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***THE QUALITY OF DISTANCE EDUCATION WITH ICT:  
SIMULATION OF THE UKRAINIAN SCENARIO***

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*The article scientifically researches the theoretical, methodological, and analytical aspects of the quality of education in distance learning using ICT. Attention was drawn to such aspects as the low level of awareness of ICT, the transition to mixed learning, the availability of distance courses on distance learning platforms in Ukraine, the unsatisfactory quality of distance courses. The essence of distance learning is summarized, and the features of distance learning of students in the field of knowledge "Information Technologies" are given. The problems arising during distance learning in the knowledge "Information technologies" field have been identified. The quality of distance education and the role of ICT in providing it are described. A descriptive model of the quality of distance education using ICT in the field of knowledge "Information Technologies" is proposed. An expert study was conducted on the quality of education at the university on the example of the Lutsk National Technical University, the use of learning platforms, and types of ICT, a comparison was made with all-Ukrainian trends. The results of the survey and their analysis are presented. It is proposed to use mixed and distance (synchronous) forms of education. It has been established that the key component of quality distance education is the constant monitoring of processes and the development of NPPs, which are ready to convey explicit and implicit knowledge to students. This will be facilitated by a descriptive model of the quality of distance learning using ICT, which has three stages: description and characterization of the external environment, implementation of the model itself, and constant monitoring of goal achievement.*

**Keywords:** distance education, quality of education, ICT, modeling, digital skills, descriptive model

## **1. Introduction**

Global informatization of society is one of the main trends in the development of humanity in the 21st century. One of the promising directions of the development of modern education is the use of distance learning technologies, which are designed to meet the requirements of the new educational paradigm of the information society, namely: the implementation of mass education for all categories of the population regardless of their place of residence, support of open, person-oriented and continuous learning of a person throughout his life, improvement of professional training in institutions of higher education by meeting various needs of applicants. Education should become a social institution that can provide a person with various services, in particular, obtaining postgraduate and additional education, which allows continuous learning. This process is impossible without the introduction of distance learning in the educational institutions of Ukraine. There is a need to form a typical model for the implementation of distance learning in ICT, which would contribute to the quality of education. Ensuring the socio-political and socio-economic development of the country is possible only if there is an adequate level of quality of higher education. Nowadays, interactive distance learning technologies are becoming more and more popular, the use of which makes it possible to



eliminate the problem of the lack of live contact between teachers and students. The basis of these technologies is the intensive and controlled independent work of students who can study in a place convenient for them, according to an agreed schedule, under the guidance of teachers-mentors, without visiting educational institutions. The main technologies with which the participants of the educational process can communicate remotely based on the educational platform are Moodle, e-mail, messengers (Viber, Telegram), video conferences (Zoom, Google Meet, Skype), and the free service for distance learning Google Classroom. For distance learning, the following rules must be followed: appropriateness of reading materials and assignments, technological tools, teacher feedback/feedback and communication with the teacher, course organization, clarity of goals and requirements, and content format. The main task of using ICT in an educational institution is to create the most favorable conditions for those who study, obtain higher education, prepare for admission to educational institutions, improve their qualifications, and retrain personnel based on the introduction of the latest information, communication, and psychological-pedagogical learning technologies. The strategic goal of the implementation of information and communication technologies in an educational institution is the implementation of distance learning as a full-fledged form of obtaining higher education.

The purpose of this research is to summarize approaches to the quality of distance learning in the field of knowledge "Information Technologies" and to develop a descriptive model of distance learning in Ukraine. Based on the goal set in the work, the following main tasks will be performed:

1. Summarize existing theoretical approaches to distance learning in Ukraine.
2. To highlight the main problems of distance learning, which lead to the deterioration of the quality of education.
3. Investigate the role of ICT in ensuring the quality of distance learning.
4. Build a descriptive model of the quality of distance education using ICT in the field of knowledge "Information technologies"

#### **The essence of distance learning**

Distance education appeared in Europe in the 19th century. as "correspondence learning", i.e. "distance learning". In the 20s of the XX century in Ukraine, a different type of correspondence education emerged – correspondence education, which was widely used in educational institutions of various types. In 1982, at an international conference in Canada, the term "correspondence education" was changed to the term "distance education". It should be noted that correspondence education is often equated with distance learning, in which information and communication technologies are used. On the other hand, the use of these technologies for any form of education is also equated with distance learning. It should be recognized that correspondence and distance forms of education have one common feature: in both cases, the teacher and the student are at a distance. Everything else, in particular the organization of educational and methodical support, its selection, structuring, organization of the educational process, and even control, are carried out in fundamentally different ways. Distance education has acquired its specificity, which is based on the principles of the possibility of choosing general educational institutions, academic disciplines, teaching staff, and receiving continuous education regardless of time and place of stay. Some functions of both the teacher and the student are changing. For teachers, organizational and educational skills are strengthened and the communicative component is reduced, and training is carried out in various forms (classroom, evening, extracurricular, etc.). Students get access to information support at a time convenient for them and save it, making it more productive. This provides an opportunity to get an education in a shorter period compared to studying in a traditional form.

B. Holmberg [1] and O. Simpson [2] write that distance learning is "a new specific form of learning that involves the use of certain approaches, methods, didactic means of interaction between the teacher and students." Considerable attention to the quality of distance education is due to its direct connection with the phenomenon of the standard of living of the population.

There is a direct relationship between investment in a person's education and his level of well-being (according to the theory of human capital by T. Schultz and H. Becker), and the content of human capital is determined by the growth rates of well-being depending on the level of education, the dependence between unemployment levels, a person's age and his education (amount of knowledge, abilities, skills, and qualifications), as well as the relationship between a person's giftedness and the level of his education, etc.[3]. Recently, the problems of distance education and ensuring its quality have become increasingly relevant and attract the attention of both foreign and domestic scientists. The problem of the quality of higher education given its significance, which is due to a direct connection with the phenomenon of the quality of life of the population, was developed by T. Schultz and G. Becker in 1964 [3].

Note that together with the implementation of distance education, electronic education or e-education (similar to e-society, e-government, etc.) is used as a type of distance education, in which participants and organizers of the educational process use electronic transport systems for the delivery of educational materials and other information objects, Internet/Intranet computer networks, media-learning tools and information and communication technologies (ICT).

The emergence of e-education caused the creation and use of special software tools for e-distance learning information systems to improve the conditions of subject-subject interaction during training. Information systems made it possible to support the educational process due to the expansion of the possibility of using software, using the information field with the ability to receive educational information, store it and process it.

Distance education has been introduced in Ukraine since 2000. It is regulated by the Concept of the Development of Distance Education in Ukraine and the Regulations on Distance Education of the MON of Ukraine [4], [5].

Distance education in the world has new features – switching attention to innovation, which can ensure profitability for educational institutions, and create easy access to ICT. However, open and distance education has a strong history of being an education for those who would not otherwise have access to education. There is a risk that these values and visions may become secondary or de-prioritized as the world moves to online education. Fifty years ago, distance education was transformed with the beginning of the open university movement. This transformation was based on the values and vision of educators. These values and visions should be as important as the policy environment, demand, and ICT access for open and distance education in the digital age [5], [6].

Distance education has existed for many years, mainly in the form of correspondence education. The nature of distance learning varies from country to country for reasons related to geography, culture, history, and available technological capabilities. In all cases, however, students are separated either by time, location, or physical proximity from the institutions and teachers who offer the training. Twenty-first-century distance learning is an electronic, synchronous or asynchronous, and Internet-based enterprise [7].

For the successful implementation of distance education, it is recommended to improve information filters, visualization tools, and personal assistance from information providers. In addition, digital literacy courses should be used to improve digital reading skills, taking into account emotional factors [8].

### **1.1. Quality of distance education**

In the context of distance education, the most problematic issue is determining its quality. Therefore, the majority of modern methodologies for assessing the quality of life of the population provide "the need for examination of the quality of education with the subsequent use of the obtained indicator at the level of one of the components of the final result. For example, the methodologies for calculating the quality (level) of life of many international institutions (the Organization for Economic Cooperation and Development, the European Fund for the Improvement of Living and Working Conditions, the European Committee for Statistical

Systems, the United Nations, etc.) provide for the assessment of the quality of education at the level of one of the integral components of the final result" [9], [10], [11], [12], [13], [14], [15].

According to the results of the first nationwide study of the level of digital skills in 2019, 53% of the population of Ukraine had digital skills below the "basic level" mark (according to the methodology for assessing digital skills used by the European Commission). A follow-up survey in 2021 showed a gradual increase in digital skills. Thus, the share of Ukrainians whose digital skills are below the "basic level" mark decreased by 5.2% or by 1.42 million people and currently amounts to 47.8%. At the same time, the share of Ukrainians who do not have any digital skills ("No skills") decreased by 4% or by 1.09 million people. What are the specifics of digital skills? Communication and information skills remain more developed since 2019. 79.2% Communication skills – a level above basic skills 78.9% Information skills – a level above basic skills At the same time, the following remain “slumping”: 55.8% Skills for solving life problems – a level above basic skills 36.8% Skills creating digital content is a level above basic skills (Ministry of Digital Transformation <https://osvita.diiia.gov.ua/research>).

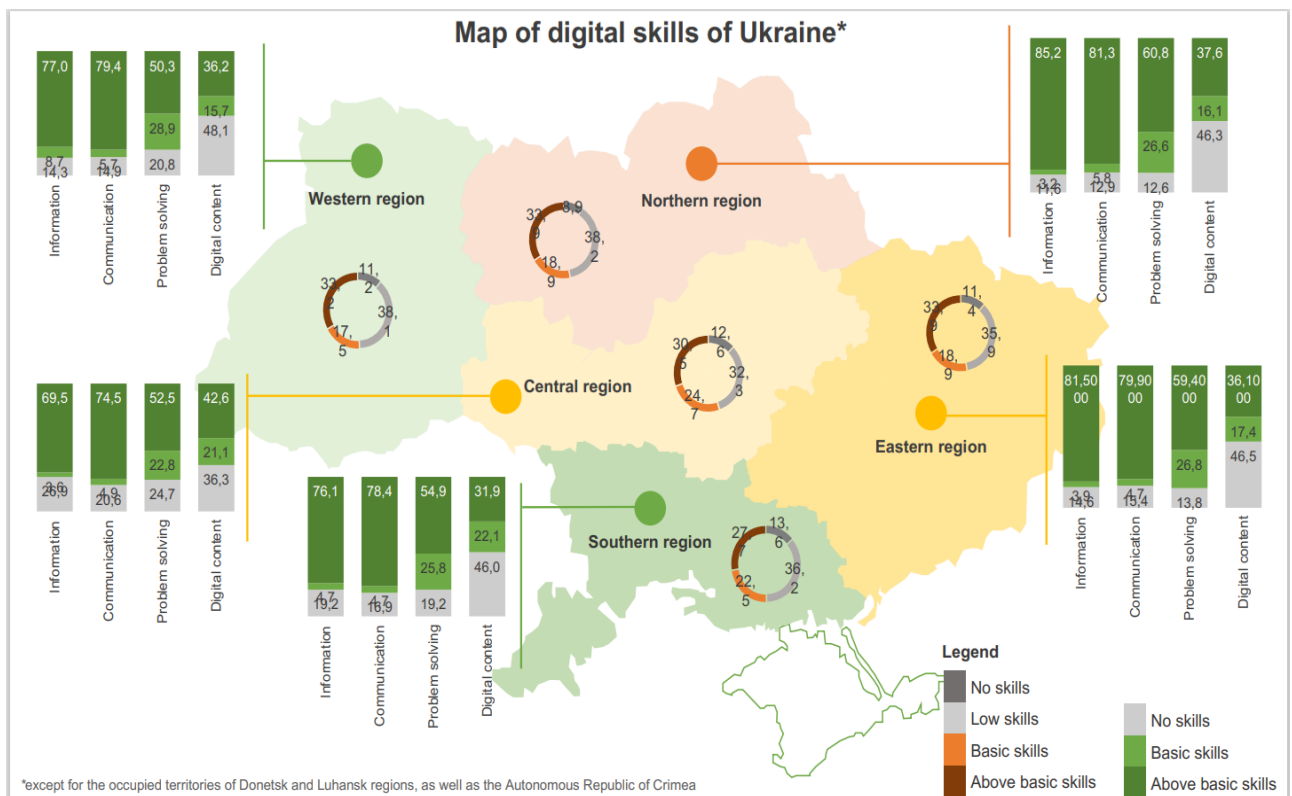


Fig 1. Map of digital skills of Ukraine

\*Source: [16].

The quality of distance learning depends on access to the Internet (Fig. 2). According to the Ministry of Digital Transformation, 91.8% of users have access to the Internet. But only 59.9% of users use the Internet at work or the place of study, that is, it is necessary to expand Internet access points in educational institutions, including in institutions of higher education. In public places, only 53.7% of users use the Internet.

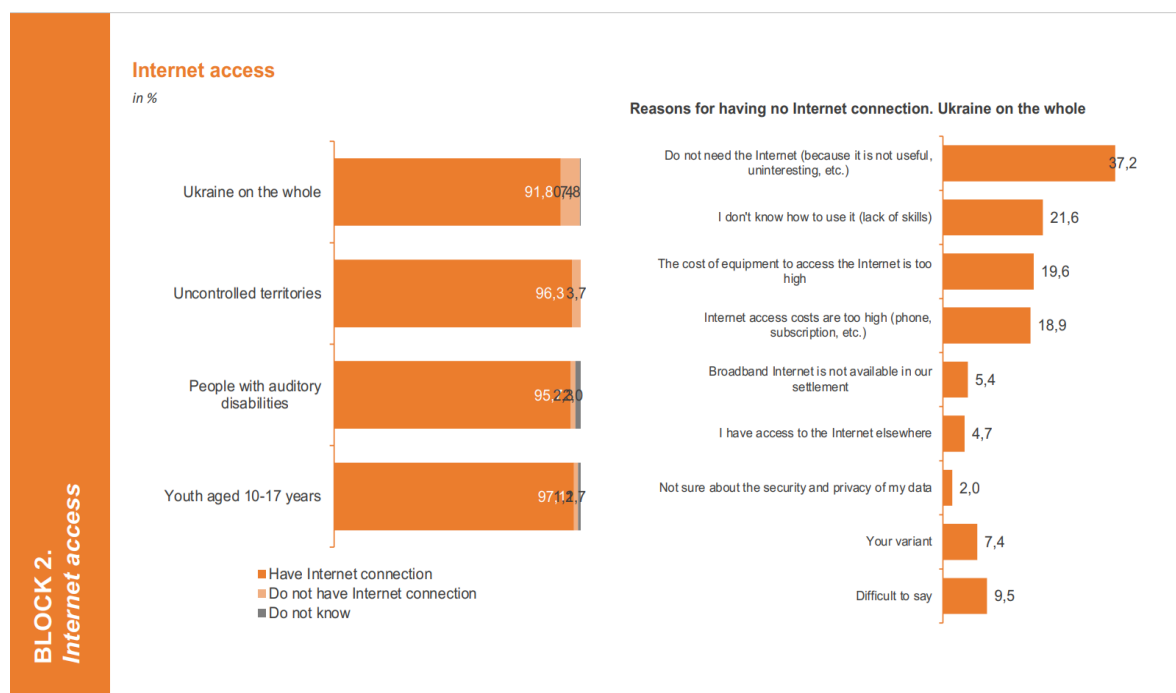


Fig 2. Internet access in Ukraine

\*Source: [16].

Also, the Ministry of Education and Science of Ukraine defined the issue of the quality of education at the priority level, which should take place in the following directions:

1. Adherence to European standards in higher education development.
2. Awareness of new understanding of quality assurance content and procedures.
3. Implementation of the directions of higher education reform approved by the government; improvement of the quality assurance system [17].

These directions are revealed through the prism of the development of higher education in the countries of the European Union:

1. Prevention of mismatch of competencies acquired during education with the needs of the future.
2. Creation of comprehensive systems of higher education.
3. Ensuring the contribution of higher education institutions to the innovative economy.
4. Support highly efficient and productive systems of higher education.

In addition, they correspond to the acquisition of such competencies, which the EU defines as the most important for the development of higher education:

1. High-level digital competencies.
2. Autonomy.
3. Critical thinking, ability to solve problems.

#### 1.1.1. The role of ICT in ensuring the quality of education

The ability of ICT to ensure the quality of the obtained education is carried out through the determination of the economic effect; communication risks; content of the quality assessment system and technologies of its use, etc. Evaluation of educational communication of the quality of education obtained with the help of ICT was actualized at the level of distance education since it is this form of acquiring professional knowledge that makes the most extensive use of ICT capabilities for receiving/transmitting educational information. Among the advantages of distance education are defined:

1. The freedom of the student of higher education in choosing the pace of assimilation of educational material,

2. Opportunities to obtain higher education in those higher education institutions, in which studying within the traditional forms of organization of the educational process for a specific person is impossible.

3. Ability to study at a convenient time,

4. The ability to influence the configuration of the educational program and reduce the risk of prejudice on the part of subjects of educational communication.

Disadvantages of the distance form of education are pointed out

1. At the level of a higher education applicant: (individual, socio-psychological, and physiological characteristics of a person and qualitative characteristics of his work opportunities).

2. At the organizational and methodical level of the implementation of the educational program (impossibility to timely correct erroneous actions of the student of higher education).

We would like to emphasize that in terms of content, distance education provides an opportunity to realize the potential of the state of freedom, and with a competent organization of the educational process and the availability of appropriate educational materials, the effectiveness of distance education is comparable to the effectiveness of full-time education, all other things being equal.

There are many aspects of a distance learning system to ensure the success of an online program – student, content, faculty, program, infrastructure, and human resources. Improving the quality of distance learning is possible if reading materials and assignments are appropriate; technological tools; teacher feedback/feedback and communication with the teacher; course organization; clarity of goals and requirements; content format.

Without high-quality distance learning, building a modern system of continuous learning is impossible. The quality of education consists of the compliance of the knowledge and skills of the graduates of the educational institution with the requirements arising from the labor market. The ability of ICT to ensure the quality of education is carried out through the determination of the economic effect, communication risks, the content of the quality assessment system, and the technologies of its use, etc. At the same time, the assessment of the quality of distance education in everything should be close to the assessment of the quality of traditional full-time or part-time education and should meet the same requirements. This can be done through the identification of factors (system elements), managing which it is possible to ensure the necessary quality of education and evaluate the indicators of the organization, process, and means of education.

#### **1.1.2. The level of development of distance learning at LNTU**

The Center for Social Expertise at the Institute of Sociology of the National Academy of Sciences of Ukraine presented the results of the study "Access to education during the restrictions of COVID-19". Accordingly, the main problems of distance learning are:

1. Limited access of students to computers - most families have two or three children, and parents also work remotely.

2. Lack of modern mobile devices – mobile devices do not support a number of applications that are required to perform technical tasks.

3. Poor internet connection quality – the internet connection is unstable and works with interruptions during video conferencing.

4. The irregular working day of scientific and pedagogical workers – teachers must be on call 7 days a week for 12 hours a day.

The research was conducted during January-February 2021 in 5 regions of Vinnytsia, Dnipropetrovsk, Kherson, Chernihiv, Chernivtsi [18].

We conducted a scientific study among students and teachers of the Lutsk National Technical University in the Volyn region regarding the problems of distance learning in technical specialties. The survey was conducted at the Faculty of Transport and Mechanical Engineering, Faculty of Customs Affairs, Materials, and Technologies, Faculty of Agricultural Technologies

and Ecology, Faculty of Architecture, Construction, and Design. Distance learning is conducted on the Moodle platform (table 1).

*Table 1*  
*Distance learning at the Lutsk National Technical University*  
*in the field of knowledge "Information Technologies"*

Indicator	1 year	2 year	3 year	4 year	1 year of master's degree
Number of active distance courses in the field of knowledge "Information technologies"	81	72	54	52	28
Software engineering	25	20	10	6	7
Computer Science	9	7	9	7	15
Computer Engineering	24	25	18	25	5
Cyber security	21	20	17	14	1
Information systems and technologies	2	0	0	0	0
Number of educational programs in the field of "Information technologies"	5	4	4	4	3
Number of distance courses in the field of "Information technologies" per educational program in the field of "Information technologies"	16,2	18	13,5	13	9,3
The total number of active distance courses in technical specialties	265	210	192	226	138
The number of educational programs in technical specialties	20	20	20	20	19
The number of distance courses for one educational program in technical specialties	53,6	42,3	38,4	46,6	28,6

Source: [19]

Table 1 shows that the largest number of distance courses were developed and implemented in the first and second years in the field of "Information Technologies", and in technical specialties in the first and fourth years. However, considering the number of distance courses per educational program, this indicator is quite low. In the first year in the "Information Technologies" field, it averages 16, in the second year 18, in the third year 13.5, in the fourth year 13, and in the first year of the master's degree 9.3. According to technical specialties, this indicator is on average equal to 53.6 for the 1st year, 42.3 for the 2nd year, 38.4 for the 3rd year, 46.6 for the 4th year, and 28.6 for the first year of the master's degree. This is a rather low indicator, considering that the training plan for applicants includes 28–32 subjects for a bachelor's degree and 6 subjects for the 1st year of a master's degree.

For the field of "Information technologies", a survey of 100 education seekers was conducted on four questions:

the quality of teaching of scientific and pedagogical workers in points from 1 to 3. Where 1 – the student of education learned a lot, the material is logical and structured, 2 – the student of

education deepened his knowledge, but did not expand it, 3 – the student of education did not learn anything new;

problems with the Internet connection in points from 1 to 3. Where 1 is a good Internet connection for the teacher and the student, 2 is an unstable Internet connection for either the teacher or the student, 3 is problems with the Internet connection on both sides, classes were not held through video conferences;

ease of use of the Moodle platform for learning in points from 1 to 3. Where 1 – the Moodle platform is understandable for learning, everything is accessible and logical, 2 – there were problems from the technical side regarding sending tasks for assessment, 3 – there were problems both from the technical side and content;

the level of communication with the teacher in points from 1 to 3. Where 1 – the teacher was always in touch, 2 – the teacher answered every other day, 3 – there was no communication with the teacher;

the level of ICT use in classes in points from 1 to 3. Where 1 is a sufficient level, of new programs and technologies, 2 – the teacher has only certain programs and technologies, and 3 – the teacher is weakly oriented in ICT.

The work uses the method of expert evaluations [20][21][22]. The results of the study are presented in the table. 2.

*Table 2*  
*Results of distance learning quality surveys at Lutsk National Technical University in the field of knowledge "Information Technologies"*

Indicator	1		2		3	
	m	f	m	f	m	f
Teaching quality of scientific and pedagogical teachers	20	10	35	15	18	2
Internet connection problems	14	12	10	22	20	22
Ease of use of the Moodle platform for learning	18	19	16	20	15	12
The level of communication with the teacher	15	19	20	19	18	9
The level of ICT use in classes	16	15	19	22	18	10
In general	83	75	100	98	89	55

According to the results of the survey, it was established that the majority of male students believe that they have deepened their acquired knowledge, but not expanded it, while women are inclined to the fact that they have obtained an average level of knowledge. Most of the men believe that they had an unstable internet connection with either the teacher or the learner, while the women had problems with the internet connection on both sides, the classes were not conducted via video conferencing. During the execution of tasks on the Moodle platform, there were technical problems with sending tasks for assessment to both men and women. The level of communication with the teacher was insufficient, as the answer did not come immediately, but the next day for men and on average for women. In general, on average, it can be stated that both men and women rated the quality of distance learning at 2 points, i.e. at an average level.

This level requires the development of a descriptive model of the quality of education using ICT.



In general, a survey was conducted among students of the field of knowledge "Information Technologies" of the Lutsk National Technical University regarding the types of use of ICT (table 3).

*Table 3*  
*Types of use of ICT in the educational process among students of the field of knowledge "Information Technologies" of the Lutsk National Technical University*

Type of ICT	Characteristic	Types
Educational	Communicate educational information, form knowledge, skills and abilities of educational or practical activities	Interactive whiteboard, interactive tables, digital books, laptops, multimedia resources
Training	Intended for consolidation of abilities and skills, repetition of learned material	Virtual educational platforms, educational robotics, virtual reality, game consoles
Information-search and reference	Information is communicated, the ability to systematize it is formed	Educational platforms Moodle, JavaScript, Python, EdEra, Campaster, Coursera, EdX, Udacity, Canvas Network, Udemy, Prometheus, Future Learn, OpenupEd, Iniversity, Stanford Open EdX, Codecademy, BYM, Emeritus, ITVDN, Google Classroom
Demonstration	Visualize objects being studied for the purpose of their research and study	Means of telecommunication (video conferences Zoom, Google Meet, forums)
Imitation	Represent a certain aspect of reality for studying its structural and functional characteristics	PhET University of Colorado Boulder
Laboratory	Enables to conduct of remote experiments on real equipment	Figma, Boosta (SEO and link building, SMM and targeting from scratch, Fiverr for freelancers as well Customer Care: Support & Sales), METANIT, – Cross-platform IDE ( <a href="https://www.monodevelop.com/">https://www.monodevelop.com/</a> ), C# online compiler ( <a href="https://dotnetfiddle.net/">https://dotnetfiddle.net/</a> )
Modeling	Objects can be modeled to study them	Creative Practice, Codecademy, ITVDN, Figma, CISCO, JavaScript, Python, Ligonom Community, Visual Studio
Educational games	Create educational situations, the activity of which is implemented in a game form	Codecademy, Ukrainian Global Faculty, Zooniverse, the portal of the American Library Association International Games Week, Fold.it, Planet Hunters, The Games and Gaming Round Table — GameRT, Plagiarism: Goblin Threat Plagiarism Game, LARP, Game platforms Cyberdura. ASUV "Slavutich"

Source: [23], [24]

From Table 3, it can be concluded that the field of knowledge "Information Technologies" uses many types of ICT. Most actively in education, teachers use educational, information-search and reference, demonstration, laboratory, and simulation. Students study on Moodle, Google Classroom, CISCO, METANIT, and Ligonom Community, MonoDevelop, and Visual Studio platforms. Educational and gaming ICT and simulation are practically not used. Because of the Lutsk National Technical University, a survey was conducted regarding distance learning platforms (Table 4).

*Table 4*  
*Distance learning platforms*  
*at the Lutsk National Technical University in 2020-2022*

Distance learning platform	2022	2021	2020	%
Distance learning platforms are used to study disciplines	1095	1250	870	25,86
Students on the knowledge base "Information Technologies"	165	185	152	8,55
Moodle	414	813	653	-36,55
Google Clasroom	17	288	383	-95,56
Telegram	18	5	4	B 3,5 p.б.
Discord	1	0	0	100,00
Google meet	18	10	11	63,64
Viber	20	63	61	-67,16
Moodle, Zoom	300	100	26	B 10,5 p.б.
Zoom	300	100	26	B 10,5 p.б.
E-mail	0	13	9	-100,00
Moodle by knowledge base "Information technologies"	62	120	114	-45,28
Google Classroom by knowledge base "Information technologies"	3	43	67	-96,17
Discord by knowledge base "Information technologies"	1	0	0	100,00

Source: [19]

According to the data in Table 4, it can be concluded that in 2020–2022 at the Lutsk National Technical University, subjects were taught on Moodle and Zoom remote platforms. Their use increased by 10.5 times during this period. In 2022, another Discord platform was added. It is used by students in the field of knowledge "Information technologies". If we compare distance education in Ukraine, the most common in 2020 is Viber, E-mail, Youtube, School website, Classroom, and Zoom (fig. 3).

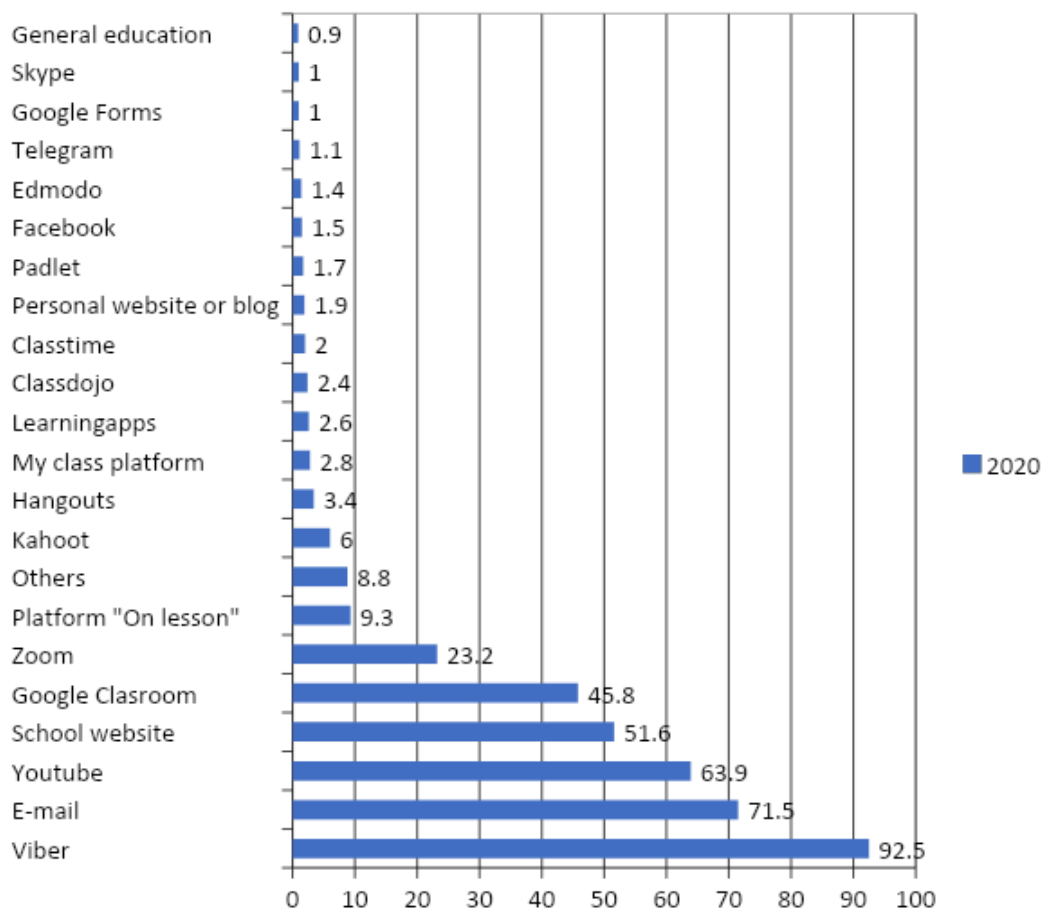


Figure 3: Distance learning platforms in Ukraine, %

Source: [25]

Similarly, as in institutions of higher education, Classroom and Zoom remain popular platforms for distance learning. However, most higher education institutions use Moodle.

### 1.1.3. Descriptive model of the quality of education using ICT

The results of the study of the quality of higher education using ICT made it possible to form a descriptive model of the quality of education for universities in the field of knowledge "Information technologies".

We will build a descriptive model according to the following stages.

Stage 1. Description and characterization of the external environment. Distance learning has been introduced in Ukraine since 2004. However, due to the COVID-19 pandemic and the war, it began to be actively used in 2019. In all regions of Ukraine, most educational institutions use distance (synchronous) learning, except Luhansk and Cherkasy, where distance (asynchronous) education prevails.

Since March 14, 2022, educational institutions have resumed the educational process as much as possible in a distance form (81.9%) or, taking into account the peculiarities of the state of the territory and the course of military operations, in a mixed (face-to-face) form (17.9%). And the results of the survey confirm the ability of higher education institutions in the difficult conditions of martial law to conduct the educational process in the usual forms, which were successfully tested during 2020-2021 during the global COVID-19 pandemic (Table 5):

*Table 5*  
*Distance learning platforms*  
*at the Lutsk National Technical University in 2020-2022*

Region	Remotely (asynchronously)	Remotely (synchronously)	Mixed form	Full-time training
Vinnitsia	3,3	92,9	1,9	1,9
Volyn	30,5	60,8	7,5	1,3
Dnipropetrovsk	8,0	84,2	4,8	3,0
Donetsk	20,0	74,3	2,9	2,9
Zhytomyr	9,2	82,1	7,7	1,0
Zakarpattia	5,0	92,2	1,5	1,3
Zaporizhzhia	16,2	33,9	49,0	0,9
Ivano-Frankivsk	5,2	93,1	0,7	0,9
Kyivska	8,6	87,5	2,3	1,7
Kirovohrad	6,1	87,2	5,3	1,3
Luhansk	66,7	33,3	0,0	0,0
Lviv	13,8	78,0	2,5	5,8
City Kyiv	10,7	86,3	2,2	0,9
Mykolayiv	3,1	82,8	14,1	0,0
Odesa	6,8	90,1	1,6	1,6
Poltava	12,7	57,4	28,1	1,8
Rivne	10,3	86,2	2,4	1,0
Sumy	29,7	57,7	11,8	0,9
Ternopil	6,3	87,3	4,2	2,2
Kharkiv	18,5	79,1	1,5	0,9
Kherson	40,3	49,3	5,2	5,2
Khmelnysky	10,5	86,1	3,2	0,2
Cherkassy	0,3	99,2	0,0	0,5
Chernivtsi	4,3	87,3	7,5	0,9
Chernihiv	53,8	25,0	21,3	0,0

Source: [26]

So, as the results of the scientific research show, among the possible formats of organization of the educational process by higher education institutions in the conditions of martial law, priority is given to synchronous (74.9%), which allows to provide quick and direct feedback and, of course, to achieve the desired results as efficiently as possible teaching. Educational institutions that carry out educational activities in relatively safe territories or those forced to change their actual location due to hostilities in 4 places of their location or temporary occupation of the territory of Ukraine, could apply this regime. In those institutions that continued to work in the territory of active hostilities (Luhansk, Chernihiv, Kherson, Sumy, Kharkiv, Donetsk regions) despite their isolation, training was mainly asynchronous, which made it possible to organize the work of the participants of the educational process according to their own schedule in difficult conditions and at your own pace. At the same time, the asynchronous mode requires applicants to have a fairly high level of self-discipline and a developed ability to manage their time, which can be quite difficult, particularly in the absence of previous experience in such work. Stage 2. Building a descriptive model of the quality of higher education using ICT in the field of knowledge "Information Technologies" in Ukraine. The quality of education is a priority in the activities of most educational institutions. Therefore, distance learning should not impair the quality of education. This especially applies to training specialists in the knowledge "Information technologies" field.

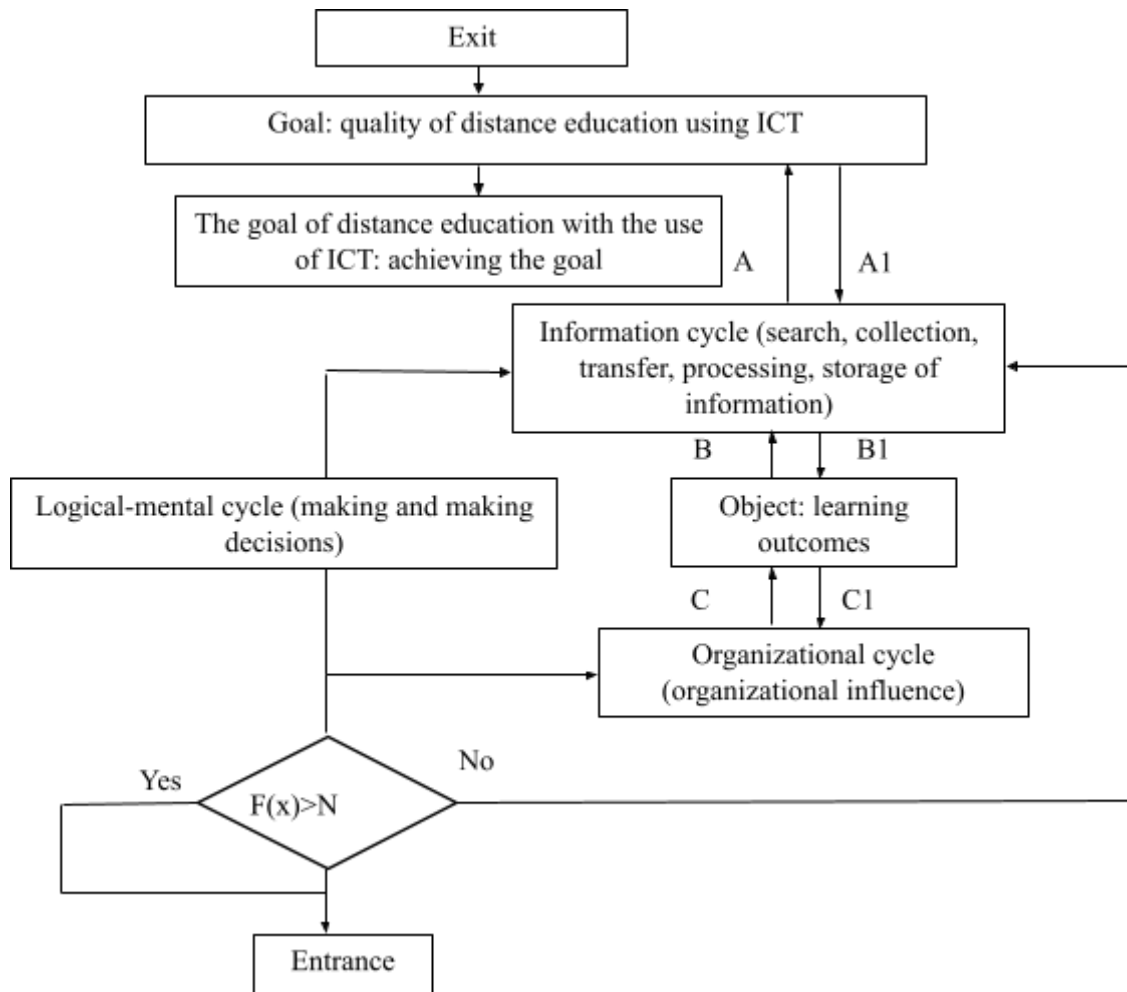


Figure 4: Descriptive model of the quality of higher education using ICT in the field of knowledge "Information technologies" in Ukraine

Source: [25]

A-A1 – external information flows; B-B1 – internal information flows; C-C1 – the organizational influence of the subject on the management object,  $F(x)$  – distance education quality function,  $N$  – criterion value (acquiring competence, its training and use).

In the descriptive model of the quality of higher education using ICT in the field of knowledge "Information Technologies" in Ukraine, it is important to highlight such features as 1) distance (asynchronous) or mixed form of education should be accompanied by constant monitoring of knowledge and its training; 2) use of various learning platforms, programming languages; 3) involvement of students in projects on the implementation of simple tasks of the national or international level; 4) academic mobility; 5) restrictions on "rationality of behavior".

The criterion values for the performance of the function  $F(x)$  can be: 1) mastery of cross-cutting skills, 2) development, interest in learning, psychological and physical comfort, 3) results of EBFF, 4) several completed team projects by students, 5) share of employment of students in international IT companies.

Stage 3. Continuous quality monitoring using ICT in the field of knowledge "Information technologies".

**Conclusions.** In the conditions of information oversaturation of the modern world, the question of effective management of information, its transformation into a knowledge resource, the use of which makes it possible to solve urgent social problems at a qualitatively new level, is

gaining considerable relevance. Explicit knowledge and organization of its broadcast, providing access to it are often obvious. In the case of explicit knowledge, it is most often about access to it in the form of documents. More complex is the situation with the detection and circulation of tacit knowledge, which can be demonstrated by action, but at the same time, it remains in a non-verbal form. In this case, the initiator, organizer, and participant in the knowledge management process cannot directly provide access to knowledge, since the latter has not yet been formalized, and the bearer of this knowledge may not have identified its presence yet. So, first of all, it is about the organization of an environment conducive to the identification of implicit, informal, or undocumented knowledge. Distance education is such an environment, especially with the use of ICT in the field of knowledge "Information Technologies". The ability of ICT to ensure the quality of the obtained education is carried out through the determination of the economic effect; communication risks; content of the quality assessment system and technologies of its use, etc. In terms of content, distance education provides an opportunity to realize the potential of the state of freedom, and with a competent organization of the educational process and the availability of appropriate educational materials, the effectiveness of distance education is comparable to the effectiveness of full-time education, other things being equal.

The results of research conducted on the quality of distance education allow us to state that it needs the development of actions to improve it. The main problems are 1) a low level of awareness of ICT and its use in the educational process; 2) expanding students' opportunities to exercise their right to choose ICT during education, including simulation, modeling, education, and gaming; 3) gradual transition to mixed education to control the quality of education; 3) a small number of distance courses available on distance learning platforms in Ukraine, the most common being Moodle, Youtube, Classroom, Teams, compared to the content of educational programs; 4) the unsatisfactory quality of filling distance courses, which is associated with a lack of time in the NPP and a lack of desire for professional growth and improvement; 5) advantage in the use of such types of ICT as educational, information-search and reference, demonstration, laboratory, and insufficient attention to simulation, modeling, educational and gaming.

The quality of distance education should be increased, relying on all types of ICT. This can be done using a descriptive model of the quality of education. In the example of the field of knowledge "Information technologies", a descriptive model was built, the implementation of which has three stages: description and characterization of the external environment, a descriptive model of the quality of higher education, and constant quality monitoring.

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### **ЯКІСТЬ ДИСТАНЦІЙНОЇ ОСВІТИ З ІКТ: МОДЕЛЮВАННЯ УКРАЇНСЬКОГО СЦЕНАРІЮ**

У статті досліджено теоретико-методологічні та аналітичні аспекти якості освіти в умовах дистанційного навчання з використанням ІКТ. Звернено увагу на такі аспекти, як низький рівень обізнаності з ІКТ, перехід на змішане навчання, кількість дистанційних курсів на платформах дистанційного навчання в Україні, незадовільна якість наповнення дистанційних курсів. Узагальнено сутність дистанційного навчання та наведено особливості дистанційного навчання студентів галузі знань «Інформаційні технології». Визначено проблеми, що виникають під час дистанційного навчання в галузі знань «Інформаційні технології». Описано якість дистанційної освіти та роль ІКТ у її забезпеченні. Запропоновано описову модель якості дистанційної освіти з використанням ІКТ у галузі знань «Інформаційні технології». Проведено експертне дослідження якості освіти в університеті на прикладі Луцького національного технічного університету, використання навчальних платформ, видів ІКТ, здійснено порівняння із загальноукраїнськими трендами. Наведено результати проведеного опитування та їх аналіз. Запропоновано використовувати змішану та дистанційну (синхронну) форми навчання. Встановлено, що ключовим компонентом якісної дистанційної освіти є постійний моніторинг процесів і розвиток НПП, які готові донести явні та неявні знання до студентів. Цьому сприятиме описова модель якості дистанційного навчання з використанням ІКТ, яка має три етапи: опис і характеристика зовнішнього середовища, впровадження самої моделі та постійний моніторинг досягнення мети.

**Ключові слова:** дистанційна освіта, якість освіти, ІКТ, моделювання, цифрові навички, описова модель

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