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ЗМІНИ В ТЕНДЕНЦІЯХ ВИКОРИСТАННЯ ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ЗАСОБІВ НАВЧАННЯ МАЙБУТНІХ ФАХІВЦІВ ПРОФЕСІЙНОЇ ТА ТЕХНОЛОГІЧНОЇ ОСВІТИ

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CHANGES IN THE TRENDS IN THE USE OF INFORMATION AND COMMUNICATION TOOLS FOR FUTURE PROFESSIONAL AND TECHNOLOGICAL EDUCATION SPECIALISTS

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АНОТАЦІЯ

Формулювання проблеми. Метою дослідження є обґрунтування її визначення динаміки змін у використанні інформаційно-комунікаційних засобів у процесі підготовки майбутніх фахівців професійної та технологічної освіти.

Матеріали і методи. Для дослідження використовували теоретичний аналіз, опитування (анкетування, бесіда), спостереження, систематизацію й аналіз даних, порівняння й узагальнення.

Результати. Подано аналіз опитування майбутніх фахівців професійної і технологічної освіти, проведених у 2016–2021 рр. у ТНПУ ім. В. Гнатюка. Незважаючи на високий і середній рівні оцінок зі шкільного курсу інформатики, до початку пандемії COVID-19 частина студентів оцінили власну готовність до використання комп'ютерної техніки як низьку, що пояснювалося прогалинами практичної підготовки, оновленням програмного забезпечення, епізодичним використанням цифрової техніки на уроках. Досліджено локації роботи студентів з комп'ютерною технікою у 2019/2020 н.р. (у домашніх умовах, у кабінетах і лабораторіях, у друзів, за місцем роботи батьків, в Інтернет клуббах, за місцем працевлаштування тощо). Пандемія COVID-19 призвела до масового запровадження дистанційного навчання, використання комп'ютерної техніки та програмного забезпечення на всіх заняттях, що сприяло підвищенню інформаційної компетентності учасників освітнього процесу.

Висновки. Аналізуючи дані дослідження можна стверджувати, що Пандемія COVID-19 призвела до стрімкого розвитку ІКТ. Домінуючими засобами забезпечення навчального процесу стали ноутбук (99,2 %) і мобільні засоби (98,4 %). Найбільш вживаним програмним забезпеченням – Microsoft Office, хмарні сервіси Google; онлайн платформами – Zoom, GoogleMeet, цифрові дошки Padlet; соціальні мережі – Viber, Telegram, WhatsApp; системи LMS (GoogleClass, Moodle). Подальшого дослідження потребують питання оптимізації завдань для студентів, дотримання санітарно-гігієнічних норм роботи з інформаційно-комунікаційними засобами.

ABSTRACT

Formulation of the problem. The aim of the study is to substantiate and determine the dynamics of changes in the use of information and communication tools in the process of training future specialists in vocational and technological education.

Materials and methods. The study used theoretical analysis, surveys (questionnaires, interviews), observations, systematization and analysis of data, comparisons and generalizations.

Results. The analysis of a survey of future specialists in vocational and technological education conducted in 2016–2021 at TNPU named V. Hnatiuk is presented. Despite the high and medium level of grades in the school computer science course, before the COVID-19 pandemic, some of the students rated their readiness to use computer technology as low, which was explained by gaps in practical training, software updates, and occasional use of digital technology in the classroom. The locations of students' work with computer equipment in 2019/2020 academic year (at home, in offices and laboratories, with friends, at the place of work of parents, in Internet clubs, at the place of employment, etc.) were studied. The COVID-19 pandemic has led to the prompted introduction of distance learning, the use of computer technology and software in all classes, which has helped to increase the IT skills of participants in the educational process.

Conclusions. Analysing the research data, it can be argued that the COVID-19 Pandemic has led to the rapid development of ICT in education. The dominant means of ensuring the educational process were laptops (99.2%) and mobile devices (98.4%). Most used software - Microsoft Office, Google cloud services; online platforms - Zoom, Google Meet, digital board Padlet; social networks - Viber, Telegram, WhatsApp; LMS systems (Google Class, Moodle). Further research is needed on the optimization of tasks for students, compliance with sanitary and hygienic standards of work with information and communication tools.

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КЛЮЧОВІ СЛОВА: професійна і технологічна освіта; цифрові технології; інформаційно-комунікаційні засоби; інформатична компетентність; здобувач вищої освіти.

KEYWORDS: vocational and technological education; digital technologies; information and communication means; information competence; higher education applicant.

INTRODUCTION

Formulation of the problem. The introduction of mixed and distance forms of training for higher education in the context of the COVID-19 pandemic actualizes the need to improve the information competence of all participants in the educational process. The use of modern information and communication technologies (ICT) in the process of training future specialists in vocational and technological education is based on knowledge and understanding of theoretical principles, the formation of the ability to solve problems using digital technology and software. This actualizes the problem of studying the use of information and communication tools in the educational process.

Analysis of current research. In scientific publications, various aspects of the use of ICT in the educational process are disclosed. In particular, models of organizational systems of open education are studied (Bykov, 2009); computer-oriented learning systems are analyzed (Zhaldak, 2010); the experience of organizing online learning in the educational institutions of Ukraine (Rudenko et al., 2021) is presented; considered Digital Competence in E-Governance Education (Morze & Makhachashvili, 2020); the advantages and contradictions of the use of ICT in the education system are identified (Foutsitzi & Caridakis, 2019); the effectiveness of ICT teaching students (Fernández-Gutiérrez et al., 2020) was studied.

In the works of scientists, actual aspects of the use of ICT in the process of training future specialists in vocational and technological education are disclosed: organizational and methodological principles in the training of educational engineers (Horbatyuk & Kabak, 2015), the peculiarities of the formation of professional competence of future labor training teachers (Gurzhi et al., 2015), the use of information and communication tools in the formation of professional competencies of future teachers and pedagogical engineers (Turanov & Rak, 2009), the use of computer modeling in the process of training a future technology teacher (Petrytsyn, 2017), the organization of independent educational activities of students of pedagogical specialties (Tsys, 2017), etc.

However, the issue of using modern information and communication hardware and software for the educational process for higher education requires further research.

The purpose of the article – substantiation and determination of the dynamics of changes in the use of information and communication tools in the process of training future specialists in vocational and technological education.

Objectives of the study: 1. To analyse the level of school computer training of students as a prerequisite for the use of digital technologies in the educational process of higher education. 2. Investigate the dynamics of the use of modern information and communication tools by higher education students.

RESEARCH METHODS

The study used theoretical analysis, surveys (questionnaires, interviews), observations, systematization and analysis of data, comparisons and generalizations.

RESULTS OF THE RESEARCH

The study was based on surveys of future professionals in vocational and technological education, conducted in 2016-2021 at Ternopil Volodymyr Hnatiuk National Pedagogical University.

Data from surveys of students of the Faculty of Engineering and Pedagogy (2019/2020 academic year) indicated that before entering the university, most of them had an average level of readiness to use ICT in the educational process (Fig. 1). In particular, 70.5% rated their own level of knowledge and skills as average, 19.7% - as high, and only a small proportion of respondents - as low. However, the analysis of school grades in the subject "Informatics" (Fig. 2) showed that 78.4% of the respondents had a high level of grades, all the rest (21.6%) - sufficient. This discrepancy between the data on low self-assessment of the level of information competence and high school grades in computer science can be explained by the existing appropriate theoretical training of students but some gaps in the practice of solving cognitive problems by digital technology. After all, the formation of skills in the use of ICT tools should take into account the constant improvement and updating of hardware and software.

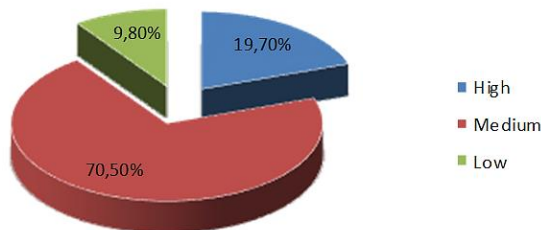


Fig. 1. Level of knowledge and skills of students in the use of ICT (before entering the university)

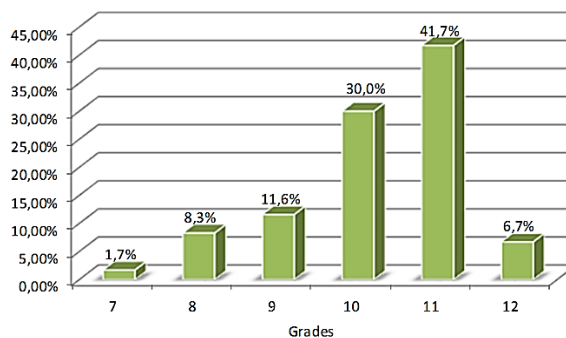


Fig. 2. School grades in computer science for higher education applicants

This statement is partly consistent with students' answers to questions about the use of computer technology by subject teachers (Fig. 3). It is clear that all computer science teachers used ICT in their lessons. In other subjects, the use of such technologies was sporadic and was explained by the inadequate provision of classrooms with modern technology and, in part,

the unwillingness of teachers to organize education based on digital technologies. A slightly higher percentage of lessons using ICT was observed in the process of studying physics (13%) and a foreign language (10%).

The COVID-19 pandemic led to the mass introduction in 2020 of distance and blended learning, based on the organization of the learning process using digital technologies, including online learning platforms (Zoom, GoogleMeet, BigBlueButton, digital board Padlet, etc.), social networks (Viber, Telegram, WhatsApp), LMS systems (GoogleClass, Moodle). Accordingly, the use of computer technology in the process of organizing and conducting classes has rapidly increased (in conditions of distance learning, up to 100%). This actualized the formation of the information culture of the participants in the educational process, however, it also led to the emergence of a number of problems that indicated the need for:

- updating the logistics and software of educational institutions;
- providing students with their own modern computer equipment and gadgets;
- use of modern mobile devices and related software applications;
- modernization of computer networks and Internet coverage;
- increasing the level of digital training of teachers;
- development of a methodology for using platforms, software and digital technology;
- reduction of digital overload of participants of educational process;
- ensuring the proper quality of education.

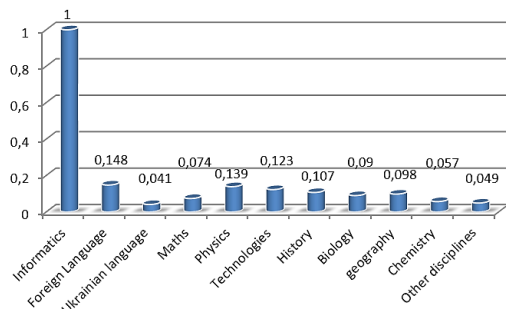


Fig. 3. Use of digital technology in school lessons

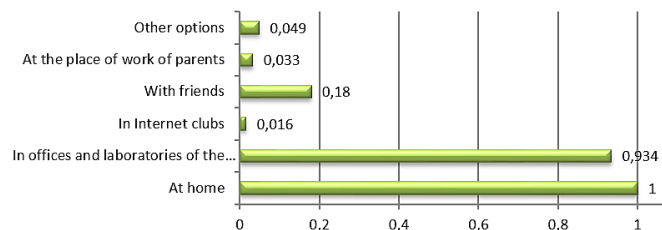


Fig. 4. Locations of students' work with computer equipment

During 2020–2021 these problematic aspects have been largely solved thanks to separate state programs and grants aimed at modernizing logistics, conducting seminars and webinars, workshops and master classes, trainings, refresher courses for teachers focused on improving information and methodological competence of specialists in the education.

Taking this into account, in the process of interviewing students, the location of work with computer equipment was considered important. Thus, at the beginning of 2019/2020 academic year, all respondents performed tasks using computers at home, in addition, 93.4% of respondents performed tasks in offices and laboratories of the university, 18% - worked with friends, 3.3% - at the place of work of parents, 1.6% - in Internet clubs (Fig. 4). Some research data on this issue for the previous 2008-2014 are given in the paper (Morze & Makhachashvili, 2020).

The situation has changed significantly since 2020. In fact, all students organize the educational process at home or, if the epidemiological situation allows, within the educational institution. In addition, the share of students (87.5%) who study remotely and communicate with teachers on the Internet, while in public places or at the place of employment, has significantly increased.

The development of ICT has also led to an increase in the number of modern technical means owned by higher education applicants and teachers. Comparative data for the study period are presented in Table 1 and the diagram in Fig. 5.

Types of information and communication tools available to higher education applicants

Table 1

№ n/n	Type of tool	Survey data					
		2016/2017		2019/2020		2020/2021	
		quantity	%	quantity	%	quantity	%
1	Computer	108	81,8	76	62,3	72	58,1
2	Laptop	104	78,8	120	98,4	123	99,2
3	Tablet	20	15,2	24	19,7	15	12,1
4	Mobile device	100	75,8	106	86,9	122	98,4
5	Modern TV	0	0,0	18	14,8	24	19,4

Until recently, the main information and communication tool used by students to complete educational tasks was a personal computer, according to surveys, there was a gradual decrease in their number (from 81.8% in 2017 to 58.1% in 2021). After a short-lived increase in the popularity of their personal tablet and, accordingly, an increase in the percentage of their use (from 15.2% in 2017 to 19.7% in 2020), the 2021 survey indicated a further refusal of students to use such a tool. Only 12.1% of higher education applicants today own a tablet.

The 2016-2021 studies showed a growing interest in laptops, mobile devices and TVs with smart features, due to their mobility and high technical characteristics, ergonomic interface. Despite the fact that a significant proportion of students have several means of communication at the same time, today laptops (99.2%) and mobile devices (98.4%) are dominant.

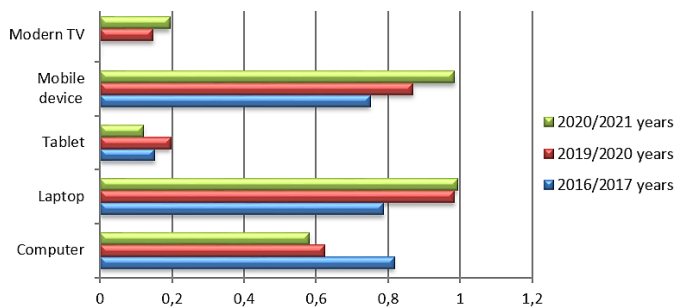


Fig. 5. Use of own information and communication means by higher education applicants

The presence of several means of communication also led to an increase in the number of software tools that students used in the educational process and in everyday life in general. Table 2 summarizes the data of surveys of higher education students on the use of certain software tools conducted in different years.

Table 2

Software tools most often used by students

№ п/п	Software tools	Survey data					
		2007/2008		2011/2012		2019/2020	
		quantity	%	quantity	%	quantity	%
1.	Microsoft Word	65	89,1	144	100,0	122	100,0
2.	Publisher	2	2,7	9	6,3	8	6,6
3.	Adobe Photoshop	3	4,1	66	45,8	81	66,4
4.	Microsoft Excel	20	27,4	33	22,9	52	42,6
5.	Solid Works	1	1,4	54	37,5	12	9,8
6.	CorelDraw	3	4,1	15	10,4	8	6,6
7.	Power Point	6	8,2	84	58,3	86	70,5
8.	AutoCAD	1	1,4	45	31,3	12	9,8
9.	Kompas-3D	5	6,9	15	10,4	32	26,2
10.	MatLab	0	0,0	0	0,0	4	3,3

Figure 6 visualizes the results of these surveys. During 2007–2020, there was a positive trend in the use of this software. In particular, the use of the Microsoft Word tool for performing and describing tasks reached 100% level even before 2011-2012.

By 2020, the use of PowerPoint software has increased to 70.5%, Adobe Photoshop - to 66.4%, Kompas 3D - to 26.2%. In our opinion, a relatively small percentage of students who used Compass 3D had an explanation. The Kompas 3D program was used by all students during the study courses (Drawing Geometry, Drawings and Computer Graphics, Computer Graphics and Multimedia, Engineering Graphics), but in the following years the need for this software significantly decreased due to the change in the nature of cognitive tasks. In addition, students also used other graphic editors (Adobe Photoshop, 3dMax, CorelDraw, etc.) to make drawings, models and images. A significant decrease in the popularity of Solid Works and AutoCAD software among students is explained in a similar way.

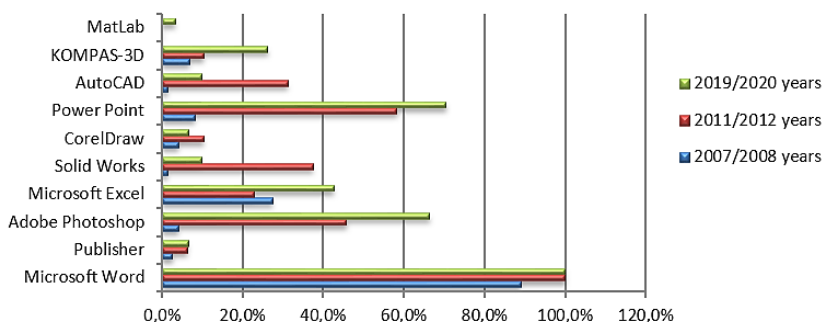


Fig. 6. Use of software by higher education applicants

The conducted surveys also indicated the use by students, at least to a small extent, of such programs as Visual Studio (software development), ArhiCAD (graphic constructions) and others. In recent years, especially in 2021, cloud services have been actively used in the educational process for processing audio and video materials, preparing multimedia presentations and interactive tasks.

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Despite the high and medium level of grades in the school computer science course, some students rated their readiness to use computer technology as low. This was primarily due to the gaps in practical preparation for solving cognitive problems by means of digital technologies, constant improvement and updating of software, the occasional use of digital technology in school lessons (computer science - 100%, other subjects - 4.1-14.8%).

The COVID-19 pandemic has led to the mass introduction of distance and blended learning in educational institutions from 2020 and, accordingly, to the use of computer technology and the necessary software in all subjects. This contributed to the rapid solution of the problem of improving the information competence of teachers and students, providing them with means of communication. By 2021, laptop (99.2%) and mobile (98.4%) have become dominant tools; the most used software - Microsoft Office, Google cloud services; online platforms - Zoom, GoogleMeet, BigBlueButton, digital board Padlet; social networks - Viber, Telegram, WhatsApp; LMS systems (GoogleClass, Moodle).

To date, the issues of compliance with sanitary and hygienic standards for working with information and communication means and optimization of tasks have become relevant, the solution of which requires participants in the educational process to use digital technologies.

REFERENCES (TRANSLATED AND TRANSLITERATED)

1. Fernández-Gutiérrez, M., Gimenez, G., & Calero, J. (2020). Is the use of ICT in education leading to higher student outcomes? Analysis from the Spanish Autonomous Communities. *Computers & Education*, 157, 103969. <https://doi.org/10.1016/j.compedu.2020.103969>
2. Foutsitzi, S., & Caridakis, G. (2019). ICT in education: Benefits, Challenges and New directions. *У 2019 10th international conference on information, intelligence, systems and applications (IISA)*. IEEE. <https://doi.org/10.1109/iisa.2019.8900666>
3. Morze, N., & Makhachashvili, R. (2020). Digital Competence in E-Governance Education: A Survey Study. *CEUR Workshop Proceedings of Information Technology and Interactions conference (IT&I-2020)*, 7, 264-266.
4. Rudenko, Y., Naboka, O., Korolova, L., Kozhukhova, K., Kazakevych, O., & Semenikhina, O. (2021). Online learning with the eyes of teachers and students in educational institutions of Ukraine. *TEM Journal*, 922–931. <https://doi.org/10.18421/tem102-55>
5. Bykov, V. Yu. (2009). *Modeli orhanizatsiinykh system vidkrytoi osvity [Models of organizational systems of open education]*. Atika. <https://core.ac.uk/download/pdf/11084479.pdf>. (in Ukrainian).
6. Gurzhii, A. M., Hurevych, R. S., & Konoshevskiy, L. L. (2015). *Formuvannya profesiinoi kompetentnosti maibutnikh uchyteliv trudovoho navchannia zasobamy informatsiino-komunikatsiinykh tekhnolohii [Formation of professional competence of future teachers of labor training by means of information and communication technologies]*. Firma «Planer». (in Ukrainian).
7. Horbatiuk, R. M., & Kabak, V. V. (2015). *Pidhotovka maibutnikh inzheneriv-pedahohiv do profesiinoi diialnosti zasobamy kompiuternykh tekhnolohii [Preparation of future engineers-teachers for professional activity by means of computer technologies]*. VMA «TEREN». <https://lib.Intu.edu.ua/uk/147258369/5329>. (in Ukrainian).
8. Petrytsyn, I. (2017). Zastosuvannya kompiuternoho modeliuвання u protsesi elektrotekhnichnoi pidhotovky maibutnoho vchytelia tekhnolohii [The use of computer modeling in the process of electrical training of a future technology teacher]. *Molod' i rynek – Youth & market*, (1), 60-64. (in Ukrainian).
9. Tsys, O. O. (2017). *Orhanizatsiia samostiinoi navchalnoi diialnosti studentiv tekhnoloho-pedahohichnykh spetsialnosti zasobamy informatsiino-komunikatsiinykh tekhnolohii [Organization of independent educational activity of students of technological and pedagogical specialties by means of information and communication technologies]*. Osadtsa Yu. http://elibrary.kdpu.edu.ua/bitstream/0564/2508/1/Цись_ЧНД.pdf. (in Ukrainian).
10. Turanov, Yu. O., & Rak, V. I. (2009). Informatsiina skladova u formuvanni profesiinykh kompetentnosti maibutnikh uchyteliv ta inzheneriv-pedahohiv [Information component in the formation of professional competencies of future teachers and pedagogical engineers]. *Naukovi zapysky Ternopil'skoho natsional'noho pedahohichnoho universytetu imeni Volodymyra Hnatyuka – The Scientific Issues of Ternopil Volodymyr Hnatiuk National Pedagogical University*, 3, 51–56. <http://dspace.tnpu.edu.ua/bitstream/123456789/952/1/Turanov.pdf>. (in Ukrainian).
11. Zhaldak, M. I. (2010). Kompiuterno-orientovani systemy navchannia–stanovlennia i rozvytok [Computer-based learning systems – formation and development]. *Naukovyy chasopys Natsional'noho pedahohichnoho universytetu imeni M. P. Dragomanova - Scientific journal of M.P. Dragomanov National Pedagogical University*, 9(16), 3–9. (in Ukrainian).

