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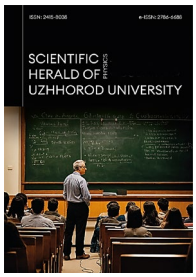


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# Open online courses technology in the professional ICT training

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**Abstract**

**Relevance.** Under the conditions of continuous social and economic development, and increasing the volumes of knowledge in all areas of society, the system of vocational education and training is facing new challenges. It is important for future employees in the sphere of information and communication technologies (ICT) to maintain their competitiveness in the labour market. Job seekers in this field need not only technical knowledge and skills but also the ability to adapt to changing conditions. Self-employment currently is a very relevant form of learning which allows you to achieve the above-mentioned qualities. Given the level of technological development and the objective challenges faced by humanity (e.g., the coronavirus pandemic), self-employment in this field almost automatically implies the acquisition of professional skills in a remote format.

**Purpose.** With the introduction of modern tools into higher vocational education, a detailed analysis of the different aspects of this process is required to identify the main trends available within the scope of online ICT courses and to assess the prospects for their use.

**Methodology.** In this study, along with regular, general scientific methods of research, a range of specific methods have been applied, including content analysis, methods of induction and deduction, and a systematic approach.

**Results.** The study analyses the main characteristics of the distance learning format, its place in the modern pedagogical discourse, and the various directions of professional skills acquisition in the field of ICT, which take place in a remote format. Ways in which professionals can verify the acquired skills will also be considered.

**Conclusions.** The information to be presented in the article is applicable as a reference, additional information for future ICT workers, and a wide range of readers interested in the topic of information technology.

**Keywords:** distance learning; information technology; online courses; pedagogy; video communication; ICT.

## Introduction

The phenomenon of distance education, which has become widespread both because of the development of information technology and the objective difficulties humanity faces, is now very much under evaluation. In particular, it's about the coronavirus pandemic, which has entailed restrictive measures and resulted in the transfer of educational institutions to a remote format. In this context, a debate has emerged within the pedagogical discourse about the appropriateness of using this type of learning.

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The opposing parties present arguments both for and against the distance learning format. At the same time, it is possible to talk about the blossoming of online courses, which are provided by various companies, including on a commercial basis.

According to recent data, the use of online courses is a worldwide trend. Particularly in Western countries, this type of learning is already a significant part of the educational market. The educational project Coursera, for example, currently reaches an audience of 5 million users from more than a hundred countries. Moreover, according to data provided by UNESCO (a specialised department of the United Nations dealing with education, science, and culture), in the European Union member states, up to 20% of the population receive education through online courses. Moreover, it is worth noting that for the development of this format of education in a number of Western countries (primarily in the U.S.) a special philosophical and methodological basis was created, which is a kind of bridge from behaviourism, which assumed the key role of the teacher personality, who had to form an educational attitude and be a kind of "moderator" of this process, to the philosophy of social constructivism. This approach implies an individualisation of the educational process and greater autonomy and autonomy (and consequently self-control) on the part of the learner than in the past. However, there is also interest in the acquisition of knowledge through online courses in Russia. For example, Ria-News [1] provides statistics according to which more than one million Russian citizens have been enrolled in online courses provided by both foreign and Russian platforms during the last few years.

In the course of this study, an information file was used as a theoretical foundation with a variety of sources as its components. It is necessary to consider the fact that the problem of distance learning implementation (including ICT training) is relatively recent, which is why there is no extensive research base, moreover, there is no array of legal and regulatory acts both at international and national (in particular, Russian) level, which would regulate the introduction of distance education into widespread use. Nevertheless, there are already some research materials devoted to the analysis of the topic under consideration in the framework of this study. It is the works of Russian and foreign scholars (Bulgaria [2] Uzbekistan [3], Azerbaijan [4], China [5], UK [6], Ukraine [7]) which form the basis of this study. Unfortunately, these works do not reveal the problem of ICT training in the general context of implementing new technologies in the educational process. In this paper, to present a systematic and coherent analysis of the current situation, the main emphasis is placed, primarily, on the problem of distance learning format implementation in the educational process. In addition, arguments of opposing sides on this issue are analysed. Secondly, an analysis is made of the different types of ICT skills acquisition that takes place in a distant (remote) format. In addition, the basic, most sought-after qualities and skills required to maintain competitiveness in the labour market are discussed, as well as ways to verify the acquired professional skills, e.g., through certification.

## Materials and Methods

When reviewing the main trends in the implementation of distance learning aimed at the training of ICT specialists, a range of general scientific and special research methods were applied. Using the following set of methodological tools, this study succeeded in determining the key assumptions which underpinned the above-mentioned trends. It is very important to elaborate on this area to develop an understanding of the ways and methods for reforming and transforming remote teaching and to find and correct existing deficiencies in this environment, i.e. to timely identify detrimental and destructive trends in theory that could disrupt the existing architecture of teaching in the area under study.

The use of content analysis allowed investigating the main points of the most significant and fundamental scientific research works directly related to the functioning of the online course market in a particular field (in the case of this study, this field was ICT training), and the level of spread and mentions of this market (and its particular products) in the mass media. By applying the induction method, the real properties of the new training format were identified. Properties that have already been mentioned and identified in the debate, and also the new ones, have been identified. The deduction method, in turn, allowed identifying the likely challenges that the restructuring of the training programme for professionals in the field under consideration in this study into a new format, i.e., a purely remote format can imply. In addition, the systemic approach provided a demonstration of the close linkage of the usually opposing main types of educational provision. This study was carried out in 6 phases, in the course of which:

1. The first stage concludes the appropriateness of using a particular definition of the phenomenon, which finds its own consideration within the framework of this study. The second stage analyses the place of distance learning both in global history (in the context of communication revolutions) and in a narrower sense, namely the location of online courses in pedagogical discourse. The third stage, along with the already mentioned and known arguments of the two opposing sides, identifies the positive and the negative, disruptive aspects of the transition of the ICT training system to a remote working format. The fourth stage, by analysing the needs of the current labour market, identifies the core abilities, soft and hard skills, that a professional in the area under consideration in this study should possess to be able to maintain his or her own competitiveness. The fifth stage implies an analysis of the prospects and opportunities for the potential ICT professional to document the skills and competencies acquired during his or her training. The sixth stage summarises the overall results of the study and concludes possible future directions for the study.

## Results and Discussion

### The phenomenon of remote education and major trends in its development

Today, there is rather extensive use of new terminology in foreign languages, usually in English, in contemporary pedagogical discourse. This includes terminology related to remote education. However, there is no single, generally accepted concept that defines the phenomenon that this study focuses on. An explanation for this is the fact that the

terms “online learning” and “online courses” and the context in which they are used may vary in different contexts. The topic of online learning has become one of the most discussed topics at pedagogical conferences as well as in specialised journals covering topical issues in education. Due to the development of remote and e-learning systems both in the world and in the post-Soviet space in recent decades, the concepts of “online learning” and “online courses” have become generally accepted. Analysis of the use of these terms suggests that their commonly accepted meanings have not yet been developed in pedagogical practice. Due to the lack of a generally accepted definition of online learning, the definition proposed by A.S. Fomina [8] can be taken into consideration, who understands online learning as “a way of organising the process of independent learning of educational materials using an educational environment based on Internet technologies, learning through the Internet and multimedia”. Under this definition, it is possible to summarise various methods of learning that actively use modern information and communication resources.

Among recent discussions in education, the debate about the prospects of online technology has the potential to go down in history as the most controversial. The views of its participants are often radically opposed. The debate is gradually transforming into an ideological confrontation between two camps: “progressives”, i.e., those who support fundamental changes in the education system under the influence of modern information and communication technologies, and “conservatives”, who defend traditional educational values and reject forms of new educational technologies. The first camp, for example, includes the Higher School of Economics (HSE), which has announced a full transition to online learning and a rejection of traditional lectures. The HSE explained that the reason for this demarche was to democratise education and increase opportunities for students to establish a personal educational trajectory. On the other hand, opponents of the widespread and dominant online education see the described methods and statements as more of a PR campaign, including due to the inability of some universities to effectively organise the learning process and achieve acceptable attendance of such courses [9; 10].

As of today, to determine the development path of the Russian education system, it is especially important to understand whether the format of online learning is a real educational revolution or rather a PR campaign of individual educational organisations to attract more people and maintain their own location in the information field [11-13]. It may be noted that participants in the discussion about the prospects of online learning often ignore the fact that today's humanity is not witnessing the first communication revolution. The creation of the Internet and the new generation of electronic computing machines (ECM) is considered the fourth communication revolution in communication theory, and before that, there were three great leaps in the material means, channels, and technologies of information transmission, which also had a direct impact on the education system.

The first communication revolution is usually linked with the advent of writing. Linguists and archaeologists argue that the written language was born in ancient Sumeria around the third millennium B.C. In the preceding era, “professional” teachers were priests of religious cults. Knowledge was transmitted directly from teachers to learners through the aural channel, which was used to convey information and visual representations of experience and skills. With the advent of writing, the model of teacher and student interaction remained virtually unchanged, also because, for a long, subsequent time, people regarded writing as a kind of sacred, sacral knowledge. J. Gutenberg, who created the printing press around 1440, made a second revolution in communication possible. Typewriter significantly increased the possibility of producing media of information material. At the same time, however, the role of the individual teacher would only increase. At that time secular education was developing apace, and the rapid development of European universities attracted attention. The distribution of books did not replace contact and interaction between teachers and pupils [14].

It is well known that the third communication revolution took place at the end of the 19th century. It was caused by the scientific works of H. Hertz related to the study of the properties of electromagnetic waves. Their continuation and result are the creation of electronic communication channels, including radio, television, and technologies for recording information on magnetic media [15; 16]. The aforementioned remarkable developments in communication technology have not separated teachers and students. On this basis, there is reason to believe that the current communications revolution will not be the starting point for the abandonment of direct contact between teachers and pupils. Thus, with the development of material production and the revolution in information and communication technology, learning technologies did not completely replace each other, but continued to be used under certain conditions or revised with new methods and communication channels. The advantages and disadvantages of online learning are also worth consideration. The advantage of this type of learning lies in its technical characteristics. For example, the possibility of ubiquitous implementation of modern information and communication technologies in teaching practices [17]. Among the undeniable advantages of online learning is also the democratisation of education. Democratisation of education refers to the possibility of choosing a particular online course, time, and place to study it, and so on. Online learning technology can also consider the personal characteristics of learners since with the availability of streaming multimedia, group learning becomes individualised. Finally, an important advantage of online learning is the cognitive compatibility between the learning technology used and the learners' perception. However, along with the advantages, online learning also has many disadvantages. The latter can be divided into several categories, in particular:

1. Psychopedagogical.
2. Technological.
3. Legal monitoring.

The first category primarily implies the lack of direct contact between teachers and students, which is what the opponents of remote learning have first and foremost drawn attention to. Contact work is considered the

mainstream of learning, and a great deal of experience has been passed down through this method from generation to generation. Another psychological and pedagogical disadvantage of online education, which has not been rightly ignored by the public, is the absence (or at least a drastic reduction) of direct interaction between students during learning. Student interaction forms the educational and motivational environment on which teachers and professors rely for their work [18-20]. For many areas of learning and professional development, having such an environment is a prerequisite for the fruitful learning process. Finally, a serious psychological and pedagogical disadvantage of online learning is the problem of tracking learning progress and outcomes [21]. It is also extremely difficult to implement corrective measures on the part of the teacher and the instructor in an online learning system.

Technical disadvantages of online learning include, for example, the dependence of this kind of learning on the availability (or lack) of broadband Internet access and the availability (or lack) of expensive technical learning tools. In addition, most teachers have a low level of methodological and technical background in terms of preparation for creating online courses. While the first problem can be predicted to be solved relatively soon (due to the natural development of technology and its increasing spread over different locations), the second problem seems to be more serious and profound. It may require special training for teachers through professional development mechanisms.

It should also be noted that, at present, the legal regulation of educational activities has not kept pace with the changes taking place. The regulatory base necessary to control online learning is not yet fully formed: the rules for the development and implementation of regular education courses based on online courses have not been solved. In addition, educational institutions lack a full-fledged mechanism for recording students' attendance to online courses [22-25]. To summarise the above arguments, one should not overestimate the remote format of education and perceive it as a breakthrough and revolution. At the same time, this type of learning should not be ignored either. The phenomenon must be approached dialectically, focusing on the development of blended, mixed learning systems that combine traditional and e-learning. Mixed learning technology can provide a natural combination of the achievements of both the traditional education system and the technological breakthroughs of recent years.

**Training ICT professionals through remote learning**

The globalisation of today's economy requires highly skilled labour market experts who can perform complex tasks and adapt quickly to changing market requirements. There is a need to ensure that the quality of workers is constantly improving. Today's professionals must provide competitive services and be skilled in handling state-of-the-art technology. For this purpose, they should be well trained and maintain a high level of qualification throughout their professional life [26].

At the same time, with the rapid development of modern information technologies, it is difficult for a company to maintain competent and qualified IT specialists at any time if it doesn’t provide special additional training and retraining programs. In this regard, the situation in the labour market cannot be ignored, since it is the main customer and further place of employment for such specialists [27-29]. For instance, according to employment portals, certain requirements for web developers are relevant today. These include profound knowledge of HTML, CSS, JavaScript, JQuery, HTML, CSS, PostgreSQL, MySQL. Basic knowledge of server-side programming languages, cross-browser layout skills, and experience with version control systems are also required. In addition, certification from professional centres (Microsoft, Oracle, Brainbench, etc.) is important to get the best jobs. Certification is important for IT specialists as it facilitates their professional development and is one of the factors of successful employment. The following technologies and development languages are in the highest demand on the Russian labour market today: HTML / CSS, JavaScript, JQuery, AJAX, PHP, MySQL. Other technologies include programming languages (C #, ASP.Net, Python, Perl, C ++, Objective-C, Java), JS libraries, CMS (Drupal, Wordpress, Joomla!) [30]. In the process of retraining and additional training of IT-specialists, it is also important to update the knowledge of programming fundamentals. In the course of obtaining the necessary education and advanced training, it is necessary to consider the fact that information technology is changing rapidly. Therefore, it is recommended to systematically monitor a variety of thematic information sources to identify new industry trends and determine the feasibility (or lack thereof) of adjusting individual retraining programmes. Therefore, in order to improve professionalism, IT professionals should constantly be aware of various new technologies, understand new ways of solving certain problems that may arise in their career path, and do their best to supplement their knowledge and skills to maintain their competitiveness.

This requires continuous professional development. The creation of a large number of electronic articles, books, manuals, e-learning, and methodology has undoubtedly increased the creative potential of experts, provided they can creatively use the obtained information. An important provision of independent work is the use of remote technology, which can maximise the understanding of materials by the consumer, and engage new ways of perceiving the human brain for the learning process, including emotional memory [31]. The use of remote technology, supported by the information resources of the global electronic information Internet network, firstly, provides an acceptable speed of updating knowledge [32-34]. It makes it possible to considerably increase the possibilities of self-learning and to eliminate all geographical and administrative boundaries. These technologies help to ensure that experts from different countries and regions have equal access to quality training.

As mentioned above, there is a big difference between distance and traditional learning. Subsequently, one can foresee a situation in which it will not compete with traditional learning but exist in symbiosis, interaction, complementing the possibility of self-learning with its information tools. Distinguishing features of distance learning in this professional field are:

1. The ability to rapidly spread existing best practices using information technologies.

2. The possibility of organising inter-regional and international cooperation and filling the information space through distance courses to give everyone rapid access to information resources.

3. The capacity of creating a virtual university with access to libraries and institutional networks.

4. The prospect of realising the principle of individual learning methods, in the course of which it is possible to provide remote learning courses to students at a convenient time, place, and high speed.

5. Acquiring the possibility of conducting several self-learning courses and the simultaneous use of sources of training information.

Therefore, using this type of learning, those who do not have the opportunity to acquire new knowledge traditionally can receive specialised education in a remote format [35]. The main representatives of the target audience of distance learning in this field are IT professionals who need to demonstrate a desire for knowledge, organisation, and the ability to work independently and autonomously [36-38].

It should also be noted that with distance learning, the ability to provide educational services to a large number of people at minimal cost is guaranteed by the efficient use of technological tools. The use of online learning makes it much easier to organise the independent work of professionals who are upgrading their qualifications. Sure, the distance learning courses have taken over important everyday tasks of developing new educational materials, testing, and assessing knowledge. The main advantages of using remote learning courses to organise self-study for IT professionals include the ability to quickly update and modify training materials, to dynamically enrich their content in line with the latest trends in the industry under consideration in this study, the ability to interact with colleagues without regard to spatial and temporal barriers, which, compared to offline retraining, saves costs. To enhance their qualifications or to validate existing and necessary knowledge for employment, today's professionals can also use, for example, currently popular certification schemes [39]. Based on this, IT professionals can obtain the modern opportunities demanded by the labour market, which are welcomed by employers and enhance their professional potential. Certified specialists usually have a higher level of knowledge, which is confirmed by international standards and increases their competitiveness in the market and promising salary levels from employers. Professional certification allows IT professionals to be trained and have their skills formally recognised in the latest information and communication technologies (ICT) [40].

For many years, software, hardware, networking, and telecommunications equipment companies (Microsoft, Google, Hewlett-Packard, Cisco, Oracle, IBM, etc.) have been leaders in this certification provision. Back in 1989, Novell launched its first Certified Novell Engineer (CNE) certification program. IT Engineer Certificate is a document that certifies the level of specialist's skills in a particular programming area. The content of the certificate includes the applicant's name, first name, middle name, date of delivery, professional name, signature, and seal of the certification body. The certification itself is based on procedures such as IBM Certified Solution Advisor-Cloud Computing Architecture V2 or Oracle9iAS Web Administrator Certified Associate. The certification program designed by the software manufacturer, vendor, or organisation consists of the list of courses and tests that need to be taken in order to be certified to a certain skill level. In addition, one or more certification exams must be taken, mostly in the form of a test. In e-testing, entrants usually have to pass laboratory examinations that assess the level of professional competence. The certification program usually bears the name of the profession obtained. For example, the MCAD (Microsoft Certified Application Developer) certification confirms that IT professionals have the knowledge, skills, and abilities to develop and maintain software components, web clients, workstations, and data processing tools using Microsoft technologies.

Thus, there is an enormous need for continuous development and improvement of knowledge and skills throughout the career of an IT professional. Nowadays, the implementation of self-learning programmes in a remote format and also professional certification allows future ICT experts to develop skills and knowledge, to acquire new ones, thereby gaining perspective, high-paying jobs, and developing in this area.

## Conclusions

The present study analysed the experience of both Atlantic (i.e. Western European and American) and domestic, Russian educational systems concerning innovations in the process of students' knowledge acquisition, in particular, such innovations include partial or full transition to the remote learning format and the growing popularity of online courses. The analysis of both advantages and disadvantages of online learning proposed in this paper inevitably leads to the conclusion that the most reasonable and effective tactic in information and communication technology training is to stick to the "golden mean", i.e., to develop a learning format in which both traditional teaching methods and more modern, distance-electronic ones harmoniously combine and complement each other. It is this format, on the one hand, that will allow the learner to be as flexible as possible and able to grasp emerging current trends and tendencies in the ICT industry; on the other hand, a partial adherence to the old, time-tested teaching methods will allow a certain discipline to be maintained, which, when moving to a completely remote type of learning, tends to break and decompose.

The material in this study will be of interest, firstly, to professionals whose work is directly related to working in the IT field and, secondly, to a wide range of readers who are interested in the field of information and communication technologies and the prospects for building a career in it.

It cannot be overlooked that during the implementation of the research work, several problems have been identified, the consideration of which would be a very important direction for further researchers. For example, given the needs of a dynamic and continuously changing IT market, software development and its implementation, a likely prospect for further research in this area is the development of specific areas of vocational training and retraining, and the development of professional skills in the field of information technology.

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**Conflict of Interest**
None.

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# Технологія відкритих онлайн-курсів у професійному навчанні ІКТ

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**Анотація**

**Актуальність.** В умовах безперервного соціально-економічного розвитку та збільшення обсягів знань у всіх сферах життя суспільства перед системою професійно-технічної освіти постають нові виклики. Майбутнім працівникам сфери інформаційно-комунікаційних технологій (ІКТ) важливо підтримувати свою конкурентоспроможність на ринку праці. Шукачі роботи в цій галузі потребують не лише технічних знань і навичок, але й здатності адаптуватися до мінливих умов. Самозайнятість нині є дуже актуальною формою навчання, яка дозволяє досягти вищезазначених якостей. З огляду на рівень розвитку технологій та об'єктивні виклики, що постали перед людством (наприклад, пандемія коронавірусу), самозайнятість у цій сфері майже автоматично передбачає набуття професійних навичок у віддаленому форматі.

**Мета.** З впровадженням сучасних інструментів у вищу професійну освіту необхідний детальний аналіз різних аспектів цього процесу, щоб визначити основні тенденції, наявні в рамках онлайн-курсів з ІКТ, та оцінити перспективи їх використання.

**Методологія.** У цьому дослідженні поряд із загальнонауковими методами дослідження було застосовано низку специфічних методів, зокрема контент-аналіз, методи індукції та дедукції, а також системний підхід.

**Результати.** У дослідженні проаналізовано основні характеристики формату дистанційного навчання, його місце в сучасному педагогічному дискурсі, а також різні напрями набуття професійних навичок у сфері ІКТ, які відбуваються у дистанційному форматі. Також будуть розглянуті способи, за допомогою яких фахівці можуть перевірити набуті навички.

**Висновки.** Інформація, викладена в статті, може бути використана як довідкова, додаткова інформація для майбутніх ІКТ-спеціалістів, а також для широкого кола читачів, які цікавляться темою інформаційних технологій.

**Ключові слова:** дистанційне навчання; інформаційні технології; онлайн-курси; педагогіка; відеозв'язок; ІКТ.