GENERAL SECONDARY EDUCATION

ЗАГАЛЬНА СЕРЕДНЯ ОСВІТА

DIGITALIZATION OF GENERAL SECONDARY EDUCATION: ISSUES AND PROSPECTS

M.-O. Yershov[*]

The article presents the results of the analysis of analytical and statistical materials of the Ukrainian mass media and relevant scientific publications on reforms in the education system, as well as the statistical material of the Ministry of Education and Science of Ukraine, the State Statistics Service of Ukraine, the State Employment Service of Ukraine and corresponding Internet resources (HeadHunter, UNESCO Database, Eurostat Educational Statistics), for it indicates the conditions of digitalization of the Ukrainian general secondary education as the primary link of the national IT education, therefore describes the issues of developing digital competency in pupils. They involve the conservatism of the Ukrainian school education, the predominance of memorization over empirical practical activity, the uneven digitization and the low results of implementing inclusive education. The article shows that the uneven digitalization of education has been caused by unequal access of urban and rural children to high-speed Internet and digital resources. The conservatism of the Ukrainian school education in determining the priorities lies in the prevalence of hard skills over soft and digital skills. The process of developing pupils' digital competency does not take into account the peculiarities of their mental and physiological development. Besides, preference is given to the memorization of information, rather than to empirical practical activities. One can observe the slow introduction of "the new literacy studies" requirements into the educational process of modern schools. Consequently, it expands the horizons for the classical school triad of basic primary school skills (reading, writing, numeracy) and motivates pupils towards self-development and self-improvement. Teachers find it difficult to combine the latest teaching aids with traditional ones rationally. Modern schools are not always ready to use a wide range of information and communication technologies' opportunities for the full implementation of inclusive education. The use of distance learning technologies in general secondary schools is somewhat sporadic. The level of many teachers' digital literacy and culture

[*] PhD Student
(Zhytomyr Ivan Franko State University)
my.yershov@gmail.com
ORCID: 0000-0002-6839-622X

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка. Педагогічні науки. Вип. 4 (103)

is rather insufficient. The moral challenges of the global digital society call into question the system of traditional human values, moral and ethical norms. The reforms in the national schooling have been attempting to eliminate the above-mentioned issues.

__Key words:__ IT education, digital competency, digitalization, education digitalization, general secondary education, information and communication technologies.

ЦИФРОВІЗАЦІЯ ЗАГАЛЬНОЇ СЕРЕДНЬОЇ ОСВІТИ: ПРОБЛЕМИ І ПЕРСПЕКТИВИ

М.-О. Єршов

На основі узагальнення аналізу аналітичних і статистичних матеріалів українських ЗМІ та наукових публікацій щодо реформування системи освіти, статистичних матеріалів МОН України, Держстату України, Державної служби зайнятості, інтернет-ресурсів (HeadHanter, UNESCO Database, Eurostat Educational Statistics) досліджено стан цифровізації вітчизняної загальної середньої освіти як початкової ланки вітчизняної IT-освіти. Охарактеризовано проблеми формування цифрової компетентності учнів: консервативність вітчизняної шкільної освіти, переважання заучування над емпіричною практичною діяльністю, нерівномірність цифровізації, низькі результати впровадження інклюзивної освіти. Показано, що нерівномірність діджиталізації освіти зумовлена нерівністю доступу міських і сільських дітей до швидкого інтернету та роботи з цифровими ресурсами. Консервативність вітчизняної шкільної освіти у визначенні цільових пріоритетів відображається у домінування твердих навичок (hard-skills) над соціально-емоційними (soft-skills) та інформаційними (digital-skills). У процесі формування цифрової компетентності учнів не враховуються особливості їх психічного і фізіологічного розвитку, перевага надається заучуванню інформації, а не на емпіричній практичній діяльності. Повільно упроваджуються в освітній процес сучасної школи вимоги "нової письменності", що розширює обрії класичної шкільної тріади базових умінь початкової школи (читання, письмо, лічба), спрямовуючи учня до саморозвитку і самовдосконалення. Вчителям важко раціонально поєднувати новітні засоби навчання з традиційними. Сучасна школи не завжди готова до використання широких можливостей ІКТ для повноцінної реалізації інклюзивної освіти. Використання у закладах загальної середньої освіти технологій дистанційного навчання відбувається епізодично. Недостатнім є рівень цифрової грамотності і культури багатьох вчителів. Моральні виклики глобального цифрового суспільства ставлять під сумнів систему традиційних людських цінностей та морально-етичних норм. Реформою вітчизняного шкільництва здійснено спробу ліквідувати охарактеризовані вище проблеми.

__Ключові слова:__ IT-освіта, цифрова компетентність, цифровізація, діджиталізація освіти, загальна середня освіта, інформаційно-комунікаційні технології.

Introduction of the issue. The needs of the information society determine the large-scale reforms in the national education system. Innovative changes must consider the current economic and educational trends. Given the issues the article addresses, the first group of such changes should include the development of the digital economy and the transition to the 4.0 technological paradigm. The second group of innovations should focus on the digitalization of education and the enhancement of the information culture of all its entities. The reforms in the education system should rely on the basic conclusions of international and national documents, including "Key Skills – 2020" (Davos, 2018), the Medium-Term Plan of Priority Actions for the Government until 2020, the Sustainable Development Strategy

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

"Ukraine-2020" and many others. In the modern Ukrainian educational legislation, information and communication technologies (ICTs) are referred to as the priority areas in the development of science and technology [11]. Above-mentioned and other normative documents increase the attention to the issues of the balanced development of human resources, which directly determine the rates of economic growth of the state and its citizens. Given this, it is essential to ensure the continuity of all levels of the Ukrainian IT education as a rapidly developing industry which has strong reserves to ensure the growth of Ukraine's economy in the context of the development of digital society.

Current state of the issue. The modern pedagogical literature covers various aspects of using ICTs in the national education system and developing digital, information-digital and information-communication competency in pupils. In turn, researchers address the following issues: the informatization of education in Ukraine (O. Bazeliuk, V. Bykov, V. Franchuk, S. Karpliuk, I. Khomyshyn, A. Khyzha, V. Kovalchuk, K. Kraus, M. Kulyk, O. Pinchuk, Yu. Ramskyi, D. Shchedrolosiev, O. Spirin, A. Yatsyshyn, O. Yudin); theoretical and methodical principles of training computer science teachers (O. Dubaseniuk, S. Hnatiuk, O. Humennyi, A. Kononenko, L. Petrenko, O. Prokhorchuk, M. Pryhodii, V. Radkevych); foreign experience in training future members of the digital society (O. Havryliuk, M. Hrebeniuk, V. Kalusenko, N. Klymenko, I. Kostenko, M. Popel, N. Sharan, H. Skakunova, A. Skrypnyk, N. Soroko, T. Volkova); non-formal education of future specialists in information technologies (O. Hlazunova, A. Hurzhii, V. Korolchuk, L. Liakhotska, O. Parkhomenko, L. Vashchenko, T. Voloshyna).

The outline of unresolved issues brought up in the article. At the same time, it is necessary to analyze the factors hindering the development of digitalization of general secondary education as the primary link of the national IT education.

Aim of research is to analyze the issues of training pupils in general secondary schools as future members of the information society.

Research methods. It employs the methods of systematization, analysis and generalization of analytical and statistical materials of the Ukrainian mass media and relevant scientific publications on reforms in the education system, as well as the statistical material of the Ministry of Education and Science of Ukraine, the State Statistics Service of Ukraine, the State Employment Service of Ukraine and Internet resources (HeadHunter, UNESCO Database, Eurostat Educational Statistics), to study the conditions of digitalization of the Ukrainian secondary education.

Results and discussion. The most important objective of the New Ukrainian School is to educate a person of a new type, that is a well-developed personality who can think critically; an innovator who can learn throughout life, develop the economy, change the world and be responsible for his or her decisions; a patriot with an active public position and stable moral and ethical principles [9]. The analysis of the three main components of the Ukrainian citizen's new image (personality, patriot, innovator) shows their "digitization" or "digitalization" [6: 80].

Every pupil should have the skills of a 21st-century dweller to successfully integrate into a modern digital society. The most important one is comprehensive problem-solving. Indeed, it is impossible to develop such skills without developing digital awareness. Therefore, its development should begin as early as possible.

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

Digital competency is usually defined as the ability to understand, critically evaluate and effectively use digital media and ICTs. Its main components are consumer-related (prompt solution of current problems), communicative (online communication: e-mails, chats, blogs, social networks) and technical (efficient and safe use of computers to solve learning and industrial tasks).

It is important to note that the rapid development of digital technologies has revealed several important issues of the Ukrainian system of education. They include the following: the financial inability of the state and the majority of Ukrainian families to ensure the consistent and systematic digitalization of the educational process; the non-compliance of many teachers with the modern requirements of education digitalization and their unpreparedness to develop the necessary information and communication skills to organize the educational process effectively; the unequal access of urban and rural pupils to high-speed Internet and digital resources.

The Ministry of Education and Science of Ukraine has created the National Electronic Platform to ensure equal access of all children to quality education. This platform should host electronic interactive textbooks with virtual 3D materials, interactive laboratories, virtual museums, forums for communication among teachers. The proposed materials can be creatively used only by teachers with well-developed digital skills and schools providing appropriate technical conditions. At the same time, almost a third of secondary schools still do not have a good Internet connection, which makes it virtually impossible to effectively use the innovations proposed by the Ministry of Education and Science of Ukraine and develop digital competency in Ukrainian pupils, as declared by the new school reform [6: 81].

Conservatism is another important issue for modern schools. This mostly concerns the definition of priorities and is reflected in the forms, methods and means of teaching and the content of educational literature. In most schools, the educational process retains the traditional focus on the accumulation of knowledge and the development of hard skills. It is an extremely time-consuming and energy-intensive approach that overloads memory and emotions, does not promote the development of critical thinking and creativity and limits the opportunities for self-development. The analysis of Ukrainian job search sites, however, shows that Ukrainian employers expect potential employees to have soft and digital skills, which allow one to quickly fill gaps in knowledge and find the necessary information to solve a certain problem [7: 165]. According to research by Harvard and Stanford Universities, personal and career success of graduates depends on hard skills by 15 % and soft skills by 85 % [9: 6].

Besides, perfectionism prevails among the principles of the conservative approach and causes emotional, moral and reputational damage to the most diligent, obedient and responsible pupils. Indeed, they are mostly considered as "dorks" by less "perfectionism-oriented" pupils. The constant desire of such pupils to always be the first in the system of axiological coordinates defined by the conservative school creates a kind of a socio-emotional "gap": the greater the recognition they achieve among conservative teachers, the less positive contacts they have among peers. Perfectionism prevents one to follow a healthy rhythm of work and leisure, choose the right axiological priorities, think "outside the box", develop self-motivation, cultivate social skills and form adequate self-esteem. Besides, the persistent desire for supremacy often motivates pupils to avoid failure and therefore limits their prospects for

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

development [3]. Taken together, these issues often do not allow "straight-A" pupils to develop the most in-demand competency in the digital society, that is the ability to solve problems comprehensively. Consequently, many of them cannot build a successful career and a happy personal life.

Another important issue of the conservative school system is the disregard for the characteristics of pupils' psycho-physiological development. It is known, for example, that about 85 % of pupils find it easier to acquire knowledge through empirical practice. Consequently, the need to memorize many abstract concepts is not accorded with the nature of their psyche. The memorization-oriented learning system "rejects" such children, labelling them as "average pupils" or those "lagging behind their peers" and thus making them feel as "outsiders", sometimes for many years ahead. At the same time, those children whom the traditional school considers to be pupils with "a low level of educational attainment" most often are skilled users of technical devices and household appliances who can operate real objects or their images better than "straight-A" pupils. The peculiarities of their thinking activity do not allow them to quickly operate abstract concepts and symbols, which dominate in the conservative educational system. However, they can easily and quickly perform the tasks associated with moving from the concrete to the abstract. Thus, both ICTs and the modern information and educational environment greatly facilitate the transition from symbolic to figurative and from concrete to abstract thinking for such "empiricists" [6: 82].

The New Ukrainian School identifies 11 key competencies to overcome the conservatism of the traditional school education system, and information and communication competency occupies a special place among them [9: 6]. The main objective of learning is not to acquire certain knowledge defined by the school curriculum, but to develop the necessary skills. They are as follows: to be able to obtain the necessary information and process it quickly and efficiently; to be able to analyze, synthesize and evaluate the obtained results; to make decisions and be responsible for them. Therefore, the educational process should be based on the use of research-oriented project technologies which will stimulate the development of critical and flexible thinking, creativity, emotional intelligence and promote early professionalization of every pupil [12: 150].

The state and the society realize the importance of the digital age requirements for organizing the educational process, as well as the value of training proactive and responsible members of the digital society [14]. The introduction of the UNESCO-recommended concept of "the new literacy studies" as a guiding principle for organizing the educational process in modern schools, however, remains problematic. This pedagogical phenomenon changes semantic proportions of the classical school triad of basic skills (reading, writing, numeracy). *Reading* means not only the ability to perceive and understand information recorded in a certain way, but also the ability to find new data by searching, collecting or analyzing independently. *Writing* implies not only expressing thoughts and ideas with the help of certain symbols, but also being able to communicate in the hypermedia environment using all available media. *Numeracy* involves not only performing certain arithmetic operations, but also being able to design them. Thus, "the new literacy studies" is the rejection of pattern-based memorization, which helps pupils to develop the ability to find and investigate facts, plan and design their actions independently. "The new literacy studies" is a system of linguistic, computational and

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

communication skills with extensive use of ICTs (computer literacy, Internet literacy, digital literacy, media competency and ICT competency).

The next issue of organizing the educational process in modern schools is the difficulty of combining innovative teaching aids with traditional ones rationally. This process requires one to consider the range of organizational, psycho-pedagogical, facilities-related, instructional and methodical aspects. Traditional forms and methods should not be completely replaced by innovative ones, although it is very essential to establish a certain balance between them. This indicates the urgency of developing methodical guidelines for teachers on the use of telecommunications and networking, multimedia and hypermedia technologies; the use of information retrieval systems; the development of digital culture in teachers and pupils; the use of ICT tools in learning activities.

It is important to note that the new digital society recognizes the special role of ICTs in the organization of education for children with special needs. In particular, the use of digital technologies facilitates the perception of information for children with hearing impairments, simplifies the development of writing skills for children with limited motor skills and enhances the effectiveness of learning for children with other special needs. In this aspect, distance learning becomes especially relevant. However, Ukrainian educational institutions are not fully ready for the implementation of inclusive education [8: 21] and distance learning. Traditionally, educational institutions use only some elements of distance learning (for example, when a school or class is under quarantine, or in case of an individual pupil's illness).

The main aim of using distance learning in schools lies in organizing independent work and monitoring its results. Most often, it is organized in two ways: 1) by providing access to electronic content based on the school Internet server or via Internet services (Google, MS OneDrive); 2) by using e-mails, personal websites, blogs and social networks (Facebook). Content is usually hosted on a server or in the cloud via free mail or social media. For this purpose, one needs to use specialized software (Blackboard, Litmos, Moodle, eFront, Edmodo, OpenEDX, SuccessFactors, SkillSoft) [2: 120]. Thus, the use of distance learning technologies in secondary schools is somewhat episodic, which points out to insufficient digital competency of teachers.

Another urgent issue of secondary schools today is the low level of digital literacy and culture of teachers, who are expected to be able to use ICTs proficiently and show greater independence of judgment, creativity, initiative and responsibility [1: 84]. Instead, a significant percentage of schoolteachers use computers as typewriters and are, therefore, not ready to apply ICTs systematically. Many teachers also lack knowledge about the rational use of computer programmes and innovative pedagogical experience [13: 5]. As practice shows, young teachers are better motivated to use ICTs but do not have enough practical experience in its professional implementation. Experienced teachers, on the other hand, have considerable pedagogical experience but have been reluctant to use their full potential due to the lack of computer knowledge during the quarantine [15].

Finally, there is one more issue with the axiological and moral-ethical challenges of the global digital society, which call into question the very system of traditional human values, moral and ethical norms. The post-industrial information society creates a fundamentally new reality and establishes new human relations with the world, which makes the study on the impact of information technologies

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

on morality rather relevant. Therefore, secondary schools should prepare not only innovators capable of active transformation of reality but also citizens and patriots who can realize the significance of a moral choice of every citizen of the country involved in the long-running information war [5: 76].

The Ministry of Education and Science of Ukraine has organized distance learning, training sessions and video courses for teachers on the EdEra platform (www.ed-era.com) to overcome the above-mentioned issues. Besides, it has developed model-based programmes and constructors for teachers to help them create the author's programmes and lessons. Next, the Ministry has created the New Ukrainian School (NUS) website (www.nus.org.ua) to establish operational interaction between educational institutions and promote communication and exchange of experience between teachers [10]. Importantly, there is the State Standard of Primary General Education (2017), which pays considerable attention to the development of information and communication culture. The educational fields which determine the content of education in the New Ukrainian School include mathematical, technological, informative, civic and historical ones. They are designed to promote the development of digital competency among the younger generation and educate responsible members of digital society. Non-formal and informal IT education is actively developing, too [4].

Conclusions and research perspectives. The article identifies and describes the range of issues which hinder the development of digital competency in pupils in general secondary education. They involve the uneven digitalization of education in urban and rural areas; the hyperbolized importance of hard-skills and the underestimation of soft-skills and information skills); the neglect of pupils' psycho-physiological development characteristics when developing their digital competency; the focus on information memorization, rather than on empirical practice; the slow introduction of "the new literacy studies" requirements into the educational process of modern schools; teachers' difficulty with a rational combination of the latest teaching aids with traditional ones; the unwillingness of modern secondary schools to use the ICT opportunities for the effective implementation of inclusive education; the sporadic use of distance learning technologies; the insufficient level of teachers' digital competency; the modern school system's inability to respond to axiological and moral-ethical challenges of the global digital society effectively.

Further research should aim to solve the following issues: the growing role of ICT in the organization of the educational process; the active introduction of distance and blended learning in educational institutions; the rapid development of non-formal and informal IT education; the emergence of new forms of cooperation between formal and non-formal IT education.

REFERENCES (TRANSLATED & TRANSLITERATED)

1. Bazeliuk, O. (2018). Zmist i struktura tsyfrovoi kultury pedahohichnykh pratsivnykiv zakladiv profesiinoi osvity [Content and structure of digital culture of VET institutions' teachers]. *Naukovyi visnyk Instytutu profesiino-tekhnichnoi osvity NAPN Ukrainy. Profesiina pedahohika – Scientific Herald of the Institute of Vocational Education and Training of NAES of Ukraine Professional Pedagogy, 16,* 81-87. DOI: http://doi.org/10.32835/2223-5752.2018.16.81-87 [in Ukrainian].

2. Bazeliuk, O. (2016). Strukturnyi analiz sposobiv realizatsii dystantsiinoho navchannia u PTNZ [A

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

structural analysis of the ways of realizing distance learning in vocational education schools]. *Naukovo-metodychne zabezpechennia profesiinoi osvity i navchannia – The research-oriented and methodical support for vocational education and training*: Materialy vseukrainskoi naukovo-praktychnoi konferentsii (Kyiv, 7-9 kvitnia 2016 r.). Kyiv, t. 1, 117-120 [in Ukrainian].

3. *Visim prychyn, chomu vidminnyk u shkoli – ne vidminnyk u zhytti [The 8 reasons why straight-A pupils are not that successful in life]* (2019, Liutyi 22). Retrieved from http://www.tutkatamka.com.ua/nathn ennya/psihologiya/8-prichin-chomu-vidminnik-v-shkoli-ne-vidminnik-v-zhitti/ [in Ukrainian].

4. Hlazunova, O.H., Hurzhii, A.M., Voloshyna, T.V., Korolchuk, V.I., & Parkhomenko, O.V. (2020). Neformalna osvita maibutnikh fakhivtsiv z informatsiinykh tekhnolohii: orhanizatsiia, kontent, instrumenty [Non-formal education of future specialists in information technologies: organization, content, aids]. *Fizyko-matematychna osvita* (FMO) – *Physical & Mathematical Education, 1 (23),* 29-35. DOI 10.31110/2413-1571-2020-023-1-005 [in Ukrainian].

5. Yershov, M.-O. (2018). Rol ukrainskoi IT-osvity na svitovomu rynku informatsiinykh tovariv i posluh [The role of Ukrainian IT education in the world market of information products and services]. *Naukovyi visnyk Instytutu profesiino-tekhnichnoi osvity NAPN Ukrainy. Profesiina pedahohika – Scientific Herald of the Institute of Vocational Education and Training of NAES of Ukraine Professional Pedagogy, 16,* 74-81. DOI: http://doi.org/10.32835/2223-5752.2018.16.74-81 [in Ukrainian].

6. Yershov, M.-O. (2019). *Suchasni problemy formuvannia tsyfrovoi kompetentnosti uchniv u zakladakh zahalnoi serednoi osvity. Informatsiino-tsyfrovyi osvitnii prostir Ukrainy:* transformatsiini protsesy i perspektyvy rozvytku. Materialy metodolohichnoho seminaru NAPN Ukrainy *[Today's problems in developing digital competency in pupils in secondary schools. The information and digital education space of Ukraine: transformations and prospects for development].* 4 Kvitnia 2019 r. Kyiv: In-t informatsiinykh tekhnolohii i zasobiv navchannia, 79-85 [in Ukrainian].

7. Yershova, L. (2018). Transformatsiia systemy tsinnostei uchnivskoi i studentskoi molodi v konteksti reformuvannia vitchyznianoi profesiinoi osvity [Transformation of the students' values system in the context of domestic vocational education and training reforming]. *Naukovyi visnyk Instytutu profesiino-tekhnichnoi osvity NAPN Ukrainy. Profesiina pedahohika – Scientific Herald of the Institute of Vocational Education and Training of NAES of Ukraine Professional Pedagogy, 16,* 162-168. DOI: http://doi.org/10.32835/2223-5752.2018.16.162-168 [in Ukrainian].

8. *Inkliuzyvna osvita v Ukraini: zdobutky, problemy ta perspektyvy. Reziume analitychnoho zvitu za rezultatamy kompleksnoho doslidzhennia [Inclusive education in Ukraine: achievements, issues and prospects. The abstract of an analytical report on the complex study]* (Cherven 2011 – sichen 2012). 36 s. (2019, Liutyi 22) Retrieved from https://osvita.ua/doc/files/news/294/29475/ERA_INCLUSION_RESUME_FINAL_Ukr.doc [in Ukrainian].

9. *Nova ukrainska shkola: poradnyk dlia vchytelia [The New Ukrainian school: a teacher's book]:* navch.-metodychn. posibnyk (2018). K.: "Litera LTD" [in Ukrainian].

10. *Novyi derzhavnyi standart pochatkovoi zahalnoi osvity [The New State Standard for Primary General Education]* (2019, Liutyi 23). Retrieved from http://nus.org.ua/wp-content/uploads/2017/08/NewSchool_

Zhytomyr Ivan Franko State University Journal. Pedagogical Sciences. Vol. 4 (103)

Вісник Житомирського державного університету імені Івана Франка.
Педагогічні науки. Вип. 4 (103)

Presentation-final_18-08-2017.pdf [in Ukrainian].

11. Pro priorytetni napriamy nauky i tekhniky [On the priority areas in science and technology]. № 848-VIII (2015). *Vidomosti Verkhovnoi Rady Ukrainy – Information of the Verkhovna Rada of Ukraine* [in Ukrainian].

12. Kulalaieva, N.V. (red.). (2018). *Proektna diialnist uchniv profesiino-tekhnichnykh navchalnykh zakladiv* [*Project activities of pupils from vocational education schools*]: treninh-kurs: navch. posibnyk. Zhytomyr: "Polissia" [in Ukrainian].

13. Radkevych, V.O. (2006). Doslidnytski zasady diialnosti pedahoha profesiinoi shkoly [Research-based principles of teacher's activity in professional schools]. *Profesiino-tekhnichna osvita – Vocational Education, 4,* 5-7 [in Ukrainian].

14. Skrypnyk, A.V., Klymenko, N.A. & Kostenko, I.S. (2020). Riven osvichenosti naselennia v haluzi tsyfrovykh tekhnolohii ta zrostannia ekonomik krain [The level of the population's knowledge about digital technologies and the growing potential of countries' economies all over the world]. *Informatsiini tekhnolohii i zasoby navchannia – Information Technologies and Learning Tools, 4 (78),* 278-297. DOI: https://doi.org/10.33407/itlt.v78i4.2948 [in Ukrainian].

15. Yershov, M.-O. (2019). Digitalisation of professional (vocational) and pre-high tertiary education of Ukraine: problems and prospects. *Scientific Herald of the Institute of Vocational Education and Training of NAES of Ukraine Professional Pedagogy, 1 (18),* 67-74. DOI: https://doi.org/ 10.32835/2223-5752.2019.18.67-74 [in English].