

VIRTUAL PLATFORM FOR PASSING LABORATORY CLASSES IN COMPUTER SCIENCE

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Abstract

The article analyzed platforms for conducting online laboratory classes, which led to the proposal of a virtual learning platform as a solution for creating a learning environment. Modern distance learning platforms combined with pedagogical technologies provide the convenience of learning through online tasks in the process of meeting the requirements of students. Based on the identified results, video tutorials, tasks, and theory were proposed in order to improve educational achievements. The analysis revealed the absence of platforms for conducting online laboratory classes in the Kazakh language. Based on these studies, the content and structure of the online learning environment for passing laboratory classes in computer science in the 7th grade of secondary school based on the textbook computer science is determined. The platform for conducting online laboratory classes was created using WordPress and additional plugins.

Keywords: Internet technologies, digital technologies, distance learning, online platforms, electronic resource, laboratory work.

Аңдатпа

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ИНФОРМАТИКАДАН ЗЕРТХАНАЛЫҚ САБАҚТАРДЫ ӨТКІЗУГЕ АРНАЛҒАН ВИРТУАЛДЫ ПЛАТФОРМА

Мақалада онлайн-зертханалық сабақтарды өткізуге арналған платформалар сараланды, нәтижесінде оқыту ортасын құру үшін шешім ретінде виртуалды оқыту платформасы ұсынылды. Қашықтықтан оқытудың заманауи платформалары педагогикалық технологиялармен үйлескен студенттердің талаптарын қанағаттандыру процесінде онлайн тапсырмалар арқылы оқытудың ыңғайлылығын қамтамасыз етеді. Анықталған нәтижелер негізінде оқу жетістіктерін жақсарту мақсатында бейнесабақтар, тапсырмалар, теория ұсынылды. Талдау қазақ тілінде онлайн-зертханалық сабақтар өткізуге арналған платформалардың жоқтығын анықтады. Осы зерттеулер негізінде орта мектептің 7-сыныбында информатика оқулығы негізінде информатика бойынша зертханалық сабақтардан өту үшін онлайн-оқыту ортасының мазмұны мен құрылымы анықталды. Онлайн-зертханалық сабақтарды өткізуге арналған Платформа WordPress және қосымша плагиндерді пайдалана отырып құрылды. Оған тиімді таңдалған тақырыптар бойынша бейнесабақтар, түрлі қосымша қызықты ақпарат және білімді бекітуге арналған тест тапсырмалары кіреді.

Түйін сөздер: интернет-технологиялар, цифрлық технологиялар, қашықтықтан оқыту, онлайн-платформалар, электрондық ресурс, зертханалық жұмыстар.

Аннотация

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ВИРТУАЛЬНАЯ ПЛАТФОРМА ДЛЯ ПРОВЕДЕНИЯ ЛАБОРАТОРНЫХ ЗАНЯТИЙ ПО ИНФОРМАТИКЕ

В статье проанализированы платформы для проведения онлайн-лабораторных занятий, что привело к предложению виртуальной обучающей платформы в качестве решения для создания учебной среды. Современные платформы дистанционного обучения в сочетании с педагогическими технологиями обеспечивают удобство обучения посредством онлайн-заданий в процессе удовлетворения требований учащихся. На основе выявленных результатов были предложены видеоуроки, задания, теория с целью улучшения учебных достижений. Анализ выявил отсутствие платформ для проведения онлайн-лабораторных занятий на казахском языке. На основе исследований определено содержание и структура среды онлайн-обучения для прохождения лабораторных занятий по информатике в 7 классе средней школы на основе учебника информатика. Платформа

для проведения онлайн-лабораторных занятий была создана с использованием WordPress и дополнительных плагинов. Она включает видеуроки по выбранным темам, разнообразную дополнительную интересную информацию и тестовые задания для закрепления знаний.

Ключевые слова: интернет-технологии, цифровые технологии, дистанционное обучение, онлайн-платформы, электронный ресурс, лабораторные работы.

Introduction

The relevance of the proposed research is related to the issue of distance education, which is one of the key aspects of education. By analyzing the platforms used in the distance education system and ways to improve them, it is urgent to identify the advantages and disadvantages and improve the quality of education. In the age of modern technology, it is important to use educational resources efficiently, improve professional skills, digitize, use pedagogical technologies, develop students' interest in self-study, modeling, create additional equipment for independent laboratory classes that allow students to study at home or at a convenient time. The article describes ways to solve this problem using open online platforms.

We all know that in the age of globalization, many changes are taking place in the field of education. In this regard, large-scale changes in education due to the global epidemic have required the mass introduction of distance learning. The introduction of information and communication technologies (ICT) in education has simplified the problem of education in the information society. ICT allows the learner to find sources of information at any time using Internet technology, read it independently, perform tasks, receive and process relevant materials, create lesson plans for teachers, create didactic materials, create visual aids, connect with students, learn about global news and much more. The ability to freely use world-class sources of information and use them competently in the learning process has created the need for effective use of open platforms.

The platform for conducting online laboratory classes was created using wordpress and additional plugins. It includes video tutorials on effectively selected topics, a variety of additional interesting information and test tasks to consolidate knowledge. The development of information technology affects all areas of human life, including education. One of the promising areas of research in the field of pedagogy are the use of mobile and cloud technologies. At present, the issues of improving the efficiency of independent work of students come first in terms of the use of Internet technologies [1].

Let's look at a number of definitions given by researchers to Internet technologies. N.G. Astafyeva and R.N. Avaluev consider Internet technologies as an automated environment that provides services for downloading, processing, storing, transmitting and using information on the Internet. Z.R. Devtereva refers to Internet technologies as technologies for creating and coordinating various information resources on the Internet: websites, blogs, forums and chats, electronic libraries, encyclopedias, interactive textbooks, cloud technologies, software development services, 5G Internet speed. During the global epidemic, a number of problems arose in the transition to distance learning. In this regard, in order to identify the advantages and disadvantages of distance learning for students, getting feedback from students and further improvement of distance learning has begun [2].

Researcher A.A. Andreev considers the dynamics of changes in knowledge and skills on new information technologies and the growing demand for professionals who can use Internet technology in their work and the lack of specialists who can effectively use it, as a result of the inefficient use of computer parks in educational institutions. It has a negative impact on the full use of the didactic potential of Internet technologies in the educational process. It is clear that the effective application of the advantages of traditional teaching methods in the software will improve the modern online learning process. The effectiveness of traditional methods of determining software requirements used in distributed software development scenarios plays an important role. It is necessary to analyze the current online platforms that allow free distance learning, and to modernize the platforms used in education, of course, only need to be connected to the Internet [3].

The definition given by the scientist L.I. Borodkin clarifies the concept of Internet technologies: "internet technology is a set of methods and techniques that contribute to the development of human creativity, the ability to manage social processes, search, collection, storage, processing, transmission, presentation, reception of information." devices that provide these services: online platforms, open websites for the sharing of educational materials, training courses are widely used [4].

Effective use of Internet technologies is the most advanced tool in the educational process, a well-developed information infrastructure with a rich information environment. Mastering this technology at a high level is a professional need of participants in the educational process, employees of secondary and higher education institutions. In order to master the pedagogy of e-learning platforms, to increase the digital literacy of teachers, the state has carried out a number of seminars, trainings, joining courses. As a result of the work, the use of

platforms, teaching and feedback were facilitated [5]. Experimental work is carried out to monitor the progress of students studying in the field of natural sciences and mathematics during the epidemic [6].

According to V.P. Tikhomirov, Internet technology is an emerging complex field of science, and in order to understand it in depth, it is necessary to carry out practical work in order to develop the necessary professional skills for the successful use of the Internet. The Internet is the only modern means of information exchange. It is safe to say that the site services with additional software depend on this Internet. The Internet is a learning environment for software development teams. Such tools include the development of online e-learning platforms for teachers. In this case the PRAL platform which includes platforms, internet, website creation, design, chat, messaging, e-mail, blog, discourse forum, newsletter, twitter, podcast, vodcast, youtube, newsgroup, RSS feed, facebook, flickr, wiki could be taken as an example [7].

In the works of scientific researchers, the links between the satisfaction of various categories of users, mainly students, teachers and moderators of the distance Learning Management System (LMS), and their interaction with the LMS in distance learning are considered [8, 9, 10].

Based on the features of the interaction of students and teachers with the LMS (learning environment), recommendations, platforms, components and factors that form a mixed environment analyzed in scientific papers, we propose the optimization of the learning environment in order to improve the quality of learning. We will consider the effective integration of online tools that increase student engagement into a single environment. The integrated virtual learning environment includes tools for presentations, downloading course content and PDF documents, student interaction and teacher feedback.

Methods and tools

According to the nature of the lesson, laboratory work is a practical method of teaching. It also has an element of students' independent work. From a methodological point of view, laboratory work includes methods of developing computer skills.

Wordpress's Contact Form 7 plugins were used to manage many contact 7 objects and to flexibly adjust forms and mail content with simple adjustments. The Flamingo and multilingual Bogo plugins, provided by Takayuki Miyoshi, were widely used to record messages sent through contact forms, and the youtube.com channel was used to record videos. In order to optimize digital technologies, we have introduced ZOOM, Microsoft Excel, Python calculators to fully use the tasks of research in the laboratory environment. Integration of frequently used programs like spreadsheet, calculator and video conferencing into a virtual platform is the optimal method of this scientific work. We created video tutorials using the Renderforest constructor, we did the editing with Adobe Premier Pro. The Renderforest designer offers many ready-made templates for creating a video clip.

Results

Let's make an expert analysis of the most widely used forms of Internet technology in distance learning today. Virtual Laboratory: Specific experience in creating multi-purpose virtualized laboratories for computer science education was developed and presented at the 20th International Conference on Software, Telecommunications and Computer Networks. Online platforms in the education system can be divided into two types: video communication and fully operational ready-made platforms. We will first make an expert analysis of video communication platforms [11].

Work on online platforms for students and teachers is facilitated, for example, the problem of distance will be solved, there will be freedom to repeat the topic covered, the created resource will not be lost. The disadvantages include the effect of prolonged work at the computer on health, fatigue, deterioration of the psycho-emotional state of a person, the absence of such an environment as in the classroom.

From the analysis in the table (Table 1) we can see the simplicity, availability, feedback, exchange of electronic resources, high level of file sharing of popular platforms, depending on the criteria identified. Disadvantages include homework assignment, monitoring and evaluation, and performance criteria. However, these criteria are addressed through integration with other online platforms. Platforms such as *univer.kz*, *platonus.kz*, etc. are used in higher education, and *kundelik.kz*, etc. are used in secondary schools [12].

Conducting laboratory work in computer science is very difficult [13]. These include screen load time, student interest in the lesson, real-time analysis in direct contact with students, organizational work, etc. [14].

Table 1 - Expert analysis of online platforms

Criteria	Edupage	Google Classroom	Online mektep	Zoom	Microsoft Teams	Discord
free	+	+	+	+	+	+
paid	-	-	-	-	-	-
mobile version	+	+	+	+	+	+
simplicity	+	+	+	+	+	+
homework	+	+	+	+	-	-
control	+	+	+	+	-	-
evaluation	+	+	+	+	-	-
communication	+	+	+	+	+	+
correspondence	+	+	+	+	+	+
see progress	+	+	+	+	-	-
create messages	+	+	+	+	-	-
feedback	+	+	+	+	+	+
table electronic resource	+	+	+	+	+	+
file sharing	+	+	+	+	+	+

In order to find a solution to these problems, we conducted a laboratory work on the subject of computer science on the existing popular platforms Microsoft Teams and Zoom (Figures 1 and 2).

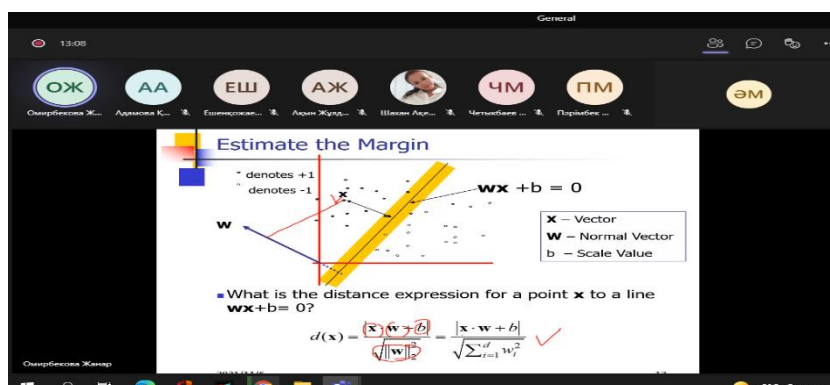


Figure 1. Experiment in Microsoft Teams

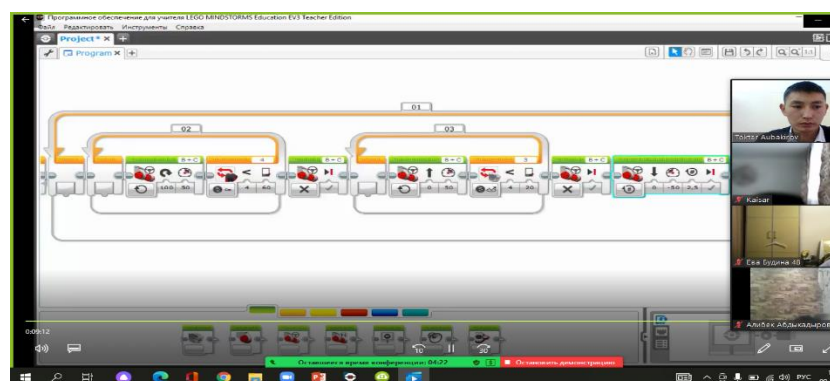


Figure 2. Experiment in the Zoom environment

As a result of the experiment, the lessons on the Zoom platform, although simple, can be organized as a time-limited conference. Although difficult in Teams, unlimited laboratory classes can be organized in the form of a video conference, showing the screen. On these platforms, learners can also show their screens and explain their work in real time. There were problems with students' time spent on laboratory work and access to the Internet. In addition, because laboratory work is thematic, we used a variety of digital technologies to

organize students' interest in the lesson through special assignments or group work, various exercises, and online tests [15].

There are a number of platforms for the development of independent learning materials, including online mektep, bilimland, topiq.kz, where you can view interactive materials for laboratory classes, which can be used as a tool for teachers. It is convenient to work with these additional learning tools, but the teacher has to work from platform to platform. Taking into account the problems and difficulties identified during the organization of laboratory classes, we created a learning environment *zerthanalar.kz*. In this learning environment, the ZOOM platform is integrated with the PYTHON code editor for interactive tasks and reports, the teacher can work only with registered students (Figure 3).

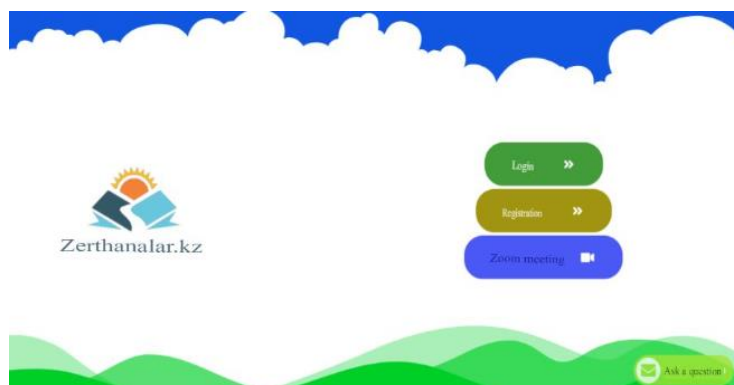


Figure 3. Home page of zerthanalar.kz

Students who register for the online lab can view, complete, and send homework assignments to the teacher. There is also an opportunity to provide feedback to the teacher, analyze the mistakes made in the work and get advice (Figure 4).

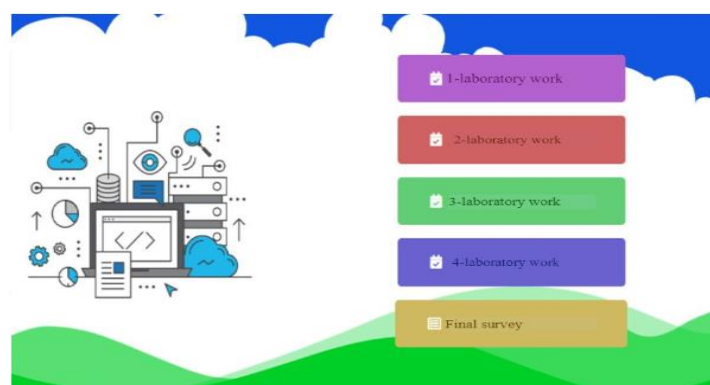


Figure 4. The page of the laboratory work environment where the video lecture and the task are located

We made the video clip using the Renderforest constructor, and the installation using the Adobe Premier Pro program. The Renderforest constructor has templates for creating a video clip. With the help of a 3D version of the same templates, video clips were created. The possibility of performing tasks related to the studied topic is considered. To find out the full name of the student performing the task, we used the plugins Ultimate Member and QSM (Quiz And Survey Master). The first one allows you to automatically fill in the user name. The second one, i.e. QSM, indicates the place it fills (Figure 5).

Special tasks were developed for online laboratory work. They allow you to work in Python, MS Word, MS Excel. It also allows the teacher to check the performance of laboratory work. Because the programming language compiler is integrated into the work environment, it is convenient to perform laboratory work. There are also video explanations of laboratory work in accordance with the topics. We have integrated the calculator into a virtual environment to make it easier for the student to complete the task. To do this, we logged into Elementor lab work and set the following link: [iframe src="https://web2.0calc.com / "width="100%"height="500"]. The calculator is on the website: <https://web2.0calc.com / website>. To insert the code of

the Shorts, the iframe plugin is used, which allows you to set the length, height of the online calculator (`width="100%" height="500"`). To create a feedback section, we used the ContactForm7 plugin. This is a plugin that allows you to get information about the user. And the user can send the file. The question is sent to the teacher's email (Figure 6).

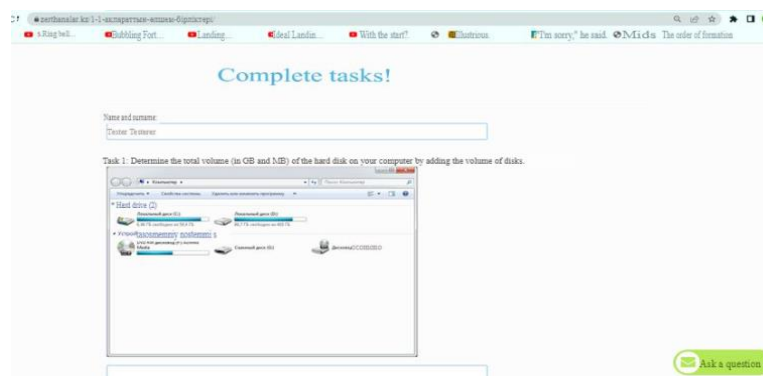


Figure 5. The task completion window

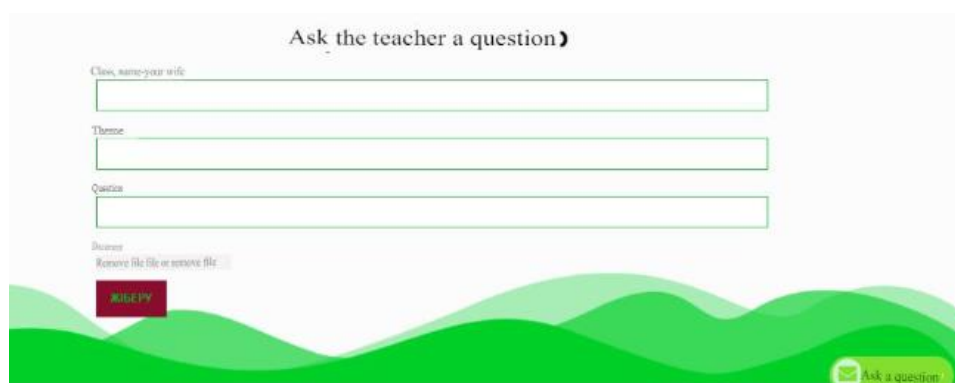


Figure 6. Feedback window

The questions of the assignment completed by the student and his answers are displayed in a special window. On this page, the teacher can evaluate the student's assignment (Figure 7).

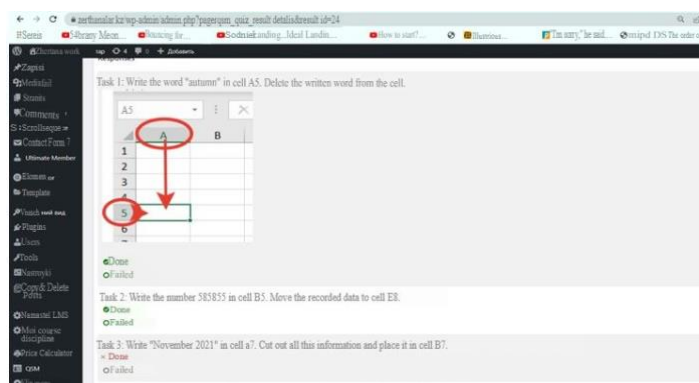


Figure 7. Section Window for viewing completed tasks

We can see the name of the student who completed the task, email, how much time he spent on the task, on what day and at what time he completed the task, his ip address. We see the fidelity of completed tasks by clicking the button "View ". Due to the fact that Computer Science is a relatively new field of science that is able to adapt to innovations in traditional or online learning, in combination with effective pedagogical technologies in distance learning, it becomes easier for students to perceive. In this regard, students studying

within the walls of the school are quickly becoming more receptive to innovation. If the main goals of distance learning with traditional training is to provide students with a high-quality education, then it is obvious that computer science is at the forefront, because digital document exchange, of course, testifies to this. This, in turn, requires teachers to have a higher level of digital literacy of students.

Conclusion

The main goal of distance learning is to create an effective learning environment, taking into account the differences between the virtual classroom, as much as possible with the traditional form of learning. The online education system requires teachers to do a lot of research and professional development in public and private communication. Today, the online education system requires teachers to effectively use digital educational resources, the competent use of electronic information resources and the competent formation of a personal learning environment for each teacher. The laboratory workplace we offer demonstrates this need.

The following results were obtained during the study:

1. Analysis of educational resources and scientific literature with the help of Internet technology.
2. An expert analysis of the most widely used forms of modern Internet technology in distance learning was conducted, and the most effective for the laboratory environment was selected.
3. An environment with resources for laboratory work in computer science was created in the secondary school.

References:

- 1 Madyarova G.A.r et al. *Mobile and cloud technologies in the virtual learning system. Edulearn21 Proceedings* (2021): p.6. URL: <https://library.iated.org/view/MADYAROVA2021MOB>
- 2 *The Challenges of Online Learning during Pandemic: Students' Voice March 2021 Wanastra Jurnal Bahasa dan Sastra* 13(1):08-12 <https://doi.org/10.31294/w.v13i1.9759>
- 3 *Studying and comparing the free e-learning platforms October 2016 Conference: 2016 4th IEEE International Colloquium on Information Science and Technology (CIST)* <https://doi.org/10.1109/CIST.2016.7804953>
- 4 J. Valaski, S. Reinehr and A. Malucelli, "Environment for sharing learning materials in software development teams," 2012 XXXVIII Conferencia Latinoamericana En Informatica (CLEI), 2012, pp. 1-8, <https://doi.org/10.1109/CLEI.2012.6427220>
- 5 M. M. Texeira et al., "The pedagogy of e-learning platforms: Prospects for science teaching," 2015 10th Iberian Conference on Information Systems and Technologies (CISTI), 2015, pp. 1-7, <https://doi.org/10.1109/CISTI.2015.7170558>
- 6 *The profile of problem-solving ability of students of distance education in science learning May 2018 Journal of Physics Conference Series* 1013(1):012081 <https://doi.org/10.1088/1742-6596/1013/1/012081>
- 7 *Synchronous or asynchronous? Various online learning platforms studied in Indonesia 2015-2020 July 2021 Journal of Physics Conference Series* 1987(1):012016 <https://doi.org/10.1088/1742-6596/1987/1/012016>
- 8 Kerimbayev, N., Nurym, N., Akramova, A. et al. *Virtual educational environment: interactive communication using LMS Moodle. Educ Inf Technol* 25, 1965–1982 (2020). <https://doi.org/10.1007/s10639-019-10067-5G>
- 9 Nurgalieva, G., Tazhigulova, A. and Artykbayeva, Y. 'eLearning in Kazakhstan', in Demiray, U. et al (Eds.), *E-Learning Practices Volume I, Cases on challenges facing e-learning and national development: Institutional Studies and Practices*, Anadolu University, 2010, pp. 335-354
- 10 Sapargaliyev, D. (2012). *E-Learning in Kazakhstan: Stages of Formation and Prospects for Development. International Journal of Advanced Corporate Learning (iJAC)*, 5(4), pp. 42–45. <https://doi.org/10.3991/ijac.v5i4.2210F>
- 11 Rikka, M. Leotta, J. Reggio, A. Tiso, J. R. R. Tolkien. Herrini and M. Torciano, "Use of UniMod for maintenance tasks: experimental assessment in the context of development, managed models", 4th International Seminar 2012 on modeling in software engineering (MISE), 2012, pp. 77-83, <https://doi.org/10.1109/MISE.2012.6226018>
- 12 *Effect of verbal creativity on problem solving abilities of junior high school students March 2020 Journal of Physics Conference Series* 1521(4):042121 <https://doi.org/10.1088/1742-6596/1521/4/042121>
- 13 *Contribution of internet resources to mastery genetic concept on prospective teachers April 2020 Journal of Physics Conference Series* 1521(4):042010 <https://doi.org/10.1088/1742-6596/1521/4/042010>
- 14 L. Hualleca, G. Madrid, J. Mellado, D. Vega-Araya and M. Villalobos-Cid, "An informatics tool for class-to-class planning and academic-load evaluation," 2020 39th International Conference of the Chilean Computer Science Society (SCCC), 2020, pp. 1-5, <https://doi.org/10.1109/SCCC51225.2020.9281221>
- 15 Madyarova, G., Adamova, K, Parimbek, Z.. (2022). *Methods of asynchronous learning of computer science in the context of a pandemic. Bulletin of Kazakh National Women's Teacher Training University.* 49-56. <https://doi.org/10.52512/2306-5079-2022-89-1-49-56>