The role of distance learning technologies in the organization of the educational process in Higher Educational Institutions of Ukraine in the conditions of the large-scale armed aggression Russian Federation against Ukraine

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Abstract.
2022 has been a year of huge challenge for all Educational Institutions of Ukraine in terms of their ability to quickly organize of distance version of the educational process in connection with large-scale armed aggression russian federation against Ukraine with goal to destruction of Ukraine and its people. After February 24, 2022 when Russia-Ukraine war that began back in 2014 became the large-scale war and President of Ukraine announced of martial law, the Ministry of Defense of Ukraine (MD) and the Ministry of Education and Science (MES) of Ukraine recommended of all Educational Institutions of the country to use the distance learning technologies (DLT) for further continuation educational process. That’s why Institutions Higher Education (IHE) and Higher Military Educational Institutions (HMEI) of Ukraine actively use own developments and the best developments of the world’s leading companies which work in this direction (Google, Microsoft, ZOOM, Coursera, Udemy, edx, SpaceX, hp, Vodafone, Lifecell, Киевстар, etc.) to improve the quality of distance learning in the conditions of the large-scale armed aggression russian federation against Ukraine. The wide opportunities of modern information technologies for the creation of simulation models of objects and processes (flash-animation, 3-D models, educational computer games etc.) allow visualization of information and make the content of the distance courses the most understandable and interesting for students and cadets. That’s why the task of researching the role of distance learning technologies in the organization of the educational process in Higher Educational Institutions of Ukraine in the conditions of the large-scale armed aggression russian federation against Ukraine is more relevant than ever [1–7].

Keywords:
distance learning technologies
distance learning
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information technologies
learning management system
messenger
video conference
informational and educational environment
According to operational information MES of Ukraine as of August 1, 2022, as a result large-scale rf 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 (Irpin), 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. Zhukovskyi National Aerospace University "Kharkiv Aviation Institute" and others [4]. In this regard, the 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 "Дія" 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 “Киїщтар” on providing unlimited, non-tariffed access to DL services and much more [4].

After the declaration of martial law, the MES recommended that Educational Institutions turn to the possibilities of DL technologies to overcome the difficulties that arose in them after the treacherous attack of the rf. DL is one of the forms of continuous education, which is designed to realize human rights to education and obtaining information. The basis of the educational process in DL is the purposeful and controlled intensive independent work of the user of educational services, who can study in a place convenient for him, according to an individual schedule, with the help of a specialized information educational environment (SIEE), which is based on means of exchange of educational information at a distance (satellite television, radio, computer communication, etc.) and the basis of these services is a methodology aimed at individual (regardless of place and time) work of users with specially structured educational material, with different degrees of communication with remote experts, teachers and those who are also studying [5-7].

The MES and MD of Ukraine recommended IHE(HMEI), in accordance, to carry out remote communications with the participants of the educational process in conditions of martial law, 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 (Viber, Telegram, WhatsApp, etc.); applications for conducting video conferences and webinars (Microsoft Teams, ZOOM, Google Meet, Skype, BigBlueButton, Discord, 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. In turn, 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 at the current stage include such software applications as: the “progressive” electronic TABLE offered by the “OPTIMA Education Center (Education Center)”, which allows its owner to observe the dynamics of changes in the success of education depending on the number of tasks/tests completed in the relevant discipline; 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 the DC - live broadcasts-streams (used in the practice of the implementation of DL by the Academy of Digital Development); 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 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. 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 higher education institutions, is the BigBlueButton platform, which is actively used by them to organize internal and external scientific video conferences with different numbers of participants or is used as a platform for the realization of the DL in the form of webinars according to the relevant DC [5-7].

The procedure of registration of participants of conferences/distance courses, in many cases, is carried out
using the QR code provided by the event organizers (individual or common for all). Among the HMEE of Ukraine, which constantly and actively use the BigBlueButton service in their activities, are such leading the HMEE of the Armed Forces of Ukraine as the I. Chernyakhovskyi National Defense University (NDU) of Ukraine, hetman P. Sahaidachnyi National Academy of Ground Forces (NASV) and many other powerful military educational institutions of Ukraine.

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 [5-7].

Now the real leaders in the provision of high-quality distance educational services among the IHE(HMEI) of Ukraine 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 martial law, can be a real opportunity for many scientists, teachers and specialists in providing distance education services [5-7].

That's why to determine the role of distance learning technologies in the organization of the educational process in Higher Educational Institutions of Ukraine in the conditions of the large-scale armed aggression Russian federation against Ukraine we will research of positive experience of use DLT Educational Institutions of Ukraine in the conditions of martial law; we will analyze common trends and non-standard innovative solutions in organization and implementation of DL in IHE(HMEI) of Ukraine; we will identify the main IT and methodical developments that have gained the highest priority in the application by leading IHE(HMEI) of Ukraine in this direction in the conditions of the large-
scale armed aggression Russian Federation against Ukraine.

**KNURE**: the one of the best example of implementation innovative educational and methodological developments and information technologies in organization unique and super powerful version of DL among Civilian Higher Educational Institutions of Ukraine. KNURE considers quality education a priority Goal of Sustainable Development (GSD) and after the martial law was announced in Ukraine, the University continued the educational process in the distance form. The KNURE has focused all its efforts on establishing and supporting the educational process with the help of distance learning technologies [5–7].

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 http://dl.nure.ua/, created on the MOODLE platform, is administered and maintained by the Center of Distance Learning Technologies https://nure.ua/branch/tsentr-tehnologiy-distantsiynogo-navchannya, which was created at the University in 2001 (Fig. 1).

![KNURE DL Service](image)

**Figure 1**
The “KNURE DL” service created on the basis of the MOODLE platform deployed on the Server of the KNURE

To ensure the DL and set up all information services during the organization of the educational process in KNURE
uses a single system of creating and maintaining accounts of users of the information ecosystem of the institution with support for e-mail addresses in the domain nure.ua for all participants (students, teachers, staff). Currently, more than 10,000 user accounts of the university are active. 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.

Of considerable interest, both for research and for the use of the experience of KNURE in other IHEs (HMEIs) of Ukraine and the world, is the practice of KNURE on conducting laboratory classes within the implementation of DL [5-7]. 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. 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. Also, teachers of the Department of BME KNURE conduct classes remotely using the newest teaching aids, such as graphics tablets and interactive screens. This allows teachers to perform transformations of mathematical expressions and write fragments of program code when conducting remote classes in dynamic mode while demonstrating the screen. This, in fact, combines the approaches of teaching in the blackboard and the presentation of material in the form of a presentation and significantly expands the methodological possibilities of conducting classes remotely during the demonstration of the screen [5-7].

From the beginning of the autumn semester of 2020-2021 academic year, the Department of Microprocessor Technologies and Systems (MTS) of KNURE has two laboratories with remote access to equipment (on-line laboratory), where students can create a project in real time and test its viability outside laboratories. Laboratory classes are conducted using the MOODLE platform (dl.nure.ua), video conferencing in Google Meet and remote access to PCs and laboratory layouts. Students and teachers use the TeamViewer remote software package to remotely access PCs in laboratories. Adjustment of laboratory equipment and support during laboratory work is provided by teaching and support staff of the Department. For laboratory work, the newest equipment is used, which has the ability to connect to a PC. Laboratory models and oscilloscopes are completely controlled by a personal computer. And with the help of the camera the work of the laboratory model is broadcast on the monitor. This allows you to upload projects to laboratory layouts remotely and view the results of their work on a computer monitor using specialized software. This approach to laboratory work on microcontroller design allows students to gain hardware skills, practical microcontroller programming skills, and provides students with additional skills for remote hardware operation [5-7].

KNURE's experience in conducting online exams is no less
intellectually valuable for specialists in the organization and implementation of information technology in the educational process of Higher Education Institutions than the experience of this Higher Education Institution in conducting online laboratory classes. The algorithm for the exam is as follows. The module "Exam" with the section "Tasks" is added to the module of this course in the service "KNURE DL" http://dl.nure.ua/, which was created on the MOODLE platform. This section provides a folder for each student, in which the student puts his answer to the exam ticket. At the beginning of the exam, the teacher and students meet for a video conference at Google Meet. To confirm participation in the exam, each student sends from his e-mail address on the domain nure.ua a blank letter to the teacher, and in response receives a pdf file with the exam ticket. During the time allotted for the exam, students write answers to the questions of their tickets. Each student photographs his handwritten answer, forms a pdf file and sends it to the course page, placing it in the topic "Exam", section "Tasks", in a folder with his name. The time allotted for checking the works (usually several hours) the teacher checks the answers. Then, all participants of the exam (students and teacher(s)) gather again for a video conference, where each student is voiced by the teacher. The assessment depends not only on how well the answers to the questions of the examination ticket are written, but also on the results of the work during the semester, the laboratory and practical tasks performed. In parallel, the Educational and Research Center for Distance Learning (NSCPF) KNURE clearly and deliberately performs work on the formation and timely provision of teachers and students of the group participating in the exam accompanying this exam electronic documentation: electronic information and instructions for its completion are sent in advance; e-mail addresses of students on the nure.ua domain are also sent in advance [5-7].

In KNURE are defended bachelor's and master's qualification works COMPLETELY, from start to finish, remotely, using the service for video conferencing from Google Suite for Education - Google Meet! 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, and has the following components. Certification of persons at the first (bachelor's) or second (master's) levels of higher education in the form of defense of qualifying works using distance learning technologies is carried out in synchronous mode (videoconference). At the same time, digital fixation (video recording, audio recording, photo fixation, etc.) of the attestation process is obtained in the form of defense of qualification work. At the time of defending the qualification work, the electronic copy of the work with the electronic digital signature of the student must be in the examination commission (it must be sent in advance by the student by e-mail). The examination commission verifies the digital signature. The decision of the examination commission on the result of the defense of the qualification work takes effect after the examination commission receives a copy of the work and after the completion of the accompanying documents. The digital record of the process of protection of qualification works is kept in the educational institution for at least one year. The secretaries of the examination commissions send the protocols of the meetings of the examination commissions, responses and reviews (their photocopies) to the deans' offices by e-mail no later than the next working day after the scheduled defense of qualification works. As an exception, active combat operations, the educational institution gives the secretary of the examination commission the right to collect signatures on paper copies of all documents (responses, reviews, protocols) after normalization of the situation and provide completed documents on the results of protection to the deans and qualification works to the archives. Now KNURE gradually embody the recommendations of the Ministry of Education and Science of Ukraine on the transition from paper copies of qualification works and coursework in the archives to creating repositories of electronic copies and copies certified by the necessary electronic digital signatures [5-7].

NTU (KPI): the example of successful organization of distance form educational process in the conditions of martial
Two educational shells are actively used in the educational process of NTU (KPI) - “KPI Web Class” (Fig. 2) and “Information Management System” (“CIM”) (Fig. 3), developed and manufactured by the university specialists, as well as the freely distributed MOODLE shell [5-7]. 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. From the point of view of the use of information technologies the problem of distance learning organization in higher education institutions is also interesting and NTU(KPI) training shell “CIM”, http://cde.kpi.kharkov.ua) which has been developed by scientists of this educational institution and functioning since 2004.
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 gives 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 [5-7].

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). Viber and Telegram messengers are the most popular for use by teachers in the distance learning process at 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.

**KNAFU: the effective solutions for the implementation of DL in HMEI of Ukraine and the world.** 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». In addition, the learning process successfully uses the distance learning system with the open source code – LMS MOODLE and the platforms Discord, ZOOM, Google Meet, BigBlueButton are used establishment as a ground for realization of international scientific conferences in their distance version [5-7].

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. 4).

The universal system for the development and conducting of computer tests has been developed and implemented in KNAFU (Fig. 5). 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 [5–7].

**Figure 4**
The IEE “DIALOG” for distance learning

**Figure 5**
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 faculties and the department of the university and is successfully used during the planning of the educational process at the university (Fig. 6). 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.

It should be noted that, in addition to those developed by scientific and pedagogical specialists of the KNAFU IT for DL, the educational institution, in its work in this direction, actively uses the best developments companies with a world name in the market of software production for the automation of learning. The “DLS KNAFU” service created on the
basis of the MOODLE platform deployed on the Server of the KNAFU е яскравим прикладом такої співпраці (Fig. 7).

Scientific and methodological recommendations on the use of the "AK74 Trainer" (an interactive educational and training complex for fire training "Learn to shoot accurately") (Fig. 8) were developed by specialists of the KNAFU in co-authorship with colleagues from the NTU (KPI) already after the large-scale armed aggression of the russian occupation forces on the territory of Ukraine.

Its aim to give cadets and university personnel, within the limits of the relevant DC, the opportunity to learn how to use this simulator as efficiently as possible, while reducing the time for high-quality training in matters of accurate shooting and significantly reducing the material and financial costs of this process. The software of the complex was created for the preparation of data for firing with various types of weapons and the possibility of reproducing the trajectory of the bullet in space, taking into account the ballistic data of the weapon and selected weather conditions. This DC is a resource located on the "DLS KNAFU" service [5-7].
Conclusions

Thus, existing on current time in the Higher Educational Institutions of Ukraine a high level educational-methodical base, hardware, software and highly skilled scientifically-pedagogical staff, allow to talk, that the Higher Educational Institutions of Ukraine in the conditions of the large-scale armed aggression of rf continue to provide quality educational services, and the role of DL technologies in success of organization and realization of this process is powerful and indisputable.

The analysis carried out in the work allows us to state, that at the choice of software for realization of DL the greater amount of higher educational establishments of as control system by learning is elect the platform of MOODLE, that is free, has an open code and perfectly integrated with software applications of other software manufacturers, such, for example, as Google, Microsoft, Zoom, that, besides, gave IHE (HMEI) of Ukraine in the conditions of martial law free access to their software.

It is also determined that in many, that in many Higher Educational Institutions, there are DL technologies that was developed by specialists of these educational institutions.
with a serious functional that specifies on their powerful skilled potential and great prospects for further work in this direction.

From the point of view of automation and application in the educational process of modern information technologies of distance learning in the educational process IHE (HMEI) of Ukraine are fully prepared to integration in educational space of European Union and NATO countries and are ready to share their knowledge and experience in the direction of using DL technologies for successfull organization of distance learning in the conditions of large-scale armed aggression russian federation against Ukraine.TOGETHER TO VICTORY!!! GLORY TO UKRAINE!!!
