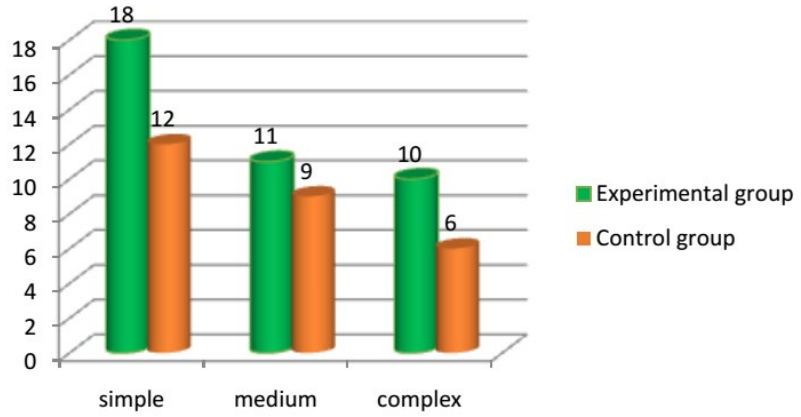

Figure 2 – Test results

Personal characteristics that develop in the process of teaching chemistry according to the traditional system and using online tools are shown in Figure 3. Figure 3 shows that the cognitive activity of schoolchildren in the experimental group increased by 8 %, activity increased by 7 %, interest increased by 17 % and curiosity by 7 % compared with schoolchildren in the control group.

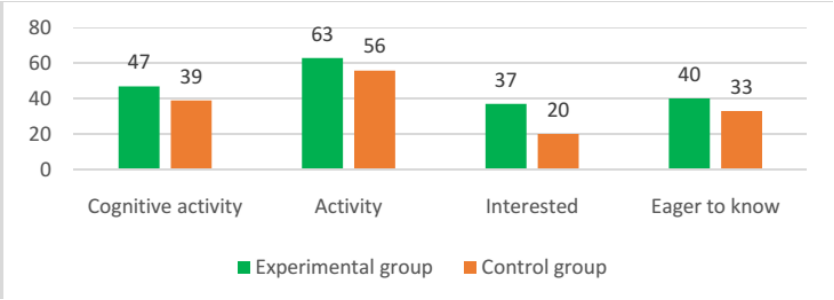

Figure 3 – Personal characteristics developing in the process of teaching chemistry according to the traditional system and using online tools

At the entrance assessment, the initial level of progress in chemistry of students was revealed with the help of a basic level diagnostic work on the topic «Main classes of inorganic compounds». Processing the results using the □2 method, which showed the absence of statistically significant differences between the initial levels of performance in students of the experimental and control groups (EG and CG). Further, as a final assessment, the students of the same groups did a control work. Its content is based on the material of the basic level of chemistry studied in both classes. The obtained statistical results testified to the presence of significant differences in the levels of progress in chemistry among students of these groups. It was also checked how the use of online tools affects the level of student achievement in chemistry lessons. To do this, we compared the final grades in chemistry, the results of tests before and after the use of online tools.

The results were processed using the G-test of signs. It should be noted that the EG included students who mostly use online tools for studying chemistry, while the CG included all the rest. The authors considered the positive and negative impact of the use of online tools for studying chemistry in the EG: B0 – the introduction of online tools does not improve the level of students' progress in chemistry, B1 – the introduction of online tools improves the level of students' progress in chemistry. The final grades of students are presented in Table 1.

Table 1 – Final grades of students

№	Experimental group		
	Before the experiment	After the experiment	shift (p)
1	4	5	+1
2	4	5	+1
3	3	4	+1
4	4	5	+1
5	4	5	+1
6	4	5	+1
7	3	4	+1
8	3	4	+1
9	3	4	+1
10	5	5	0
11	4	5	+1
12	3	4	+1
13	5	5	0
14	4	5	+1
15	4	3	-1
16	4	5	+1
17	4	4	0
18	4	5	+1
19	4	4	0
20	4	3	-1

The number of deviations was counted: zero – 4, positive – 14, negative – 2. We get that most of the deviations are positive. So they are typical, and n=14. Atypical deviations are negative -2, which means $G_{emp} = 2$.

According to the reference book, we find the critical values by the magnitude of the typical deviations of the deviation, in our case for n=14. $G_{cr}=5$ for $p\leq0.05$, $G_{cr}=4$ for $p\leq0.01$ i.e. at a significance level of 5%, the sum of atypical deviations should not exceed 5. And at a significance level of 1 % -2. In our case, Gemp = 2, i.e. $G_{emp}\leq G_{cr}$. Therefore, B_0 is not accepted, but B_1 is accepted ($p\leq0.01$).

Thus, the positive shift in student achievement in chemistry is not accidental. This confirms the positive impact of online tools on the development of students' interest in the study of chemistry, on the level of students' knowledge of chemistry. The results obtained served as the basis for the conclusion about the positive impact of using online tools in chemistry lessons.

Conclusion

So, online tools in teaching chemistry can activate all types of educational activities: learning new material, preparing and checking homework, independent work, verification and control work.

Based on the use of digital technology, many methodological goals can be implemented more effectively. It is digital technologies: electronic textbooks and tests, online simulators, presentations, educational platforms that allow schoolchildren to learn the material with interest and quickly.

The results of the analytical study allowed us to conclude that it is necessary to use online resources, the Internet, the design of chemistry lessons, the Flipped Classroom technology, case technology, a practical lesson, a research lesson, to develop the technical creativity of schoolchildren using online tools.

The reliability of the obtained results is confirmed by mathematical processing of the results using diagnostic techniques used in the pedagogical experiment.

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ХИМИЯ САБАҚТАРЫН ЖОБАЛАУ МЕН ӨТКІЗУДЕ ЭЛЕКТРОНДЫҚ БІЛІМ БЕРУ РЕСУРСТАРЫН ПАЙДАЛАНУ

Мақалада қашықтан оқыту технологияларын, интернет-ресурстарды пайдалана отырып оқытуды ұйымдастырудың өзекті мәселелері ашылған, жалпы білім берудің негізгі білім беру бағдарламаларына онлайн-білім беруді енгізу мүмкіндігі көрсетілген. Мақалада сондай-ақ кәсіби ортада және әртүрлі жас топтарындағы

білім алушылар арасында жиі кездесетін желілік ресурстардың тізімі берілген, желінің білім беру мүмкіндіктерін зерттеудің маңыздылығы негізделеді және олардың мотивациясын арттыру үшін оқу сабақтарының дизайнын әзірлеуге негізделеді. мектеп оқушыларының пәнді оқуы. Авторлар желілік сабақтардың үлгілерін және «Төңкерілген сынып» технологиясын пайдалана отырып, химия сабақтарын жобалау алгоритмдерін, кейс технологиясын, сонымен қатар практикалық сабақты, интернет ресурстарын пайдалана отырып зерттеу сабағын сипаттайды.

Мектептегі компьютер мен интернеттің рөлінің артуына байланысты компьютерді қолдану сабақты тартымды, есте қаларлық етеді, сондықтан бүгінгі таңда білім беру үдірісінде мұғалімдер онлайн құралдарды жиі қолданады. Электрондық білім беру ресурстарына фотосуреттер, мәтіндік құжаттар, бейнеклиптер, дыбыстық жазбалар, әртүрлі модельдер, виртуалды шындық және интерактивті модельдеу объектілері, символдық объектілер және оқу процесін ұйымдастыруға қажетті басқа да оқу материалдары жатады. Интернеттегі химия сабақтарында онлайн құралдарды қолдану сабақты қызықты етеді, бірақ оларды қолдану әдістемелік тұрғыдан негізделген болуы керек. Ұлттық білім беру деректер базасы, Күнделік, Platonus, BilimLand және т.б. сияқты платформалар әзірленіп, қашықтықтан жұмыс істеуде.

Кілтті сөздер: желілік ресурстар, интернет ресурстары, химия сабағын жобалау, желілік сабақтардың үлгілері, «Төңкерілген сынып» технологиясы, кейс технологиясы, практикалық сабақ, зерттеу сабағы.

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ПРИМЕНЕНИЕ ONLINE ИНСТРУМЕНТОВ В ПРОЕКТИРОВАНИИ И ПРОВЕДЕНИИ УРОКОВ ХИМИИ

В статье раскрываются актуальные вопросы, связанные с организацией обучения с использованием online инструментов, Интернет-ресурсов, показана возможность включения электронных

образовательных ресурсов в основные образовательные программы общего образования. В статье также представлен перечень ресурсов сети, наиболее распространенных в профессиональной среде и у обучающихся разных возрастных групп, обоснована значимость изучения образовательных возможностей сети и разработки дизайна учебных занятий с целью повышения мотивации школьников к изучению предмета. Авторы описывают модели сетевых уроков и алгоритмы проектирования уроков химии с использованием технологии «Перевернутый класс», кейс-технологии, а также урока-практикума, урока-исследования с использованием Интернет-ресурсов.

Показано, что в связи с возросшей ролью компьютера и Интернета в школе использование компьютера делают урок более привлекательным, запоминающимся и поэтому сегодня в образовательном процессе преподаватели чаще используют цифровые образовательные ресурсы. К цифровым образовательным ресурсам относятся фотографии, текстовые документы, видеофрагменты, звукозаписи, различные модели, объекты виртуальной реальности и интерактивного моделирования, символьные объекты и иные учебные материалы, необходимые для организации учебного процесса. Отмечено, что применение на уроках химии online инструментов делает урок интересным, но их использование должно быть методически оправданным. Разработаны и успешно функционируют в дистанционной форме такие платформы как Национальная образовательная база данных, Күнделік, Platonus, BilimLand и др.

Ключевые слова: online инструменты, Интернет-ресурсы, проектирование урока химии, модели сетевых уроков, технология «Перевернутый класс», кейс-технология, урок-практикум, урок-исследование.

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