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## **DIDACTIC POSSIBILITIES OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE PROCESS OF DEVELOPMENT OF EDUCATIONAL ENVIRONMENT IN UPPER SECONDARY SCHOOL**

**Abstract.** The technological development of the educational process facilitates free access to modern ICTs and interactive learning technologies. Among the pedagogical technologies, information and communication technologies have a significant potential for the educational process. Currently, pedagogical technologies used at school should be combined with ICT to target the actual system of techniques and facilities of organizing educational activities in order to achieve educational purposes. Objectives of the study: to characterize the technological development of the educational process in upper secondary school in terms of a new stage in the development of the theory of education and training; to ponder over the development of the educational environment in terms of the didactic potential of pedagogical technologies and ICT; to analyze the empirical data of upper secondary school students' surveys and determine if ICT has become a tool to acquire knowledge.

**Keywords:** upper secondary school; educational environment; information and communication technologies (ICT); didactic possibilities of ICT.

### **1. INTRODUCTION**

**The problem setting.** Information and communication technologies have become an instrument in almost all spheres of human activity. Informatization of social relations affects the life priorities, individual aims and value orientations of each person and it appears as a response to the challenges of the present. This situation encourages each of us to explore unlimited possibilities of ICT and develop skills in working with computer technology. On the other hand, it forces to integrate “voluntarily” our consciousness into information and telecommunication systems. How is it possible for future graduate of general educational institution not to get lost in such a world, how to obtain the benefit (for example, material or creative and intellectual) from existing in educational area-environment? Internet applications, multimedia, “web cases” and many other benefits of modern civilization not only promote the modernization and development of the global educational environment, but also dictate their conditions, requirements, formats, laws.

**The analysis of recent studies and publications.** In our research we rely on a number of scientific achievements and practical results. We take into consideration achievements in pedagogy and philosophy in university studies (V. Andrushchenko, I. Bekh, I. Voloshchuk, V. Kremen, V. Lugovyi and others); research on the role and importance of technologies in the context of European integration (M. Artiushyna, V. Bazeliuk, P. Lushyn, O. Slisarenko, L. Snitsar, V. Solodkov, L. Pukhovska and others); theoretical generalization and practical developments regarding the usage of computer teaching aids (V. Bykov, V. Volynskiy, R. Hurevich, A. Hurzhii, Yu. Zhuk, S. Litvinova, O. Pinchuk and others); generalizations and recommendations concerning solution of problems with the application of information technologies (M. Zhaldak, Yu. Mashbyts, N. Morze and others). We consider as an important tool for the development of the global educational environment: world trends in the formation of informational educational environment in the process of modernization of secondary education (V. Bykov, O. Grytsenchuk, S. Ivanova, G. Lavrentieva, I. Malyska, O. Ovcharuk, D. Rozhdestvenska, N. Soroko, O. Konevshchynska); tools of information and communication technologies of a single information environment of the education system of Ukraine (V. Lapinskyi, A. Pylypchuk, M. Shyshkina and others); educational environment for the training of future teachers by means of ICT (R. Hurevych, G. Hordiichuk, L. Konoshevskiy, O. Shestopal); theoretical and methodological principles of the development of the information and educational environment of the university (L. Panchenko and others).

**The purpose of the article** is to illustrate the didactic possibilities of using ICT in the development of the educational environment of the upper secondary school.

## 2. METHODOLOGY OF RESEARCH

With the purpose of research and description of the didactic capabilities of information and communication technologies in developing the educational environment of the upper secondary school, we used analysis of scientific publications, system analysis and generalization, our own didactic and methodological developments, materials of experimental research based on our observations, questionnaires and interviewing upper secondary school students.

## 3. RESULTS OF RESEARCH

### 3.1. The urgency of the problem: upper secondary school and the “three-subject didactics”

The learning process that takes place in upper secondary school can no longer be imagined without both students and teachers having to master various information and communication technology (ICT) products. The technology-intensive learning and education implies not only the availability or immediate accessibility of modern interactive technologies, but also the existence of the corresponding technical and technological infrastructure at school, as well as possession by upper secondary school students and teachers of various gadgets with a broad range of software and web applications whose potential communication capabilities can go beyond boldest expectations. The technology-oriented learning and education processes are also characterized by the presence effect, as well as a temporary (one-time) or suspend-and-resume (repeated at arbitrary intervals) transaction mode. The school loses its monopoly as to the performance of the learning

process. This actualizes the demonopolization of subject-to-subject interaction. Subject-based academic areas become outdated, whereas the content of the corresponding school subjects requires a dramatic revision. Existing methods lag behind the reality of today's educational environment and thus need to be reformed in line with the opportunities provided by ICT. Didactic science has yet to study in detail the way the modern ICT tools influence the teaching technologies involved in the provision of upper secondary school education. It was no surprise that Ukrainian researchers characterized the brand new stage in the development of the theory of education and learning by calling it the three-subject didactics: "Today it is reasonable to refer to the three-subject didactics as one of the branches of education science that studies the most common patterns, principles and methods of learning institution that ensures conscious and lasting assimilation of knowledgebase, skills and useful habits in the context of an equitable relationship between students and teachers, and within the information- and communication-driven pedagogic environment" [1, p. 35].

Indeed, the level of dexterity with ICT media (tools) and their availability for personal use all change the educational environment at school.

The new three-subject mental objects of the value-oriented and semantic space within the educational environment of upper secondary school come and go, transform, concentrate and disperse. How is it possible under these circumstances to "tame" ICT and use them without further concern in practical learning and education? What can be done to intertwine the acquired (and those that are to be acquired) ICT skills with the general educational policies? How is it possible to ensure that both ICT and ICT tools act as "beneficial" intermediaries in the acquisition and passage of knowledge to the young generation?

An online article titled *Information and Communication Technology (ICT) and Education* argues that the demands of the modern society promise a unique opportunity for the education system; traditional education intends to help accumulate and recall information from certain domains of knowledge, however, today it has to rise up to the challenge related to the training of young people for integration and successful social and economic life. Knowledge transforms into new ideas and human life activities, while new technologies become the tools that can be used to improve most education areas; information and communication technologies have an exceptional context for future education [2].

The researcher C. Buabeng-Andoh in his review of publications related to ICT problems [3] focuses on the computer skills of teachers and students, which he defines as the ability to manage a wide range of computer applications serving different purposes. However, most teachers express neutral, if not negative, attitude towards the integration of ICT into teaching and learning as they lack corresponding knowledge and skills [3, p. 139], therefore, skill improvement plays a key role in the successful integration of computers into classrooms [3, p. 142]. Based on the results of his analysis, C. Buabeng-Andoh concludes that the efficient integration of technology into practical class work poses a greater problem for teachers than the actual connection of computers to the network; to successfully integrate ICT into education, it is important to optimize personal, institutional and technological factors [3, p. 147].

Our attention was attracted by the publication "Factors Influencing the Use of Information and Communication Technology (ICT) in Teaching and Learning Computer Studies in Ohaukwu Local Government Area of Ebonyi State-Nigeria" by I. S. Agbo. The author states: research studies in the past years show that ICT is an effective means for boasting educational opportunities, but most teachers neither use this technology as an instructional delivery system nor integrate technology into their curriculum [4, p. 71]; effectively integrating ICT into learning systems is much more complicated than providing computers and securing a connection to the Internet [4, p. 72]; personal characteristics of teachers are an important influence on how easily they take up an innovation [4, p. 74].

According to the results of our research, some conclusions have been drawn regarding the efficiency of usage of computer technology in learning processes and self-study. Inadequate provision of educational institutions with computer equipment, lack of appropriate curricula affects the organization of the process of study. At the same time, didactic tasks, which can be solved with the help of computer technologies, remain poorly researched. First of all, it concerns the professional activity of teachers. It is no accident that the team of young researchers at Southern Utah University, Cedar City, Utah, USA, & Hokkaido University of Education, Asahikawa, Japan, studying the impact of the ICT environment and Technology Integration in Japan and the U.S., states that “the utilization of technology in the elementary classroom is becoming increasingly vital in a global society” [5, p. 29]. But these researchers point out: “businesses around the world have embraced technology, yet many schools preparing the workforce of the future are not making the same strides” [5, p. 31]. K. Wilson and K. Boateng stress: “the idea of integrating ICT into teaching and learning creates a concern between pedagogy and technology. To master ICT skills is not the only concern, but using the acquired skills to improve teaching and learning is of major concern. The infusion of ICT in pedagogy should be such that it tends to enhance learning through a new learner-centered culture. It also fosters enquiry and exploration, promotes collaboration, motivates and engages learners. The use of ICTs does not only allow the move from reproductive model of teaching and learning to an independent, autonomous learning model that promotes initiation, creativity and critical thinking with independent research. Teachers are required to use technology in lesson delivery, it is important that technology become part of their training. There is the need to examine the relation between techniques, knowledge and set of instructors' skills which is related to the application of ICT use in the classroom” [6, p. 97].

The proficiency in ICT, sufficiently professional use of these technologies will help the teacher to keep the “reality of a lesson” under control, so that he/she (the teacher) will not be left beyond “here and now”, but will be integrated in the interactive processes of the subject-subject and three-subject interaction. Under such conditions, ICT become assistants-mediators in the transfer of important professional information to students, forming key groups of competencies of upper secondary school students as future specialists.

### **3.2. Education environment, pedagogic technologies and the didactic potential of ICT**

In this and other publications, we can offer only partial solutions for the problem under consideration. However, we are positive that the upper secondary school learning environment, the pedagogic technologies used to deliver the primary goals of education and the didactic potential of ICT must all be in line with each other. This is as much obvious, as the fact that there should be coherence between the individualization and differentiation of learning [7], [8], the issues of the fundamentalization of knowledge and the building of knowledgebase [9], the common denominator of the invariable and variable components of syllabus [10], the approaches and concepts of the realization of profession-oriented learning [11], [12]. The educational environment, pedagogic technologies and the didactic potential of ICT should also be explored in the context of such disciplines as psychology, sociology, philosophy, etc.

As R. Holland states, “human self-reflection determines personal existence and serves as a basis for people to evolve as social units” [13, p. 480]. Therefore, environment is a complex of phenomena that synergistically influence humans and to a great extent determine their development.

We define educational environment as accumulation of biological, psychological, social and cultural factors that through their interaction determine the living space of upper

secondary students and carry a certain informational charge that registers as knowledge. Nowadays, the pedagogic technologies used at school must be reoriented at an intensive use of ICT in order to direct the existing system of techniques and means for organizing learning activities at achieving the defined educational goals and reaching the ultimate outcome. In general, any educational outcome must be filled with axiological sense that generates positive, creative self-development and ensures self-identity and self-actualization.

The educational environment of any scholastic institution that has ICT at the bottom of its operation requires novel technical training aids. Today it is a vital problem and a need that, once fulfilled, will allow implementing the full extent of the key competency groups (components) detailed in the Concept of the New Ukrainian School [14]. This will result in acquiring primary learning skills, as well as teachers building and improving their professional expertise. It is pointed out in the online article *Use of Information and Communications Technology (ICT) in Education* that modern advances in the field of information and communication technologies provide ample opportunities for improving the quality of education; interactive educational software, open-access electronic libraries and technologies of interactive learning can initiate new forms of interaction between students and teachers. Education can be enriched through the integration of such technologies into traditional educational forms and methods; ICT possess the potential for advancing the learning and education process and facilitating communication in the educational environment, however they must be put into practice by highly qualified professionals with an experience in pedagogy and education [15]. Researcher H. E. Al Harbi writes: “with the advent of ICT, many countries have incorporated more technological tools in their educational system. Some research has suggested that using ICT in instruction enables students to take a more active role in their learning rather than their more traditional role of passive observer and listener. However, other research shows that changes in classroom practices will not occur simply because ICT is more available in the classroom unless it is used effectively” [16, p. 33]. And further she states: “there are a number of significant aspects required for effective implementation of ICT in the classroom. These aspects include: (1) avoiding techno-centric thinking, (2) starting with the identification of educational problems, and (3) promoting constructivist learning environments” [16, p. 34]. One of the H. E. Al Harbi conclusions is: “effective ICT implementation promotes constructivist learning environments where students engage with ICT to facilitate creative and critical thinking involving real world learning. In summary, avoiding techno-centric thinking, starting with identification of educational problems, and considering constructivist learning, are the most important aspects of the effective use of ICT in education” [16, p. 36].

Scientists and teachers believe that among the pedagogical technologies it is information and communication technologies that have a significant potential for providing educational activities and their self-assessments that are close to adequate. Here lie specifics and the phenomenon. And if we talk about the formation of skills for independent learning, then ICT will accompany people in this process throughout their lives. Without a competent approach to implementing the ICT in educational process, without creating the information literacy algorithms it is difficult to support the development of European integration processes. In the Internet resource “Infinite Connections: Education and new technologies” (2014) we read: “information and Communication Technology (ICT) has developed rapidly over the past 40 years. ICT has influenced almost all aspects of our lives and has changed the way we communicate, work and socialize” [17, p. 1]; “ICTs have undeniably changed many aspects of our lives. One key question for education policy makers is whether they have also changed the way we learn” [17, p. 5]; “although the presence of ICT cannot be equated with increased learning gains, it has the potential to open a window of opportunity for doing things differently in education” [17, p. 8]; “new technologies have transformed many aspects of our

lives and present a number of new opportunities and challenges for education <...> have the potential to expand educational access and choice and make learning more participatory and individualised” [17, p. 9].

Researchers [18, p. 11–12] argue that the use of ICT plays an important role in building the knowledgebase needed to construct a tenable explanation of the cause-and-effect relations between processes and phenomena, to learn the laws of objective reality, to carry out applied research, day-to-day practical work and cognitive activities. In the authors’ opinion [19], the relevance of the research in the field of ICT arises from “the state of modern education as a social institute that secures a young person’s professional success and his/her competitive edge in the labor market; a significant expansion of the forms of open education, ICT is characterized by the introduction and use of the Internet, which determines the application of productive methods for working with scientific, learning and guidance aids; the realization of the concept of humanistic education <...>. Today every university is facing a difficult, multi-factored task of arranging and developing a new information-oriented educational environment aligned with the demands of the social perspective. <...> The way to achieve these goals and solve the problem of providing informational support of education is the system integration of ICT into different domains of education [19, p. 4–7]. Speaking about previous ideas, we can talk about the building of a common information environment where “the goals of building the information support system, and thus the common information environment, lie in the improved efficiency of the processes (activities) that take place within the system” [20, p. 35].

### 3.3. Information sources, ICT competencies and the didactic strategy

Based on the analysis of the scientific literature we conducted pedagogical experiments (observations, surveys, questionnaires and interviews) with upper secondary students, and identified the sources from which they extract vital knowledge. Relying on the opinion of the O. Savchenko that “a person exists, develops and takes shape in close cooperation with the environment and other people” [21, p. 130], we have concluded that the environmental approach to the building of knowledge in upper secondary school students cannot be efficiently realized without taking into account the opportunities offered by ICT. We consider the ICT-based environmental approach as a factor of self-reflection that “is not just an ad-hoc product of activity, brainwork or communication, but also one of the conditions for the self-organization of a person who develops through fathoming the sense and value of objects existing within that person’s multidimensional world, through discovering in them his/her self, true needs and abilities, and the underlying behavioral motives” [22, p. 40].

Online communication (social networks, such as Facebook, Twitter, Vkontakte, etc.) is getting more popular and accessible. However, such communication demands an increasingly more intensive use of technology and, consequently, requires ICT skills. Having polled 1,003 school-leavers (2016, general educational institutions of urban and rural areas), we have discovered the purposes for which they use the World Wide Web resources (Table 1).

*Table 1*

#### Purposes of using the Internet

Variants of answers	Frequency	% of those who replied
Communication in different networks	742	74.00
Search for educational information	726	72.38
Recreation (relaxation) (music, films, shows)	661	66.14

Search for information by preferences (cooking, cars, sports, paintings, etc.)	612	61.02
Information about various novelties, getting the current information	555	54.84
Skype dialogues	422	44.07
E-mail usage	410	40.88
Reading anecdotes, humorous stories	333	33.20
Search for the information you need to perform future professional responsibilities	312	31.11
Surfing the Internet (purposeless content analysis)	245	24.43
Replenishing your electronic library with books	224	22.33
Search for information about products / services	224	22.33
Search for new computer games or entertainment	209	20.84
I play computer games online	193	19.24
Monitoring of vacancies for the purpose of employment (temporary earnings)	177	17.65
Online shopping	158	15.75
Visiting sites of public authorities	125	12.46
Search for like-minded people, partners to implement new ideas, projects and initiatives	103	10.27
Participation in forums, conferences	99	9.87
Search for information on sex topics, erotica	95	9.46
Blogging, virtual diaries, own site	53	5.28
Creating sites to order, distributing ads etc	44	4.38

Of course, the benefits of the Internet are obvious: the ability to find quickly the required information from any site of the world, read the necessary literature, and chat with peers on different topics.

Finding out the sources from which upper secondary school students are learning, we have identified the main components that determine their educational activities (432 upper secondary school students were interviewed (2017) (Table 2).

*Table 2*

#### **Sources of information used by upper secondary school students to get knowledge**

<b>Sources of information</b>	<b>Frequency</b>	<b>In %</b>
Books, media (television, radio, press)	321	74.31
Parents	248	57.41
Internet	221	51.16
Classwork	185	42.82
Friends	169	39.12
Affinity groups	40	9.26
The world around me	8	1.85

The last position in Table 2 is occupied by “The world around me” with 1.85%. The option “Affinity groups” turned out to have lesser importance as well – 9.26%. This indicates that upper secondary school students are not taught to derive knowledge from everything that surrounds them in day-to-day life, and affinity groups are losing their traditional importance. On the other hand, we cannot say that ICT have become the priority tools for the upper secondary school students to acquire knowledge.

As V. Bykov points out, “the special aspects of the current stage of scientific and technical progress emphasize and actualize the issues concerning the advance of information-oriented education; they bring forward the problems of achieving a high level of students’, teachers’ and population’s ICT competency – the citizens of the information society; they place focus on the need for learning, in particular learning through information processing, throughout one’s entire life” [23, p. 32].

This constitutes both the necessary condition and a demand, as the upper secondary school students, feeling more confident in cyber space, are more capable of mastering ICT where it comes to information processing and interpretation, as well as of using the corresponding devices in a more professional way. Therefore, this facilitates brand new kinds of relations between colleague teachers, between teachers and upper secondary school students, and between upper secondary school students themselves. In the setting of such educational environment at school, the subject-to-subject relation goes beyond the traditional didactic notions and assumes the undeniable signs of belonging to three subjects. This spurs all parties to the educational process to work together towards learning other (different, new) forms of the realization of learning and education process and to subordinate them to the common dream. When it comes to a teacher’s individual pedagogic performance, it is necessary to take into consideration their individual psychological reactions to ICT and the associated tools. In other words, as A. Franzoni and S. Assar point out, this is about a didactic strategy of teaching in the form of an organized and systematized sequence of actions and consumption of resources used by teachers in the course of training whose primary goal consists in making studying easier for students [24].

We carry the problems of motivating upper secondary school students to self-learning and improving the skills of teachers who work amidst the integration of ICT into the upper secondary school educational environment outside of this article and into our further didactic studies.

#### **4. CONCLUSION AND PROSPECTS FOR FURTHER RESEARCH**

Based on the analysis of literary sources, pedagogical practice and processed empirical data of the survey of upper secondary school students we described the didactic possibilities of using ICT in the process of developing the educational environment of the upper secondary school. The discussion covered such didactic problems: ICT and technologization of educational process in upper secondary school; integration of ICT in the technology of education and upbringing of upper secondary school students; the use of ICT in the formation of a system of knowledge of upper secondary school students and the integration of ICT into the practice of class work; influence of the ICT environment on the relations of teachers and students, on the process of integration of technologies in the system of the educational environment of the upper secondary school. The focus was made on ICT in Ukrainian education and the European integration vector of its development.

The controversial notion of “the new three-subject mental objects of the value-oriented and semantic space within the educational environment of upper secondary school” is used.

The fact that the upper secondary school at the present stage of its development loses a monopoly on the education of upper secondary school students, leads to problems, the solution of which is in the environment of modern educational technologies. The technological development of the educational process facilitates free access to modern ICT and interactive learning technologies. The level of ICT skills determines the educational process at upper secondary school. Among the pedagogical technologies, it is the information and communication technologies that have a significant potential for providing educational activities and self-assessments that are close to adequate. So, pedagogical technologies used at



school should be combined with ICT to target the actual system of techniques and facilities of organizing educational activities in order to achieve educational purposes.

Prospects for further research: identifying contradictions related to technocentric and critical thinking, and finding ways to solve them; motivation for self-education of students and improvement of the qualifications of teachers as a condition of integration of ICT into the system of educational environment of upper secondary school.

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## ДИДАКТИЧНІ МОЖЛИВОСТІ ВИКОРИСТАННЯ ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ У ПРОЦЕСІ РОЗВИТКУ ОСВІТНЬОГО СЕРЕДОВИЩА СТАРШОЇ ШКОЛИ

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**Анотація.** Технологізація навчально-виховного процесу сприяє вільному доступу до сучасних ІКТ і технологій інтерактивного навчання. Серед педагогічних технологій саме інформаційно-комунікаційні технології мають значний потенціал для забезпечення освітнього процесу. Нині педагогічні технології, що використовуються у школі, мають поєднуватися з ІКТ, щоб цілеспрямувати фактичну систему прийомів і засобів організації навчальної діяльності на досягнення освітніх цілей. Завдання дослідження: схарактеризувати технологізацію навчально-виховного процесу у старшій школі з погляду нового етапу у розвитку теорії освіти і навчання; обміркувати розвиток навчального середовища на основі дидактичного потенціалу педагогічних та ІКТ технологій; проаналізувати емпіричні дані опитувань старшокласників, виявити, чи стали ІКТ інструментом здобуття учнями знань.

**Ключові слова:** старша школа; освітнє середовище; інформаційно-комунікаційні технології (ІКТ); дидактичні можливості ІКТ.

## ДИДАКТИЧЕСКИЕ ВОЗМОЖНОСТИ ИСПОЛЬЗОВАНИЯ ИНФОРМАЦИОННО-КОММУНИКАЦИОННЫХ ТЕХНОЛОГИЙ В ПРОЦЕССЕ РАЗВИТИЯ ОБРАЗОВАТЕЛЬНОЙ СРЕДЫ СТАРШЕЙ ШКОЛЫ

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**Аннотация.** Технологизация учебно-воспитательного процесса оказывает содействие свободному доступу к современным ИКТ и технологиям интерактивного обучения. Среди педагогических технологий именно информационно-коммуникационные содержат значительный потенциал для обеспечения образовательного процесса. Ныне ИКТ и педагогические технологии, используемые в школе, должны интегрироваться для того, чтобы фактическая система приемов и средств организации учебной деятельности максимально соответствовала образовательным целям. Цели исследования: охарактеризовать технологизацию учебно-воспитательного процесса в старшей школе с точки зрения нового этапа в развитии теории образования и обучения; осмыслить развитие учебной среды на основе дидактического потенциала педагогических и ИКТ технологий; проанализировать эмпирические данные опросов старшеклассников, выявить, стали ИКТ инструментом получения учащимися знаний.

**Ключевые слова:** старшая школа; образовательная среда; информационно-коммуникационные технологии (ИКТ); дидактические возможности ИКТ.

