

2.2 Information technologies and their role in the successful organization of the educational process in higher educational institutions of Ukraine in the conditions of martial law

The russian-Ukrainian war, which began in 2014 and turned into a large-scale aggression by the occupying forces of the russian federation after February 24, 2022, led to significant changes in the priority forms of the educational process in Educational Institutions of Ukraine. In the conditions of martial law, introduced in the country on the day of the start of the large-scale invasion, mixed and distance learning (DL) became the forms of providing educational services that, based on the active use of information technologies, were able to ensure a quick recovery of the educational process with minimal financial costs for its organization.

Immediately after the introduction of martial law the Ministry of Defense of Ukraine (MD) and the Ministry of Education and Science of Ukraine (MES) 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 [52].

In order to successfully carry out the educational process in mixed and distance forms, Educational Institutions were recommended to use in their work the following informational technologies (IT): learning management systems (LMS) (MOODLE, Google Workspace for Education, Microsoft Office 365 Education, etc.); applications for conducting video conferences and webinars (BigBlueButton, ZOOM, Microsoft Teams, Google Meet, etc.); e-mail; messengers (WhatsApp, Signal, Telegram, Viber, etc.); communication in telephone mode; electronic versions of textbooks; video-lessons from leading Ukrainian and foreign lecturers; live broadcasts-streams; forums; chat rooms; placement of tasks and recommendations on the institution's own website; the resources of the educational platforms Coursera, Udemy and EdX; simulation models of objects and processes (3-D models, flesh-animation, educational cartoons and computer educational games) 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; educational simulators which use technology of augmented reality; the alternative Internet communication networks, IT of double password, thorough identification, cryptographic protection of information are widely used Higher Military Educational Institutions of Ukraine (HMEI) in their work on the organization of the educational process at a distance in order to ensure the defense of information with limited access and much more different IT [53].

The innovative IT, which are actively used in the educational process of various educational institutions of Ukraine for the organization of mixed and distance forms of learning in the conditions of martial law, rightfully include: 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; 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); 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) [52,53].

Also unique for the educational process became a version of educational video content, created at the Department of Biomedical Engineering (BME) of Kharkiv National University of Radio Electronics (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 lecturer 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 lecturers 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 [54].

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 lecturers 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 students 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. To the significant achievements in the direction of creative application of information technologies in the educational process by the scientific and pedagogical personnel of KNURE includes the experience of passing exams and defense of coursework, bachelor's and master's qualification theses. The algorithms for conducting these educational events meet the requirements of the MES regarding their organization in a distance form, and the software application chosen for communication between the lecturers and the student during their implementation was chosen the same and it is Google Meet [54].

LMSs «KPI Web Class» and «CIM» are IT-developments National Technical University “Kharkiv Polytechnic Institute” NTU(KPI) (Fig. 1,2) [55].



Figure 1. Starting page of the educational shell “KPI Web Class” NTU(KPI)

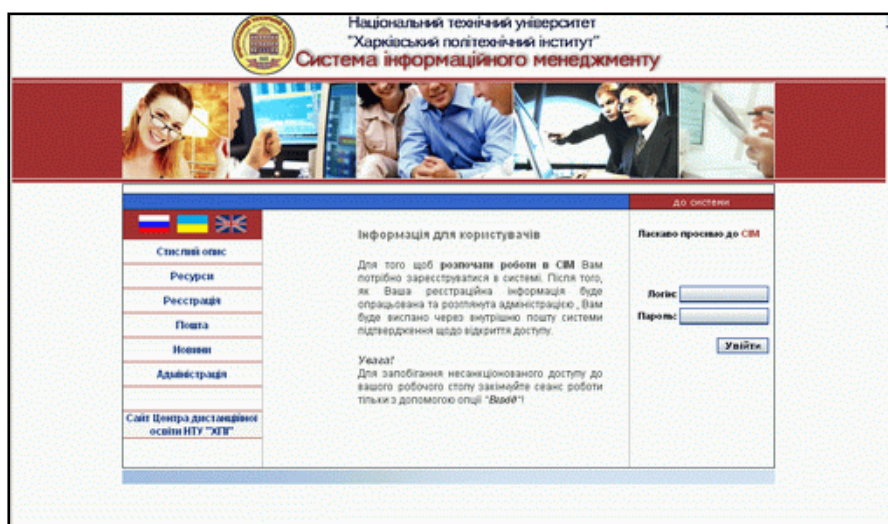


Figure 2. Starting page of the educational shell “CIM” NTU(KPI)

National Academy of National Guard of Ukraine during the training of cadets use the special training simulators for honing the skills of shooting from anti-tank and anti-aircraft missile systems ("Fagot", "Corsair", "Stugna-P", "Igla"), simulating real combat conditions with the use of augmented reality technologies (Fig. 3).



Figure 3. The special training simulators for honing the skills of shooting from anti-tank and anti-aircraft missile systems.

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», an interactive educational and training complex for fire training «Learn to shoot accurately» («AK74 Trainer»), the complex simulator of the «Mi-8 MTB» helicopter are own IT-developments of Kharkiv National Air Force University (KNAFU) (Fig. 4-7) [52-56].

Main window

Subjects of training

№ з/п	Група	Список курсів за вибором
1	Група №111	Інформація з напрямку підготовки 2001 "Авіація та космонавтика" курсантів Харківського національного університету Повітряних Сил
2	Група №111	Теорія інформації
3	Група №111	Обчислювальна техніка
4	Група №111	Комп'ютерна графіка
5	Група №111	Алгоритмічні мови та програмування
6	Група №111	Комп'ютерні мережі
7	Група №111	Інформатика

Testing

Course Structure

Figure 4. The IEE «DIALOG» for distance learning.

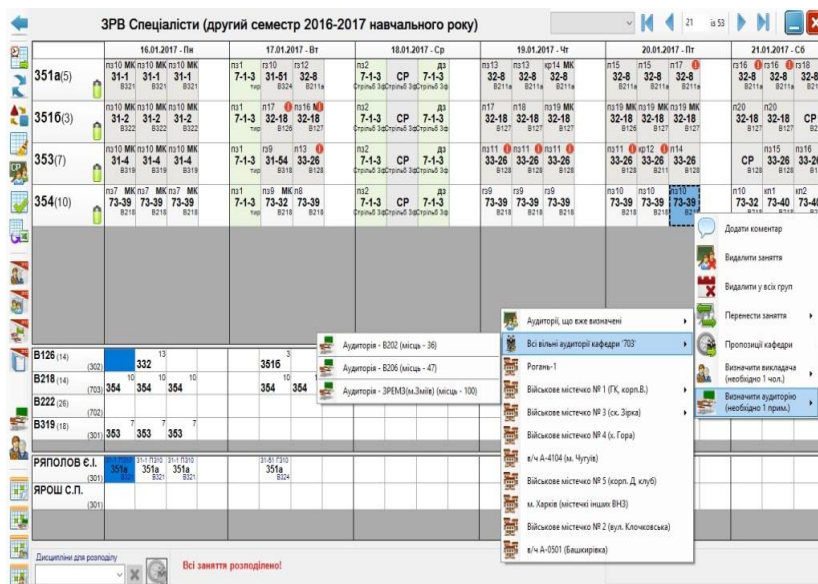


Figure 5. The user interface of software complex “CASCAD”



Figure 6. Original appearance of interface interactive educational-training complex “Learn to shoot accurately”

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. Europe has not known such large-scale destruction since the Second World War. 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.

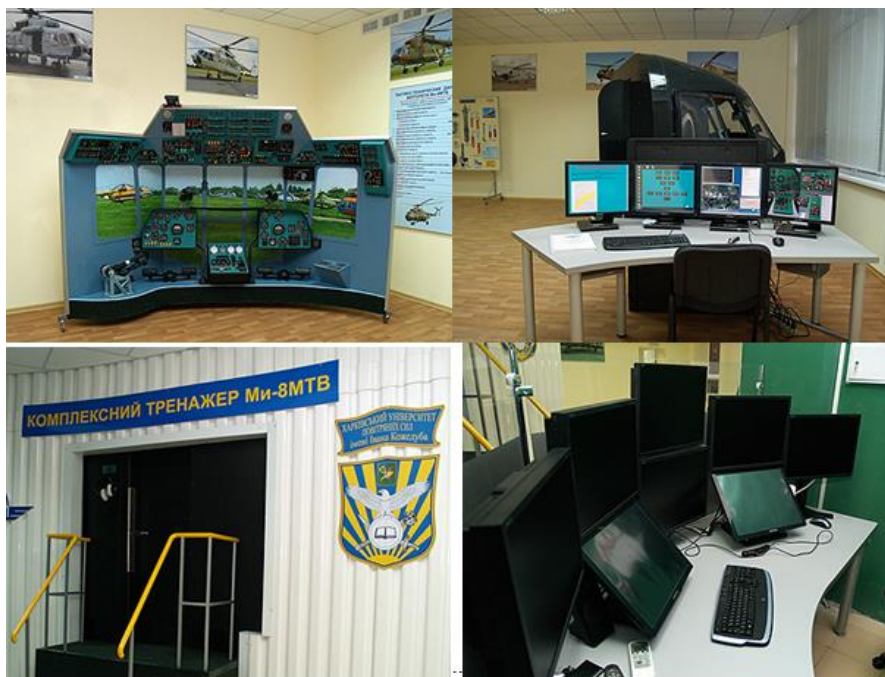


Figure 7. The complex simulator of the «Mi-8 MTB» helicopter.

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. Since the beginning of the russian invasion, more than 7 million Ukrainians were forced to leave their homes, but remained in Ukraine, almost 4.9 million Ukrainians officially received the status of internally displaced persons. 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 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). 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 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 (Irpın), 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. 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"...[57]

But no one will ever be able to defeat the Ukrainian people, let alone destroy us and our state – UKRAINE! Our knowledge is our power. That’s why such serious attention is paid to the issue of the implementation of the latest information technologies in the educational process precisely during the armed aggression of the russian federation against Ukraine. The use of information technologies is our way to Victory!!! TOGETHER TO VICTORY!!! GLORY TO UKRAINE!!!