

An integrated approach to digital training of prospective primary school teachers

Olga G. Yaroshenko¹[0000-0003-1555-0526], Olena D. Samborska²[0000-0002-8071-9730]
and Arnold E. Kiv³[0000-0002-0991-2343]

¹ Institute of Higher Education of the NAES of Ukraine, 9 Bastionna Str., Kyiv, 03056, Ukraine
yaroshenko_o@ukr.net

² Bar Humanitarian and Pedagogical College named after Mykhailo Hrushevsky,
1 Hrushevsky Sq., Bar, 23000, Ukraine
samborska@ukr.net

³ Ben-Gurion University of the Negev, P.O.B. 653, Beer Sheva, 8410501, Israel
kiv@bgu.ac.il

Abstract. The article emphasizes the importance of information and digital technologies in pre-service training of primary school teachers, substantiates the content and components of information and digital competence of prospective primary school teachers. It points out that the main purpose of information and digital training in the pedagogical higher educational institutions (HEI) is to ensure the formation of digital competence of future primary school teachers, to prepare them for developing primary students' digital literacy in classes on various academic subjects, for active use of ICT in primary school teachers' professional activities. An integrated approach to the modernization of information and digital training of pre-service primary school teachers, which covers the main forms of the educational process – training sessions, independent work, practical training, and control activities is justified. The article presents the results the pedagogical experiment aimed at testing the effectiveness of the integrated approach to the modernization of information and digital training of prospective primary school teachers. The results are determined by the level of digital literacy and the ability of students in the control and experimental groups to use information and digital technology in the educational process of primary school.

Keywords: information and digital training, information and digital competence, training by means of network services, prospective primary school teachers, academic discipline, pedagogical practice, pedagogical experiment.

1 Introduction

The State Standard of Primary Education focuses the educational process on shaping students' information and digital competence, mastering the basics of digital literacy for development and communication, the ability to use digital technologies safely and ethically in teaching and other life situations [6]. The Concept of the New Ukrainian

School recognizes Information and Digital Competence as one of the 10 key competences to be mastered by students [7]. The Professional Standard of Primary School Teacher defines the capabilities of a pedagogical employee of a New Ukrainian School, among which there is the capability to use digital technologies in the educational process [16]. These documents outlined the guidelines of our study regarding the development of an integrated approach to the modernization of information digital training for prospective primary school teachers.

Modernization is improvements, changes that meet the requirements of modern times [12]. In particular, Olena S. Bereziuk and Vira Smoliar consider the process of educational modernization to be "... an important step towards the social, political and economic development of Ukraine. That is why it is important to update the education system in accordance with today's requirements, the needs of modern society and the development of modern personality in it ... " [2, p. 8]. Vira M. Andriievska has developed a model of training pre-service primary school teachers using ICT, in which she has identified the target, content processing, and result-evaluation components [14]. Liudmyla I. Bilousova and Nataliia V. Zhytyenyova consider the intensification of the educational process to be the main way to improve the professional training of prospective primary school teachers. The researchers conclude that the process of intensification of the educational process is closely related, first, to the search and introduction of pedagogical technologies based on the use of digital means, through which large-scale educational programs for the development of practical skills in the use of ICT are implemented [3]. These and other studies are aimed mainly at the modernization of learning technologies, but do not completely cover the ways of modernization of the basic forms of organization of the educational process.

The purpose of the article is to substantiate an integrated approach to the modernization of information digital training of prospective primary school teachers, covering the main forms of educational process in the higher education establishment such as training, independent work, practical training, control measures, and to experimentally test its effectiveness.

2 Results and discussion

Regarding our research, the result of the professional training of prospective primary school teachers is formedness of their ICT competence. The experimental study was preceded by an analysis of the works of Olga V. Bondarenko [4], Vita A. Hamaniuk [5], Lilia Ya. Midak [11], Pavlo P. Nechypurenko [13], Nadiia V. Olefirenko [14], Oksana V. Ovcharuk [15], Lina M. Rybalko [9], Serhiy O. Semerikov [10], Aleksander V. Spivakovsky [19], Oleksandra I. Yankovych [20] and others. The results of the analysis allowed to clarify the terminology in the field of information and digital technologies, to determine the essence of information and digital competence of the future primary school teacher. They are disclosed in our publications [17], [18].

It was also found that the information and digital competence of the future primary school teacher is formed on the basis of:

- conscious understanding and knowledge of ICT, opportunities for their use in personal and social life, education and work;
- awareness of the role of digital technology in supporting creativity and innovation, responsibility for the use of information;
- ability to find, collect and process various information through digital technologies, to use it according to real and virtual environment;
- understanding the importance of ICT for lifelong learning [17].

In choosing an integrated approach to modernize the training of future primary school teachers, we proceeded from the assumption that “the approach is a less directive methodological formation ... that has or provides an alternative to other approaches and eliminates the possibility of a single methodology (for example, in some humanities directions)” [21, p. 58]. The rationale for the integrated approach to information and digital training of future primary school teachers is carried out in accordance with the principles of systematicity, consistency, activity, independence; continuity, a combination of individual and group work using network services; self-development; reliance on subjective experience.

Let us focus on the main characteristic of the integrated approach to the modernization of information and digital training of future primary school teachers. The Law of Ukraine “On Higher Education” [24, Art. 50] determines that the main forms of organization of the educational process in the higher education system are training sessions, independent work, practical training, and control activities. However, the approach to the modernization of information and digital training of future primary school teachers, justified in our research, concerns the specified forms of organization of the educational process of HEI.

The analysis of the curricula of HEI that train specialists for primary schools [22] gave grounds for strengthening the content of the academic disciplines such as “Modern Information and Digital Technologies of Teaching”, “Practical Course of Computer Science with Programming Elements”, “Methods of Teaching the Subject “I explore the world” (information area)” with professionally oriented information regarding the use of ICT in primary education.

To improve methodological training of students, the variant component of the curriculum was supplemented with an optional course “Modern Information and Digital Technologies in the Educational Process of Primary School”. The course curriculum consists of three modules. The module “Using Network Services as a Teaching Tool” refers to the development of the learning tools with G Suite for Education. Its main purpose is to prepare students for shaping the foundations of information and digital competence in primary school students.

Educational classes can be modernized by organizing group work of students using network services, systematic application of research, project, and problem methods of teaching, analysis of pedagogical situations, game modeling of educational activities.

By means of the integrated approach, students acquire the skills to work in a team, communicate in the process of group activities in the state language working in small groups (3–4 students) using network services. During group learning activities, in order to form the key and subject competencies of students, the classes make use of the

resource potential of social networks and mobile applications [8] that allow students to create a group for free communication, online exchange of information and access to important resources. According to the rules of group work, you need to create effective small groups and elect leaders in them. The effectiveness of the group is ensured by the psychological compatibility of its members and the ability of at least 50% of them to carry out educational activities properly [23].

To organize learning activities in groups using network services, we suggest choosing a G Suite cloud service (or any other by students' wish). While working, small groups get access to Google Drive, where students can upload all the information, they need to complete a group task, giving each member of the group access to it.

During the information processing, students need to create presentations. To do this, they use Google Slides. It's allows the whole group to participate in making the presentation and some adjustments. Teacher evaluates students, monitors their progress and educational outcomes using Google Classroom technologies.

Working in small groups using network services, students have the opportunity to work with other applications and platforms, including messengers (Skype, Viber, Telegram etc.).

In our approach to the modernization of information and digital training of future primary school teachers, independent work of students is significantly transformed, which, according to the Regulation "On the Organization of the Educational Process in Higher Education Institutions", is the main form of developing students' competencies during their free time from mandatory training sessions. The upgrade is that students' independent work is organized on the G Suite platform using the Google Classroom service. For independent work, students are offered an electronic educational resource developed by us on the disciplines of information and digital training. It is hosted in the Google Classroom environment. Software and methodological support for remote forms of interaction between students and teachers through dialogue communication "student – teacher" and "student – student" has been established.

E-learning technologies are used in organizing students' independent work. These are new forms and methods of teaching, organizing students' independent work, and a new approach to the educational process [1]. To use them in studying the discipline "Modern Information and Digital Technologies in the Educational Process of Primary Schools", an electronic educational and methodological kit was created, which includes: a working curriculum for students (syllabus), a lecture course, guidelines for practical work, guidelines for independent work, test tasks, criteria for evaluating students' educational achievements, and a glossary.

Doing independent tasks, students can use G Suite elements such as personal email (Gmail), Google drive (Google Drive) to download and save documents. By means of Google Docs, Google Sheets, Google Slides, which allow to process text documents in almost all formats, students build charts, graphs and tables without installing additional programs on their gadgets, as well as present the results of their activities in the form of self-created presentations.

According to the integrated approach, students' independent work with using network technologies is carried out in the following stages:

- preparatory stage-setting tasks, drawing up methodical cards, distribution of tasks among students;
- practical phase – execution of tasks using network services;
- pre-evaluation stage – current verification of the implementation of tasks online;
- generalizing stage – summing up the achieved results, making conclusions, preparation for the delivery of the developed materials to the teacher;
- final assessment stage – checking and evaluating the work by the teacher in the student's personal account at Google Classroom.

We also suggest that students use G Suite services to create and maintain their own blogs, using the basics of Blogger or Sites Creator to create and maintain a personal website. Using these applications, future primary school teachers have the opportunity to share their own developments and achievements in compliance with copyright and use the acquired experience not only during their studies, but also in further professional activities.

Practical training in the context of the integrated approach to information and digital training of future primary school teachers is a long-term involvement of students in the use of ICT in the educational activities of primary schools. It should be noted that getting a systematic education (from the level of a professional junior bachelor to a bachelor's degree) students undergo five types of practices. At each of them, future teachers perform tasks related to the use of information and digital technologies in the educational process of primary schools. Preparing for practice, students also visit primary schools, where they carry out educational projects, conduct educational activities for students, get advice from teachers, and perform the experimental part of course work. Mastering the methods of teaching mathematics, Ukrainian language and literary reading, computer science, the integrated course "I explore the world" (natural, civil and historical, social, healthcare aspects), students develop plans and summaries of training sessions using digital technologies. They prepare multimedia presentations for lessons, select additional text and illustrative materials, create cards with individual tasks and additional educational texts, use an electronic database for monitoring student learning results, systematize and store their own methodological developments on personal blogs and websites. All this is used during all kinds of pedagogical practice.

The integrated approach to modernization of information and digital training of future primary school teachers has been pilot-tested in conditions of real educational process at Bar Humanitarian Pedagogical College named after Mykhailo Hrushevsky, Uman Humanitarian and Pedagogical College named after T. G. Shevchenko and Pedagogical College of Khmelnytskyi (Khmelnytskyi Humanitarian Pedagogical Academy).

Its effectiveness was established according to the criteria, indicators and diagnostic tools listed in table 1. The participants of the pedagogical experiment were 114 students enrolled in the colleges having basic general secondary education. The time of the ascertaining phase of the pedagogical experiment coincided with the end of the study of the Computer Science, which refers to general education and the overall preparation for professional junior bachelor's degree (junior specialist). Measurement was carried out to identify the residual knowledge and practical skills of students who completed

the third year of training at the educational and professional level of a professional junior bachelor (junior specialist). To test students' digital literacy, we used a test that consisted of 30 test tasks. According to the results, the respondents were divided into three groups – with high, sufficient and average levels of digital literacy (table 2, fig. 1).

Table 1. Criteria, indicators and diagnostic tools for the formation of information and digital competence of future primary school teachers

Criteria	Indicators	Diagnostic tools
The effectiveness of information and digital training for the program of general secondary education.	Assimilation of knowledge about methods of transmission, search, transformation, use of information and about resources of information and digital technologies used in educational activities	Computer successfulness tests. Questionnaire. Observation.
The ability of students to teach junior high school students using information and digital technologies.	Awareness of electronic educational resources (EER) for primary school. Ability to use the tools of information and digital technologies in the preparation and training for primary school students. Ability to independently create electronic educational resources.	Average values of semester assessment in the disciplines “Modern Information and Digital Technologies in the Educational Process of Primary School”, “Practical Course of Computer Science with Programming Elements”, “Methods of Teaching Computer Science”. The results of the practical task. Expert assessment of primary school teachers and methodologists during the period of pedagogical practice. Electronic portfolio of students.

Table 2. Results of the ascertaining stage of the pedagogical experiment

Level of the students' digital literacy	Students	
	People	%
High	25	21,93%
Sufficient	35	30,70%
Average	54	47,37%
<i>Total</i>	<i>114</i>	<i>100,00%</i>

According to the results of the ascertaining stage of the pedagogical experiment, near half of the respondents had an average level of digital literacy. Of course, this is not enough for effective shaping the digital literacy of primary students and implementing the educational process in primary schools using IT.

At the forming stage of the pedagogical experiment, the purpose of which was to test the effectiveness of an integrated approach to the modernization of information and digital training of future primary school teachers, the respondents were 54 students of the control and 58 students of the experimental groups.

The groups consisted of students who started the fourth year and expressed a desire to continue their studies at college to obtain a bachelor's degree in a reduced period of study (120 ECTS credits). The experiment continued until the pre-graduate practice at

the final year of applicants for an educational bachelor's degree. During this period, students studied the subjects of information and digital training such as "Practical Course of Computer Science with Programming Elements", "Methods of Teaching Computer Science", "Modern Information and Digital Technologies in the Educational Process of Primary School". They conducted three types of pedagogical practice (summer practice in health camps, trial lessons and classes at school, practice "The first days of a child in school").

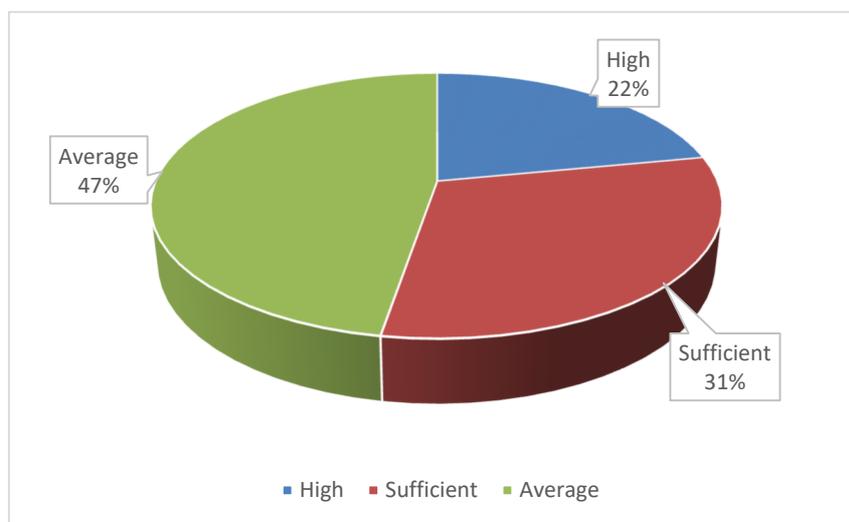


Fig. 1. Diagram of the distribution of future primary school teachers into groups according to the level of digital literacy (stating the stage of the pedagogical experiment, in %).

The main differences between studying these subjects by students of the control and experimental group were as follows:

- the students were actively influenced by the educational environment of educational institutions of the first level, interacted with students and teachers of primary classes in person and remotely;
- the future teachers studied the course "Modern Information and Digital Technologies in the Educational Process of Primary schools" included in the variable part of the curriculum;
- educational classroom and independent work of higher education applicants was carried out according to the methods of training described above;
- group training activities were optimally combined with front-line and individual training and took place using network services;
- the mandatory task of all types of practices was the systematic use of information and digital technologies in the educational activities of educational institutions of the first level.

Since the pedagogical experiment is still in progress (there is still a pre-graduate practice), then, as stipulated by the methodology for conducting the formative stage of the pedagogical experiment, two intermediate measurements were made before it began. One – after studying the disciplines of professional information and digital training, the second after completing the practices “The first days of the child in school” and “Trial lessons and classes in primary school”.

The first measurement is the results of the semester control in the disciplines of information and digital training (figure 2).

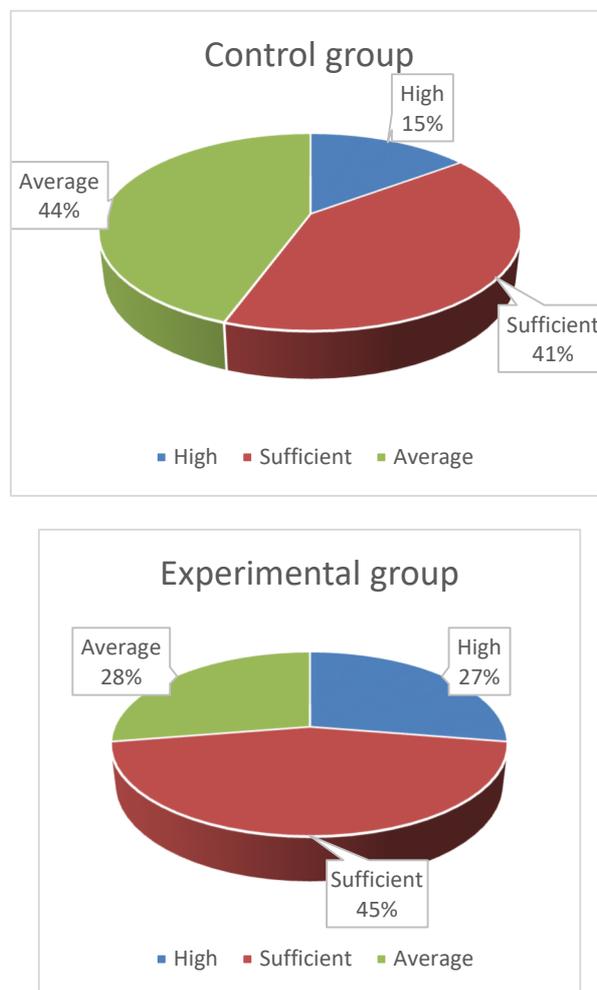


Fig. 2. Levels of formation of *digital* competence of students in the control and experimental groups (in %) based on the results of the first measurement.

The second measurement concerns doing a complex task by students before the beginning of pre-graduate practice, consisting of electronic testing (30 test tasks) and a

practical task. The practical task was to design and implement one's own portfolio at Google Sites as a way to systematize and store documentary evidence of one's own achievements in the process of information and digital training. The maximum score for completing the complex task was 100 points. Students who scored 90-100 points were assigned to a high level of digital competency, 70-89 points – to sufficient and less than 70 points – to the average level. This distribution is shown in figure 3.

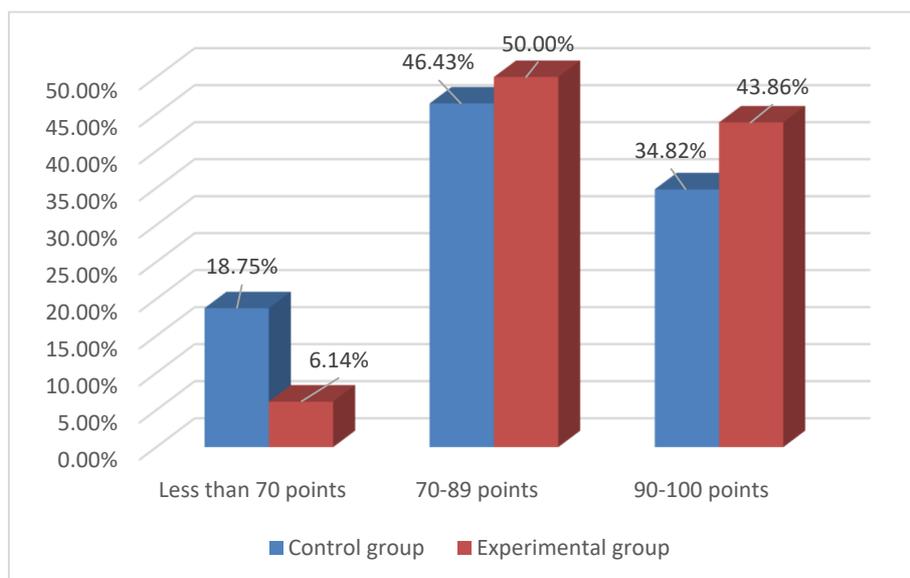


Fig. 3. Levels of digital competence of participants of the forming stage of the pedagogical experiment (in %) based on the results of the second measurement.

Figure 3 illustrates that the vast majority of students in the control and experimental groups scored more than 70 points. In a didactic sense, this is a positive result. However, the qualitative indicator of the effectiveness of ICT training (the number of students who have reached a high and sufficient level of competence under study) in the experimental group is 93.86%, in the control group – 81.25%.

In order to arrive at a statistical conclusion about the reliability of the results obtained, the χ^2 criterion was used for independent samples at a significance level of 0.05. The resulting value χ^2 is equal to 8.118. Compare it with the critical value $T = 7.82$, indicates that: $\chi^2 > T$. So, the obtained results of the formation stage of the pedagogical experiment are statistically reliable. This leads to the conclusion about the positive impact of the integrated approach to the modernization of information and digital training of future primary school teachers both on the process and results of development of the information and digital competence of prospective teachers of the New Ukrainian School.

3 Conclusions

1. The standard of higher education of the first (bachelor's) level of specialty 013 Primary Education, the Professional standard "Primary School Teacher of General Secondary Education Institutions", the State standard of primary education determine the need to develop information and digital competence of prospective primary school teachers, preparing them for shaping digital literacy of primary students in classes of various academic subjects. As the analysis of practice has shown, there are some issues in pre-service pedagogical training, which need to be solved. One of them, the modernization of information and digital training of future teachers, including primary classes, is an important task of the theory and methodology of professional education. Modernization of information and digital training of student teachers is necessary to ensure the quality of higher education in the personal and professional directions.
2. Modernization of information and digital training of prospective primary school teachers can be carried out in various ways. In our study, it is proved that one of them can be the application of the integrated approach to improving the main forms of the educational process – training sessions, independent work, practical training of students, and control measures. In the practical implementation of the integrated approach, a significant role is played by game modeling of pedagogical situations by students, during which they are teachers who plan, develop and implement the educational process using ICT.
3. The results of the pedagogical experiment were higher among the students of the experimental group. Processing of the results obtained using a statistical assessment based on the χ^2 criterion allowed to make a firm conclusion that the proposed integrated approach to the modernization of information and digital training of prospective primary school teachers improves their overall professional training, and ensures the quality development of their information and digital competence.

References

1. Astafieva, M.M., Zhylytsov, O.B., Proshkin, V.V., Lytvyn, O.S.: E-learning as a mean of forming students' mathematical competence in a research-oriented educational process. In: Kiv, A.E., Shyshkina, M.P. (eds.) Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019), Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
2. Bereziuk, O.S., Smoliar, V.: Shliakhy modernizatsii osvითnoi systemy Ukrainy. In: Bereziuk, O.S., Vlasenko, O.M. (eds.) Tendentsii modernizatsii natsionalnykh osvითnikh system. Vyd-vo ZhDU im. I. Franka, Zhytomyr. <http://eprints.zu.edu.ua/13051/> (2014). Accessed 25 Oct 2019
3. Bilousova, L.I., Zhytyenyova, N.V.: Functional approach to the use of technology of visualization for intensification of learning process. *Information Technologies and Learning Tools* **57**(1), 38–49 (2017). doi:10.33407/itlt.v57i1.1525
4. Bondarenko, O.V., Pakhomova, O.V., Lewoniewski, W.: The didactic potential of virtual information educational environment as a tool of geography students training. In: Kiv, A.E., Shyshkina, M.P. (eds.) Proceedings of the 2nd International Workshop on Augmented

- Reality in Education (AREdu 2019), Kryvyi Rih, Ukraine, March 22, 2019. CEUR Workshop Proceedings **2547**, 13–23. <http://ceur-ws.org/Vol-2547/paper01.pdf> (2020). Accessed 10 Feb 2020
5. Chorna, O.V., Hamaniuk, V.A., Uchitel, A.D.: Use of YouTube on lessons of practical course of German language as the first and second language at the pedagogical university. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 294–307. <http://ceur-ws.org/Vol-2433/paper19.pdf> (2019). Accessed 10 Sep 2019
 6. Derzhavnyi standart pochatkovoï osvity (State standard of primary education) (2018). <https://www.kmu.gov.ua/storage/app/uploads/public/5a8/de2/5e1/5a8de25e1504c877583228.doc> (2018). Accessed 29 Nov 2019
 7. Elkin, O., Hrynevych, L., Kalashnikova, S., Khobzey, P., Kobernyk, I., Kovtunets, V., Makarenko, O., Malakhova, O., Nanayeva, T., Shiyan, R., Usatenko, H., Gryshchenko, M. (ed.): The New Ukrainian School: conceptual principles of secondary school reform. Ministry of Education and Science of Ukraine, Kyiv (2016)
 8. Kazhan, Yu.M., Hamaniuk, V.A., Amelina, S.M., Tarasenko, R.O., Tolmachev, S.T.: The use of mobile applications and Web 2.0 interactive tools for students' German-language lexical competence improvement. In: Kiv, A.E., Shyshkina, M.P. (eds.) Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019), Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
 9. Lavrentieva, O.O., Rybalko, L.M., Tsys, O.O., Uchitel, A.D.: Theoretical and methodical aspects of the organization of students' independent study activities together with the use of ICT and tools. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 102–125. <http://ceur-ws.org/Vol-2433/paper06.pdf> (2019). Accessed 10 Sep 2019
 10. Markova, O.M., Semerikov, S.O., Striuk, A.M., Shalatska, H.M., Nechypurenko, P.P., Tron, V.V.: Implementation of cloud service models in training of future information technology specialists. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 499–515. <http://ceur-ws.org/Vol-2433/paper34.pdf> (2019). Accessed 10 Sep 2019
 11. Midak, L.Ya., Kravets, I.V., Kuzyshyn, O.V., Pahomov, J.D., Lutsyshyn, V.M., Uchitel, A.D.: Augmented reality technology within studying natural subjects in primary school. In: Kiv, A.E., Shyshkina, M.P. (eds.) Proceedings of the 2nd International Workshop on Augmented Reality in Education (AREdu 2019), Kryvyi Rih, Ukraine, March 22, 2019. CEUR Workshop Proceedings **2547**, 251–261. <http://ceur-ws.org/Vol-2547/paper18.pdf> (2020). Accessed 10 Feb 2020
 12. Modlo, Ye.O., Semerikov, S.O., Shmeltzer, E.O.: Modernization of Professional Training of Electromechanics Bachelors: ICT-based Competence Approach. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018), Kryvyi Rih, Ukraine, October 2, 2018. CEUR Workshop Proceedings **2257**, 148–172. <http://ceur-ws.org/Vol-2257/paper15.pdf> (2018). Accessed 25 Oct 2019
 13. Nechypurenko, P.P., Starova, T.V., Selivanova, T.V., Tomilina, A.O., Uchitel, A.D.: Use of Augmented Reality in Chemistry Education. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 1st International Workshop on Augmented Reality in Education (AREdu 2018), Kryvyi Rih, Ukraine, October 2, 2018. CEUR Workshop Proceedings **2257**, 15–23. <http://ceur-ws.org/Vol-2257/paper02.pdf> (2018). Accessed 30 Nov 2018
 14. Olefirenko, N.V., Kostikova, I.I., Ponomarova, N.O., Lebedieva, K.O., Andriivska, V.M., Pikilnyak, A.V.: Training elementary school teachers-to-be at Computer Science lessons to

- evaluate e-tools. In: Kiv, A.E., Shyshkina, M.P. (eds.) Proceedings of the 7th Workshop on Cloud Technologies in Education (CTE 2019), Kryvyi Rih, Ukraine, December 20, 2019, CEUR-WS.org, online (2020, in press)
15. Ovcharuk, O., Ivaniuk, I., Soroko, N., Gritsenchuk, O., Kravchyna, O.: The use of digital learning tools in the teachers' professional activities to ensure sustainable development and democratization of education in European countries. In: Semerikov, S., Chukharev, S., Sakhno, S., Striuk, A., Osadchyi, V., Solovieva, V., Vakaliuk, T., Nechypurenko, P., Bondarenko, O., Danylchuk, H. (eds.) The International Conference on Sustainable Futures: Environmental, Technological, Social and Economic Matters (ICSF 2020). Kryvyi Rih, Ukraine, May 20-22, 2020. E3S Web of Conferences **166**, 10019 (2020). doi:10.1051/e3sconf/202016610019
 16. Profesiynyi standart "Vchytel pochatkovykh klasiv zakladu zahalnoi serednoi osvity" (Professional standard "Primary school teacher of general secondary education"). <http://nus.org.ua/wp-content/uploads/2018/08/20180815.pdf> (2018). Accessed 25 Oct 2019
 17. Samborska, O. Informatsiino-tyfrova kompetentnist maibutnoho vchytelia pochatkovoï shkoly i faktory yii formuvannia (Factors of forming the informational and digital competence of the future primary school teacher). International Scientific Journal of Universities and Leadership 1, 114–125 (2019). doi: 10.31874/2520-6702-2019-7-1-114-125
 18. Samborska, O.D.: Conceptual teasaurus of information and digital competence for the future pedagogical worker of primary education. Information Technologies in Education **38**, 85–96 (2019). doi:10.14308/ite000687
 19. Spivakovsky, A., Petukhova, L., Kotkova, V., Yurchuk, Yu.: Historical Approach to Modern Learning Environment. In: Ermolayev, V., Mallet, F., Yakovyna, V., Kharchenko, V., Kobets, V., Kornilowicz, A., Kravtsov, H., Nikitchenko, M., Semerikov, S., Spivakovsky, A. (eds.) Proceedings of the 15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer (ICTERI, 2019), Kherson, Ukraine, June 12-15 2019, vol. II: Workshops. CEUR Workshop Proceedings **2393**, 1011–1024. http://ceur-ws.org/Vol-2393/paper_420.pdf (2019). Accessed 30 Jun 2019
 20. Tereshchuk, H.V., Kuzma, I.I., Yankovych, O.I., Falfushynska H.I.: The formation of a successful personality of a pupil in Ukrainian primary school during media education implementation. In: Kiv, A.E., Soloviev, V.N. (eds.) Proceedings of the 6th Workshop on Cloud Technologies in Education (CTE 2018), Kryvyi Rih, Ukraine, December 21, 2018. CEUR Workshop Proceedings **2433**, 145–158. <http://ceur-ws.org/Vol-2433/paper08.pdf> (2019). Accessed 10 Sep 2019
 21. Ushakov, E.V.: Vvedenie v filosoffiiu i metodologiiu nauki (Introduction to the philosophy and methodology of science). Ekzamen, Moscow (2005)
 22. Yaroshenko, O.G., Samborska, O.D.: Vitchyzniana praktyka informatsiino-tyfrovoyi pidhotovky maibutnykh uchyteliv pochatkovoï shkoly u pedahohichnykh koledzhakh (National practice of informational and technical training for future primary school teachers at pedagogical colleges). Problemy osvity **92**, 245–251 (2019)
 23. Yaroshenko, O.G.: Navchalne spilkuvannia yak chynnyk aktyvizatsii piznavalnoi diialnosti shkolariv (Educational communication as a factor in activating the cognitive activity of schoolchildren). Bioloheia i khimiiia v shkoli 4, 15–19 (2002)
 24. Zakon Ukrainy "Pro vyshchu osvitu" (The Law of Ukraine "On Higher Education"). <http://zakon5.rada.gov.ua/laws/show/1556-18> (2014). Accessed 21 Mar 2015