

## INFORMATION AND WEB TECHNOLOGIES



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### **Positive influence of distance learning technologies on the restoration of the educational process in Higher Educational Institutions of Ukraine in the conditions of large-scale armed aggression russian federation against Ukraine**

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### Abstract.

The large-scale armed aggression Russian Federation against Ukraine with goal to destruction of Ukraine and its people has begun on February 24, 2022. President of Ukraine announced of martial law on the same day. The Ministry of Defense of Ukraine (MD) and the Ministry of Education and Science (MES) of Ukraine recommended the Educational Institutions of the country to use the wide opportunities of the distance learning technologies (DLT) for restoration of the educational process in this conditions. Involvement of the giants of the world-class digital industry in the process of providing the distance educational process with digital content, devices, technologies and active use by Educational Institutions of own DL developments, made it possible to return to learning in distance and mixed forms in extremely short period of time and to achieve decent results according to the indicators of the provision of educational services.

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### Keywords:

*distance learning technologies  
information technologies  
distance learning  
distance learning system  
learning management system  
informational and educational environment  
messenger  
video conference*

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The russian armed aggression against Ukraine has been going on for the tenth year. In February 2014, the russian federation occupied Crimea. In April 2014, russian military units invaded the territory of Donbass, forming their puppet formations there - «dnr» and «lnr». After a long military build-up and russia's recognition of these entities as independent states, on February 24, 2022, russian occupation forces launched a large-scale invasion of the territory of Ukraine. The russian leadership counted on a blitzkrieg, but russia's lightning invasion of Ukraine failed. The military miscalculations, underestimation of the level of training, armament and motivation of the military of the Ukrainian Army, resistance of the civilian population, support of Ukraine by the entire civilized world - all this together prevented the plans of the rashists, regarding the rapid destruction of Ukrainian statehood and the genocidal extermination of the Ukrainian people and the Ukrainian nation in general, from being realized. The russian army received decent resistance. Its, so to speak, "elite" military units were shamefully defeated near Kharkiv, Kyiv, Sumy, Kherson and many other Ukrainian cities and towns. For about a year, the russian occupying forces have been trying to take Bakhmut...

The year has passed since the beginning of the large-scale invasion of the russian troops into Ukraine. The scale of war crimes committed by the russian federation during this period is unheard. 68,000 criminal proceedings have been registered under Article 438 of the Criminal Code "Violation of the Rules and Customs of War" and every day 100-200 new proceedings are added to this number. Crimes against humanity are quite difficult to control, but it is already known about thousands of kidnappings of people in the newly occupied territories of Ukraine, which are accompanied by torture and inhumane treatment. According to the data of the Ministry of Reintegration of the Temporarily Occupied Territories of Ukraine on April 22, 2023 the number of Ukrainian children deported to russia already may reach from 16 to 300 thousand. About 1,000 children have been injured. The irreversible losses of human capital are simply terrible: as of the morning of April 22, 2023, as a result of the large-scale aggression of the russian federation in Ukraine, about 500 children have already died; the number of human victims among the civilian

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population has already reached almost 10 thousands according to official data, and among the military, this figure is also within the same limits (the UN emphasizes that these figures are only verified and documented deaths, and the real number of dead is much higher) [1-3].

On December 1, 2022, since the beginning of the large-scale war with the Russian Federation, more than 14.5 million citizens have already left Ukraine, of which at least 11.7 million people – to the countries of the European Union. The looting in territories not controlled by the Ukrainian authorities is widespread. Europe has not known such large-scale destruction since the Second World War. 81,000 Ukrainian civil infrastructure objects were destroyed, including 62,000 residential buildings. In the period from October 2022 to February 2023, 77% of Russian strikes fell on critical infrastructure objects, which led to the fact that the population of the country during the season of low temperatures was forced to suffer from the lack of heating, light, cold and hot water in the houses. According to operational information MES of Ukraine as of August 1, 2022, as a result of large-scale Russian invasion on Ukraine territory on February 24th, 2022, it was damaged 2200 Educational Institutions of Ukraine, including 225 were completely destroyed, 1975 partially damaged. Among completely destroyed – 7 IHE. The number of damaged IHE and post-graduate pedagogical education institutions is numerically greater. This number reaches 49. The most damaged IHE were in the Kharkiv (21) and Donetsk (6) regions (together 58.7% of the total number of damaged IHE). They experienced the greatest amount of destruction and damage to their real estate objects V. Karazin Kharkiv National University, "Chernihiv Polytechnic" National University, State Tax University (Irpine), G. Skovoroda Kharkiv National Pedagogical University, Mariupol State University, Azov Technical University (Mariupol), T. Shevchenko Luhansk National University (newly built building in Rubizhny, Luhansk region), M. Zhukovskiy National Aerospace University "Kharkiv Aviation Institute" and others. Direct damage from a large-scale invasion is estimated at 140 billion dollars, and indirect damage is five times more. Since the beginning of the Russian invasion, more than 7 million Ukrainians were

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forced to leave their homes, but remained in Ukraine, almost 4.9 million Ukrainians officially received the status of internally displaced persons. All these actions are the act of genocide of the Ukrainian people, as well as the thesis of the russian president, which was proclaimed by him on the first day of the large-scale russian aggression against Ukraine about "denazification" [4-5].

From the first day of large-scale armed aggression russian federation against Ukraine in conditions martial law the MD and MES of Ukraine began to find the ways restoration of the educational process in Educational Institutions of Ukraine. MES of Ukraine appealed to well-known global corporations and companies in the field of digital industry for charitable assistance for the rapid restoration of the educational process in the country in the conditions martial law. The result of these negotiations was: providing Google and Microsoft corporations with access to their educational software packages and supporting the processes of providing Ukrainian educators with additional devices for learning; free access to ZOOM products; reaching an agreement with the leaders of the online education market - Coursera, Udemy and edX platforms to provide free access to courses to Ukrainian students; implementation of the launch of e-documents about education in the "Diya" mobile application to ensure equal opportunities for access to education and employment for all citizens of Ukraine with the support of the EU4DigitalUA project (Academy of electronic governance (e-Governance Academy)); dozens of IHEs of Ukraine received the Starlink satellite Internet communication system manufactured by SpaceX, which enabled them to provide their students with access to educational electronic learning resources, libraries, repositories, LMS educational platforms and other resources with a stable high-speed Internet connection; free provision by the manufacturer of computer equipment - HP company, of its devices to Educational Institutions of Ukraine; signing an agreement with Vodafone, Lifecell and "Kyivstar" on providing unlimited, non-tariffed access to DL services and much more [5].

After the declaration of martial law, the MD and MES of Ukraine recommended HMEI (IHE), in accordance, to carry out remote communications with the participants of the

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educational process, using: communication tools built into learning management systems (LMS), such as MOODLE, Google Workspace for Education/Google Suite for Education, Microsoft Office 365 Education, etc.; e-mail; messengers (for example, WhatsApp); applications for conducting video conferences and webinars (ZOOM, BigBlueButton, Microsoft Teams, Google Meet etc.); electronic versions of textbooks; tele-lessons from leading Ukrainian and foreign teachers; live broadcasts-streams; forums; chat rooms; communication in telephone mode; placement of tasks and recommendations on the institution's own website; the use of the resources of the educational platforms Coursera, Udemy and EdX, the companies that own them, after the large-scale invasion of the Russian army on the territory of Ukraine, completely stopped their cooperation with the aggressor country.

The wide possibilities of modern IT for creating simulation models of objects and processes (3-D models, flesh-animation, educational cartoons and computer games) allow you to visualize information and make the content of distance courses (DC) as visual and understandable to the user, regardless of the degree of complexity of the material to be learned. Innovative IT developments for the organization and implementation of education in Ukraine at the current stage include such software applications as: the "progressive" electronic TABLE offered by the "OPTIMA Education Center", which allows its owner to observe the dynamics of changes in the success of education depending on from the number of tasks/tests completed in the relevant discipline (Fig. 1); remote lectures, practical classes, seminars in the STREAM format (for example, in the YouTube application) with parallel online communication of the participants of this live broadcast in the chat of this DC- live broadcasts-streams (used in the practice of the implementation of DL by the Academy of Digital Development) (Fig. 2); the GitHub web service has proven itself well in practical classes on the disciplines of studying IT technologies for the convenient work of a team of students when they create a joint software application (this service is actively used in the educational process by the Kyiv School of Programming - ProgAcademy) and many others of developments, both in-house produced by



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specialists in the field of automation of training of various Educational Institutions of Ukraine, and software applications from flagship companies in the direction of creating new IT for the field of education.

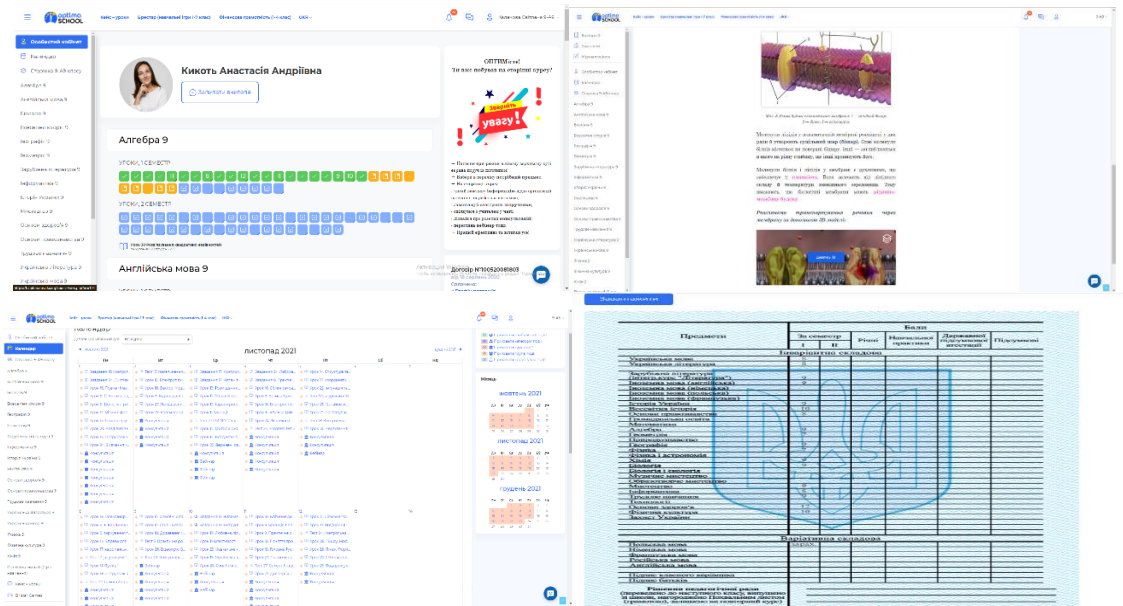


Figure 1

Main windows LMS of the "OPTIMA Education Center" developed on the basis of the platform MOODLE

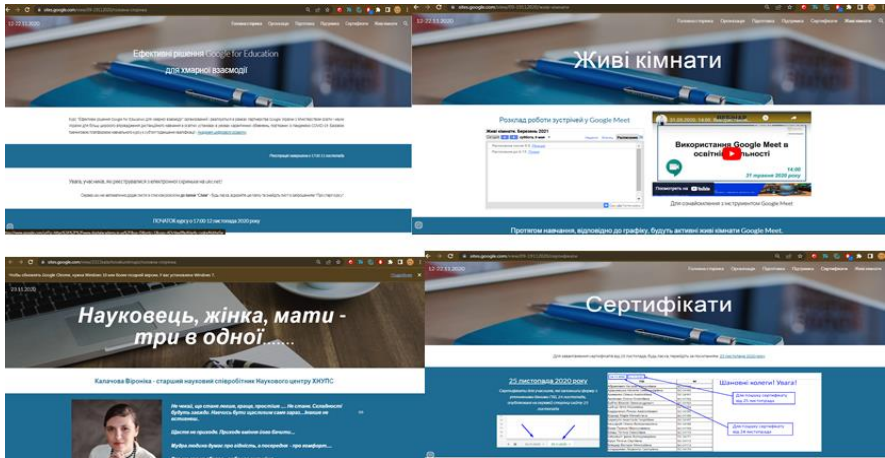


Figure 2

Main windows LMS of the Academy of Digital Development developed on the basis of the educational platform from the company Google

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One of such software applications, which is in high demand both among the organizers of distance education in IHEs of Ukraine and among their colleagues from HMEIs (for example, Ivan Kozhedub Kharkiv National Air Force University (KNAFU), I. Chernyakhovskyi National Defense University (NDU) of Ukraine, hetman P. Sahaidachnyi National Academy of Ground Forces (NASV) etc.) is the BigBlueButton platform, which is actively used by them to organize internal and external scientific video conferences with different numbers of participants and also it is used as a platform for the realization of the DL in the form of webinars according to the relevant DC. Alternative Internet communication networks, double password, thorough identification, cryptographic protection of information - all these are examples of modern IT, which allow the Higher Education Institution of Ukraine in the conditions of martial law to successfully and with high indicators of the quality of providing educational services, to carry out the educational process in mixed and distance formats [5].

The real leaders in the provision of high-quality distance educational services among the IHE(HMEI) of Kharkiv are Ivan Kozhedub Kharkiv National Air Force University (KNAFU), Kharkiv National University of Radio Electronics (KNURE), National Technical University - «Kharkiv Polytechnic Institute» (NTU(KPI)). Their positive experience in implementing existing and developing their own IT technologies and methodical developments in the educational process for DL over many years and, especially, in the conditions of large-scale armed aggression russian federation against Ukraine, can be a real opportunity for many scientists, teachers and specialists in providing distance education services.

For many years, KNURE has been focused all its efforts on establishing and supporting the educational process with the help of distance learning technologies. For many years, KNURE has been using the MOODLE platform (Modular Object-Oriented Dynamic Learning Environment) that has become more than relevant in the conditions of martial law. The "KNURE DL" service created on the MOODLE platform, is administered and maintained by the Center of Distance Learning which was created at the University in 2001 (Fig. 3).



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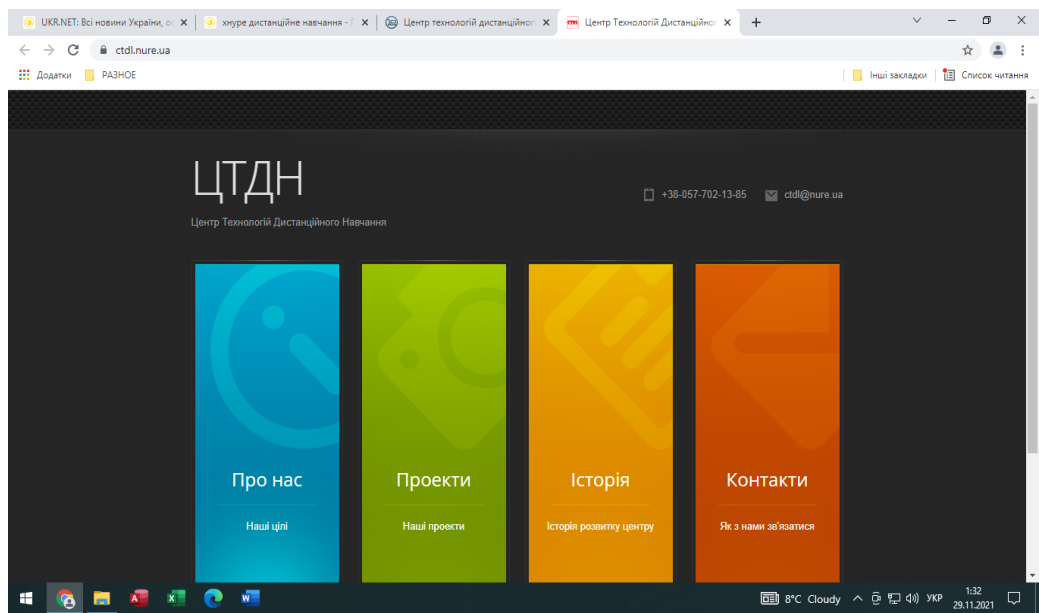


Figure 3  
**The Center for Distance Learning Technologies of KNURE**

More than 1,300 distance learning courses have been created. About 5.5 thousand students and about 600 teachers use the “KNURE DL” service. In turn, the services from Google Suite for Education/Google Workspace for Education – Google Classroom and Google Meet, allowed KNURE to establish the educational process as quickly and efficiently as possible in the conditions of martial law. Google has created a distributed system of support and training of users for its services. In addition, close integration of Google services with the distance learning management system – LMS MOODLE. KNURE also joined to the Coursera educational platform and provided to students and staff the free access to a large number Coursera educational courses [5, 6].

Extensive capabilities of modern information technologies to create simulation models of objects and processes allow to visualize information and make the content of the distance course as clear as possible to the user. Unique for the educational process became a version of educational video content, created at the Department of Biomedical Engineering (BME) KNURE, which is designed for laboratory work in technical disciplines, which uses complex hardware (Fig. 4).

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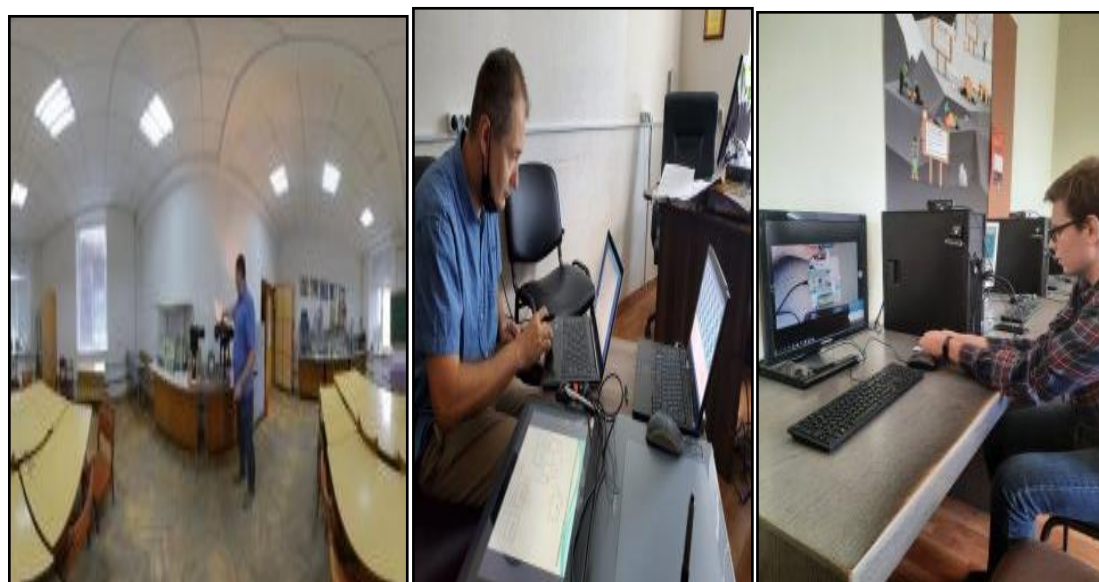


Figure 4

**Examples of application of innovative educational content, methods, equipment for the implementation of DL from KNURE**

This content is based on the use of modern video technology with the effect of presence, which allows the user during such a remote lesson to face the maximum possible level of clarity and reality when working on complex equipment with macro and micro review, demonstration of different devices separately from each other and all together. The panoramic video that underlies this content allows the DL student to have the yourself field of vision, not the video operator who shoots the classroom or computer class, the classroom or the laboratory. Content based on the use of modern video technology with the effect of presence is a combination of the newest technologies and explanations in chalk on the blackboard. This is a real effect of presence in the classroom, where there is a teacher who demonstrates and explains the principles of equipment, and students at their workplaces in cyberspace.

KNURE has experience in conducting on-line exams and on-line defenses of bachelor's and master's qualification works, using the service for video conferencing from Google Suite for Education/Google Workspace for Education - Google Meet (Fig. 5)!

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Figure 5

**The software application Google Meet from Google Suite for Education platform/Google Workspace for Education window Source**

The defense of bachelor's and master's qualification works in KNURE has an algorithm that fully complies with the "Recommendations for the organization of current, semester control and certification of students using distance technology" provided by the Ministry of Education and Science of Ukraine on May 14, 2020 [5, 6].

Two educational shells are actively used in the educational process of NTU (KPI) - "KPI Web Class" (Fig. 6 ) and "Information Management System" ("CIM") (Fig. 7 ), developed and manufactured by the university specialists, as well as the freely distributed MOODLE shell.

The MOODLE shell is used mainly as an experimental base for scientific and methodological work and for the implementation of corporate projects in the field of e-learning. MOODLE has more than 90 distance learning courses.

The "KPI Web Class" training shell has been operating since 2001. With the help of this shell, more than 200 distance learning courses have been developed.

Training shell "CIM", which has been developed by scientists of this educational institution and functioning since 2004. It is a learning management system (LMS) which

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includes more than 250 distance learning courses and its most basic parameters meet the requirements of the international standard of SCORM.

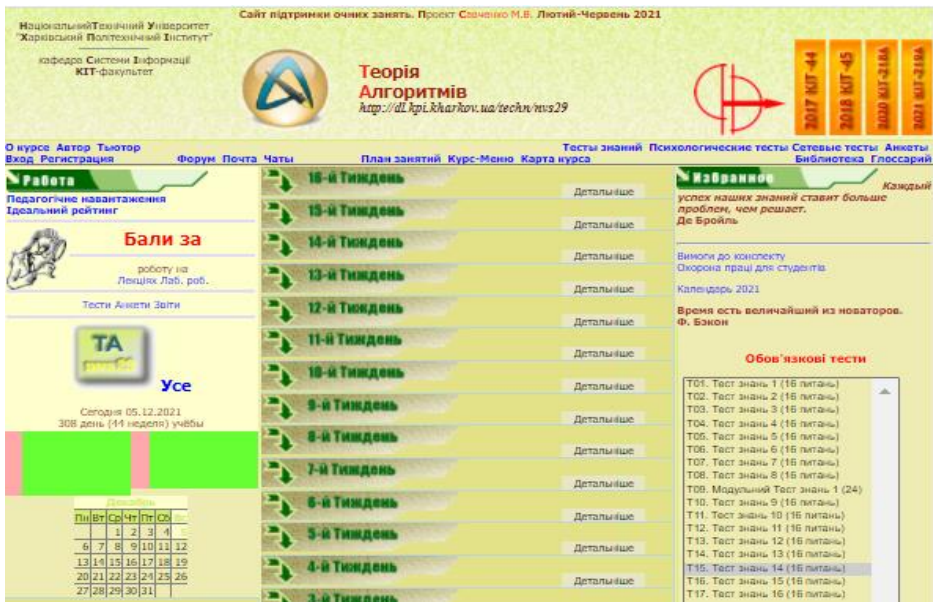


Figure 6  
Starting page of the educational shell "KPI Web Class" NTU(KPI)



Figure 7  
Starting page of the educational shell "CIM" NTU(KPI)



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“CIM” is a software complex that provides the work of teachers and students in any distance learning format – consulting, resource and instruction. The methodological principle of building “CIM” is the distribution of responsibilities among the participants of the educational process. This approach give an opportunity to create a maximum user-friendly computer desktop interface for teachers, students and other users, that do not require special programming knowledge – enough only elementary skills of working with Internet browsers. An important feature of “CIM” is a developed system of administration of the educational process, which actively uses a rating system of evaluations and modular control and provides a detailed tracking of educational activities of teachers and students.

Free software applications from Google, such as: Google Forms, Google Classroom, YouTube, have found their circle of users-fans and among the teaching staff of the departments of NTU (KPI). Microsoft online forms from Microsoft Office 365 Education are mostly used for online testing of students in the educational institution. Configuring the service allows you to open the test only for a specified period of time and log in to a pre-created account. NTU (KPI) also actively uses the ZOOM, Google Meet, Skype services to conduct on-line meetings and video conferences (Fig. 8) [5, 6].



Figure 8  
The window of software application Zoom

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The Zoom service is used to maintain business relationships, conduct online meetings and study in educational institutions. You can access the program from a computer, a tablet and a phone. Anyone who has created an ZOOM account can arrange an meeting. A free account allows to hold of video conference for lasting 40 minutes, but the service has removed this restriction during the coronavirus pandemic. Anyone user with a link or conference ID can join the video conference. The event can be planned in advance and also can make a recurring link, that is for a permanent lesson at a certain time you can make the same link to enter. There are many software applications and platforms for video conferencing at that time. They are all similar but have characteristic differences. The main advantages of software application Zoom that make it so popular among users, compared to other software applications for video conferencing and on-line meetings are: excellent communication; video and audio communication exists with each conference participant; screen demonstration is possible with sound; an interactive whiteboard is built into the platform, which can be shown to all participants of the videoconference; you can record a video conference; the possibility of granting the rights to administer the conference to the co-organizer. But the Zoom service has many worthy competitors in terms of the functionality of the application for online meetings and video conferencing, such as Microsoft Teams, which he actively uses in his work NTU (KPI) during the organization of distance learning (Fig. 9).

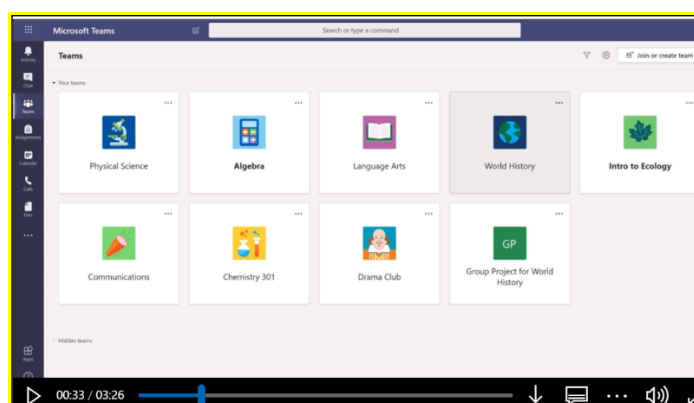


Figure 9

**The window of software application Microsoft Teams  
of Microsoft Office 365 Education platform**



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At present, the main information technologies for automation of learning and realization of its distance form in KNAFU are: the informational and educational environment «DIALOG»; the universal system for the development and conducting of computer tests; the complex of designing the academic schedule «CASCAD»; Scientific and methodological recommendations on the use of the "AK74 Trainer" (an interactive educational and training complex for fire training "Learn to shoot accurately") [5, 6].

As a result of conducting research on increasing the effectiveness of combat training through the use of distance learning technologies, the informational and educational environment (IEE) «DIALOG» has been developed by KNAFU scientists in 2008, and is DLS which allows: to plan training by distributing subjects by type of training; to study as a group according to the subjects for which they are studying; organize classes in accordance with the requirements of the orders of the Ministry of Defense Ukraine regarding the training of military specialists; to carry out automated control of testing of those who learn with automatic fixing of time and results of passing tests; control the process of learning by the average score for the group, the course through the system of statistical data generation (Fig. 10).

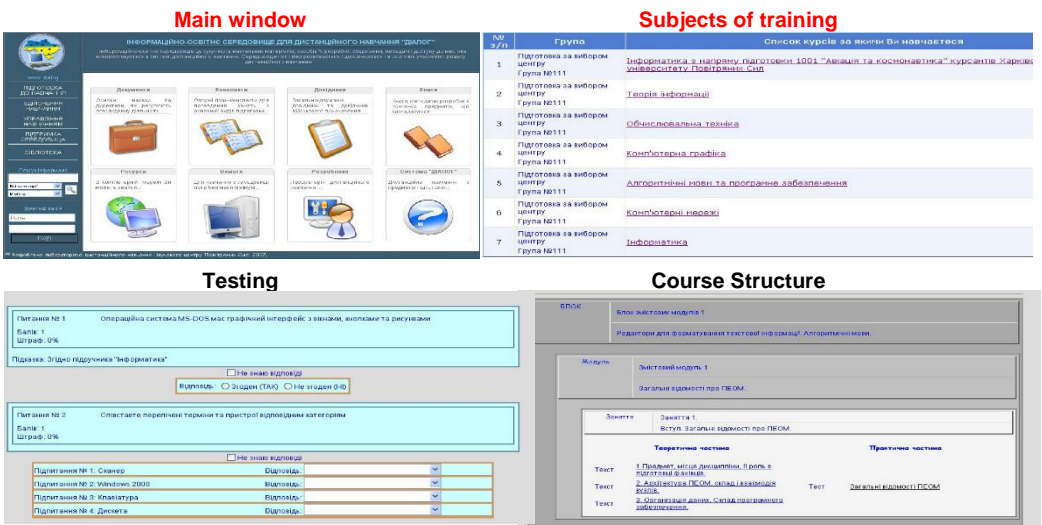


Figure 10  
The IEE "DIALOG" for distance learning

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The universal system for the development and conducting of computer tests has been developed and implemented in KNAFU (Fig. 11). The developed software application allows to solve the following tasks: locally, on separate PCs, to develop computer tests and conduct testing and self-control of those who study; choose the types of answers to questions (with one correct answer, with a few correct answers, with a response in the form of a record); divide the questions by category and type of answers and give the corresponding number of points for the correct answer; to randomly distribute questions by categories; use as a matter of a variety of document fragments (graphic, formulas, etc.) from other programs (MS Word, MS Excel, etc.); enter type of time limit and time limit; to pass the test and return to the questions; at the end of the test, analyze the responses [5, 6].

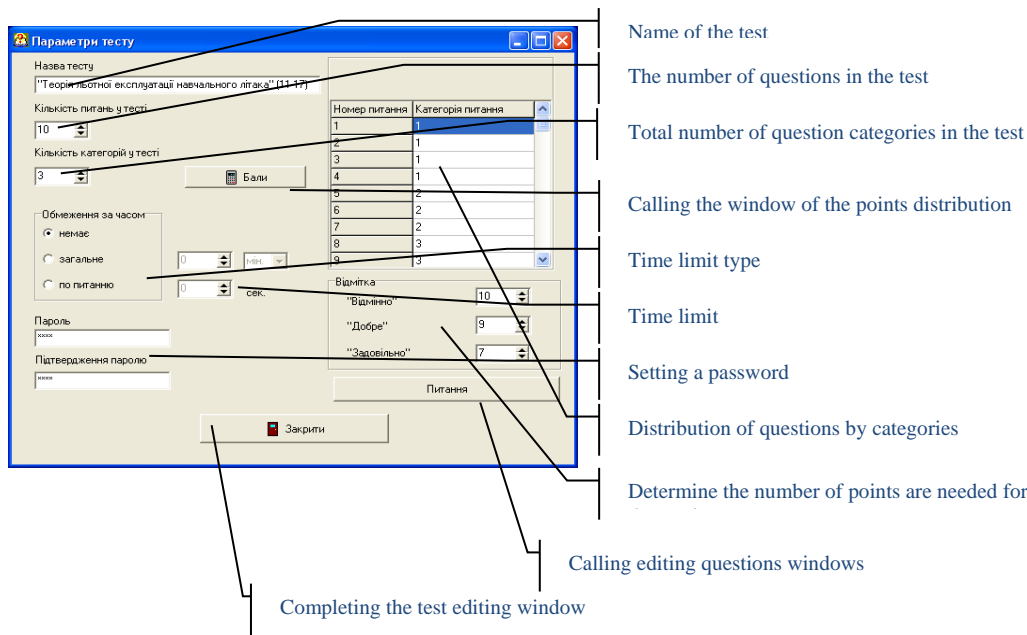


Figure 11  
**The window for creating (editing) the test parameters of a universal system for developing and conducting computer tests**

The developed in KNAFU program complex of the automated system of designing the lessons schedule «CASCAD» is deployed at the work places of the educational departments of the

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faculties and the department of the university and is successfully used during the planning of the educational process at the university (Fig. 12). The main advantages of the software complex «CASCAD» are: it is an unique software product, created at the university, which fully corresponds to the content of all stages of the planning of training sessions for the semester; automatic control of the formation lessons schedule according to the defined criterions of the quality of the lessons planning; automatic fixing of all user actions to change data; automated formation of reporting (statistical) documents for the planned learning process.

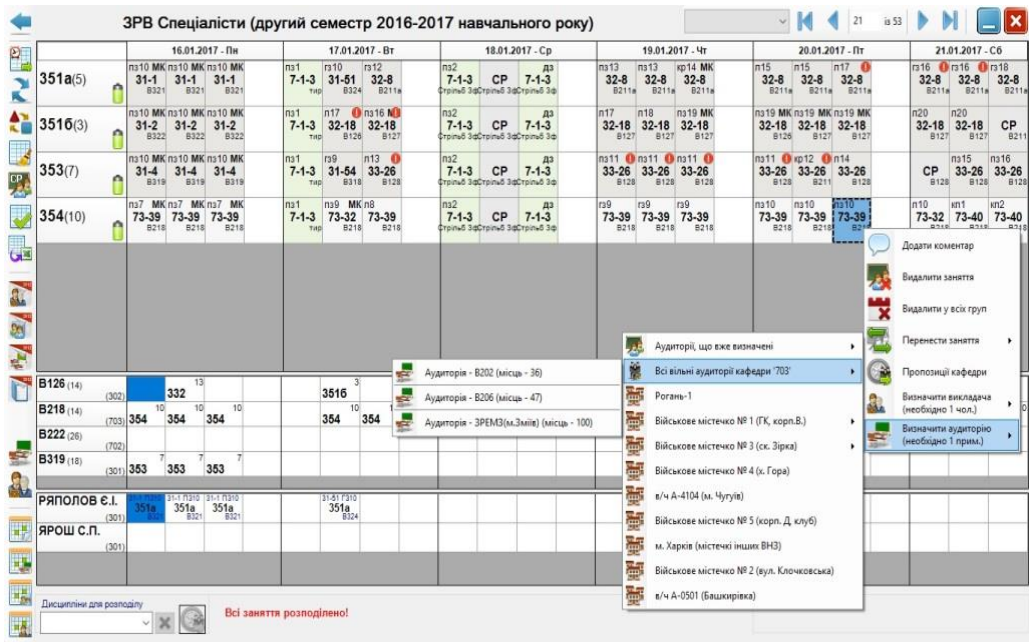


Figure 12  
User interface software complex "CASCAD"

In addition, the learning process successfully uses the distance learning system with the open source code – LMS MOODLE and the platforms ZOOM, Google Meet, BigBlueButton are used establishment as a platform for realization of international scientific conferences in their distance version and for the acquisition of knowledge in various disciplines by the staff of educational institutions through distance courses for professional development (Fig. 13, 14).

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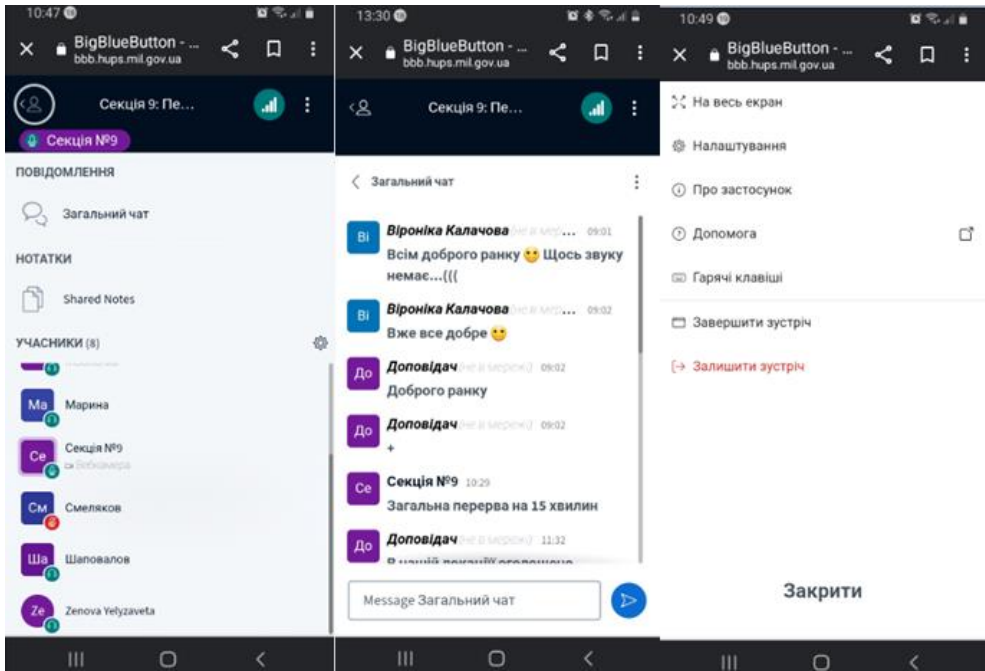


Figure 13

Use of BigBlueButton platform by KNAFU as a platform for realization of international scientific conferences in their distance version

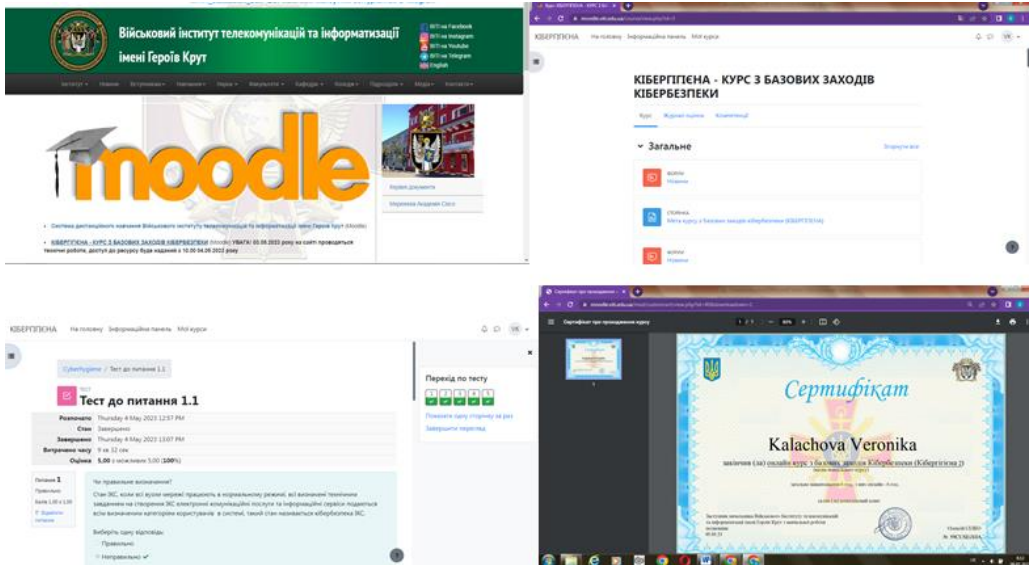


Figure 14

Use of LMS MOODLE by MITIT provide knowledge from a distance course on Cybersecurity for the staff of KNAFU

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Thus, Higher Educational Institutions of Ukraine in the conditions of the large-scale armed aggression of rf against Ukraine continue to provide quality educational services at the expense of high level educational-methodical base, highly skilled scientifically-pedagogical staff, the use of modern technical equipment and software from the best world manufacturers of the digital industry - partners of Ukraine in its fight against russian aggression and the application of own Educational Institutions of Ukraine DL technology-developments allowed quickly to restore the educational process in Higher Educational Institutions of Ukraine and distance learning technologies had and have now a particular positive influence on this process.

TOGETHER TO VICTORY!!! GLORY TO UKRAINE!!!

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