Original Article

Digital Competence as a Necessary Component of the Professional Competence of Pharmaceutical Industry Employees

Kuchyn Iurii[1], Tetiana Reva[2], Nataliia Stuchynska[3], Mykytenko Pavlo[3], Kucherenko Inna[3]*, Oksana Chkhalo[2]

[1]Department of Surgery, Anesthesiology and Intensive Care of Postgraduate Education, Bogomolets National Medical University, Kyiv, Ukraine. [2]Department of Medical and General Chemistry, Bogomolets National Medical University, Kyiv, Ukraine. [3]Department of Medical and Biological Physics and Informatics, Bogomolets National Medical University, Kyiv, Ukraine.

Abstract

The article presents the results of scientific research on the formation of digital competence of future masters of pharmacy medical (pharmaceutical) institutions of higher education. In particular, the essence of the concept of digital competence is considered and the purpose of formation of digital competence of students of pharmaceutical institutions of higher education is established. The results of the survey of employees of the pharmaceutical industry/pharmacy industry of different regions of Ukraine, which was carried out to study the readiness of graduates of pharmaceutical faculties medical (pharmaceutical) institutions of higher education to use information technology in professional activities. The results of a study conducted to establish the internal motivation to use information technology in the professional activities of pharmaceutical workers are presented. A comparison of the results of the survey on subscales: satisfaction with the activity, efforts, awareness of the competence, personal self-realization. Pearson's consistency criterion was used to establish statistically significant differences in the mean values of the studied groups. It was found that the averaging of indicators does not allow for the interpretation of the general level of motivation, but it allows to establish statistical differences in the study groups. The number of points on each subscale should be considered as an indicator of differences in the levels of internal motivation to use information technology in professional activities. The study provides grounds to argue that there is a relationship between the level of intrinsic motivation and willingness to use information technology in professional activities.

Keywords: Digital competence, Information technology in pharmacy, Distance learning, Professional competence, Master of pharmacy

Introduction

In the modern information society, the issue of the quality of higher professional education is relevant. The rapid development of technology and globalization challenges, including those related to the COVID-19 pandemic, causes qualitatively new demands on healthcare professionals and their training systems. The urgent tasks are to update the forms and methods of teaching, the search for alternative models of building the educational process for the formation of a competent, socio-cultural, and creative personality of a citizen of Ukraine and a competitive specialist [1, 2]. The problem of "aging" knowledge becomes especially relevant: if earlier curricula and the content of educational material underwent minimal changes, now they are reviewed almost every year. Systemic changes in education and health care include, in particular, their digital transformation, which encourages the modernization of the system of information training of masters of pharmacy, aimed at forming systematic knowledge, skills, and practical skills of using information technology in professional activities.

Analysis of Recent Research and Publications

Practical experience of formation of professional and digital competence of future specialists in the field of information technologies was studied by M. Zhaldak [3] (study of the system of socio-professional competencies), O. Spirin [4] (clarification of the concepts of information and communication and information competencies, determining their content and place in the system of professionally specialized competencies). The works of I. Kucherenko, P. Mykytenko, N. Stuchynska are devoted to the practical scientific and methodological support of computer training of

Address for correspondence: Kucherenko Inna, Department of Medical and Biological Physics and Informatics, Bogomolets National Medical University, Kyiv, Ukraine.
innanmu2018@gmail.com

How to cite this article: Iurii K, Reva T, Stuchynska N, Pavlo M, Inna K, Chkhalo O. Digital Competence as a Necessary Component of the Professional Competence of Pharmaceutical Industry Employees. Arch Pharm Pract. 2022;13(1):82-7. https://doi.org/10.51847/8OrtVmWGRO

students of medical (pharmaceutical) institutions of higher education, in particular future masters of pharmacy [5-9].

A. Dobrovolska was engaged in theoretical and practical aspects of IT training of specialists in the field of health care [10] (theoretical substantiation, practical development and elucidation of the effectiveness of the model of the pedagogical system of formation of IT competence of future doctors and pharmacists in the process of obtaining higher education in specialized HEIs), N. Ivankova [11] (development of a model for the formation of information and communication competence of the future doctor, which formalizes the features of the organization of training in medical (pharmaceutical) institutions of higher education), S. Myslovska [12] (establishing ways to improve the training of medical health care students to use information technology in future professional activities), M. Saenko [13] (determination of opportunities to acquaint students of medical institutions of higher education with modern information and communication technologies and ways to use them in future professional activities).

Scientific achievements of I. Nizhenkovskaya, T. Reva, and N. Stuchynska [14-18] are devoted to the problems of the competence approach in pharmaceutical education, in particular, the study of prospects for the development of higher pharmaceutical education, self-study skills, and trends in the training of specialists in the pharmaceutical industry.

The purpose of the study is to analyze the readiness and motivation of graduates of pharmaceutical faculties medical (pharmaceutical) institutions of higher education to use information technology in professional activities.

Materials and Methods

Theoretical and empirical methods of scientific research were used to perform the set tasks, namely:

bibliosemantic method (for studying psychological and pedagogical, scientific literature, normative documents on the formation of digital competence of future masters of pharmacy);

empirical methods to determine the readiness and motivation to use information technology in professional activities surveyed graduates of pharmaceutical faculties medical (pharmaceutical) institutions of higher education. The total number of respondents is 165 people. V. Klimchuka and A. Musica);

statistical methods (for systematization of theoretical and experimental data, analysis of statistical differences in the studied groups of respondents).

Results and Discussion

Analysis of current trends in the use of information technology in pharmaceutical practice gives grounds to argue about the need to form digital competence of future employees of the pharmaceutical industry, changing the benchmarks of the level of training: from user to professional mastery of information computer technology.

In a publication of the Joint Research Center (JRC), the Science and Knowledge Service of the European Commission [19, 20], five main structural components of digital competence were identified: literacy of information operations (viewing, searching, filtering data, information and digital content; evaluation of data, information and digital content; data management, information and digital content), communication and collaboration interaction through digital technologies, sharing of digital technologies, involvement in active public activities through digital technologies, cooperation through digital technologies, network etiquette, digital identity management), creation of digital content (digital content development, integration and processing of digital content, copyright and licenses; programming), security (protection of devices; protection of personal data and privacy; protection of health and well-being; protection of the environment), problem solving (solving technical problems; identifying needs; creative use of digital technologies; identifying gaps in digital competence).

According to the Recommendations of the European Parliament and the Council [21], digital competence involves the confidence and critical use of information society technology for work, leisure, and communication, based on basic ICT skills, namely the use of computers to receive, evaluate, store, produce, present and share information, communicate and working together through the global Internet.

The rapid positive dynamics in the information, production and social processes of the pharmaceutical industry, the change in the portrait of the consumer, and the style of communication have led to increased requirements for personnel policy of employers to select young professionals. A modern specialist in the pharmaceutical industry, which today is high-tech and innovative, must have the skills to process information flows and use data using information and communication technologies. Therefore, an important task of modern pharmaceutical education is to train a highly qualified specialist who will provide quality services and use in their professional activities information and communication and computer-oriented technologies. Effective application of modern technologies is possible only if they are not a superstructure to the existing system of education, but reasonably and harmoniously integrated into the educational process, providing new opportunities for both teachers and students of medical (pharmaceutical) institutions of higher education [22].

The target guideline for the formation of digital competence of future masters of pharmacy is specified through tasks that reflect the main activities in this area, namely:

- formation of knowledge on the theoretical foundations of the use of information technology in pharmacy, collection, storage, retrieval, processing, transformation, dissemination of data in medical and pharmaceutical information systems; types, structure, and characteristics of pharmaceutical information systems; state standards, basic approaches to the formalization and structuring of various types of medical and pharmaceutical data used to form decisions in pharmaceutical activities; algorithms and software to support decision-making in the treatment and prevention process [23];
- formation of skills to use modern Internet resources and services for professional activities; to carry out text and graphic data processing with the use of standard, applied, and special software; to use computer medical and technological systems in the process of professional activity; use statistical algorithms and methods of obtaining knowledge from data;
- possession of the conceptual and functional apparatus in the amount established by the curriculum of the Free Economic Zone; basic technologies of data conversion with the use of word processors, spreadsheets, relational database management systems; skills of using medical information systems and Internet resources for the implementation of professional tasks of the future specialist.

In this regard, it is important to prepare future masters of pharmacy as specialists who are competent in the use of information technology in professional activities. This involves the formation of students' systematic and holistic information-analytical knowledge and skills in the process of professional training. The determining role is the role of computer science disciplines "Information Technology in Pharmacy" and "Computer Modeling in Pharmacy". It should be noted that the methodology of teaching computer science disciplines in higher education institutions is largely determined by the needs of future professional activity. Therefore, as a result of mastering computer science disciplines, students should form an idea of the full range of opportunities and areas of application of modern computer technology to solve problems of professional activity of modern pharmacists. This will increase interest and create additional motivation to study computer science disciplines. Given the trends and rates of development of digital technologies, there is a need for systematic modernization of the educational environment and improving the content, forms, and methods of teaching computer science disciplines.

To establish ways to optimize the educational trajectory of pharmacy students and increase the level of readiness of graduates of pharmaceutical specialties medical (pharmaceutical) institutions of higher education to use information technology in professional activities, we conducted a survey of pharmaceutical/pharmacy industry workers in different regions of Ukraine and different age groups. The questions of the questionnaire concerned the experience of applying the knowledge acquired in the process of studying computer science disciplines in future professional activities. The respondents were 165 specialists in the pharmaceutical industry, of which 46.1 % work as pharmacists, 6.1 % – pharmacist-intern, 6.7 % – pharmacist, 6.7 % – pharmacy managers, and 0.6 % heads of department, and 33.9 % hold other positions. Age categories of respondents: up to 25 years – 72.7 %, from 26 to 34 years – 14.5 %, from 35 to 44 years – 7.9%, from 45 to 54 years – 3.6 % and 1.2% were over 55 years old. 38 people had 1-year experience (23 %), 92 individuals had from 1 to 5 years (55.8 %), 19 respondents – from 5 to 10 years (11.5 %), 5 (3 %) had from 10 to 15 years of experience, 11 (6.7 %) people had over 15 years of experience. 68.5 % of respondents use word processor (MS Word) tools, 62.4 % of respondents use electronic forms in their professional activity. 98.2 % of respondents use the World Wide Web in their professional activities. In turn, 87.3 % of respondents use the resources of the global Internet to improve their professional knowledge and skills. Information-reference and information-search systems are used by 92.7 % of respondents. 67.3 % of respondents are positive about the sale of medicines through the pharmacy's website. Multimedia or interactive presentations in professional activities are used by 59.4 % of respondents. 74.5 % of respondents create queries, reports, or macros in databases during their professional activities.

We analyzed the use by respondents of common professionally-oriented software: Skarb, IBC Pharmacy, ANR Pharmacy, Paracelsus, PC Pharmacy, and 1C. Pharmacy. It was found that the most commonly used software is 1C. Pharmacy (71.5 %), the distribution of the use of other software is shown in **Figure 1**.

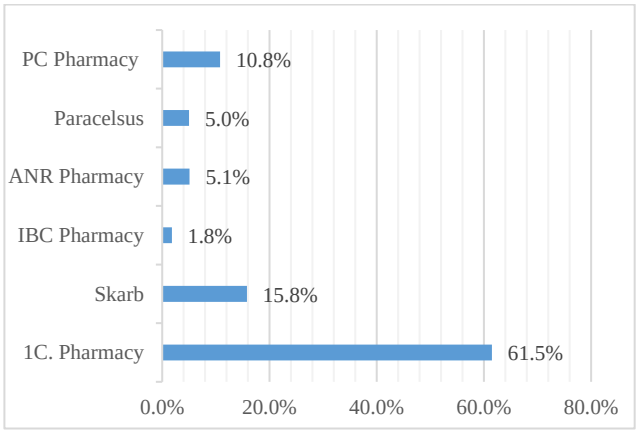

Figure 1. The use of software to sell and search for goods in pharmacies

Information technologies of functional approximation and forecasting of statistical data in professional activity are used

by 26.1%, and computer technologies of statistical analysis of pharmaceutical data – 39.4%.

Also interesting is the attitude of graduates of the Faculty of Pharmacy to distance learning of future masters of pharmacy, which has become widespread in the COVID-19 pandemic: distance learning is supported by 43.6 % of respondents, 38.8 % had trouble answering and 17.6 % do not support distance learning of future Masters of Pharmacy. In particular, the survey asked questions about the application of acquired knowledge and skills in computer science disciplines in professional activities. The majority of respondents believe that the existing digital competence is a necessary component of the readiness of future graduates of the Faculty of Pharmacy to work. The evaluation was based on a 10-point scale, the distribution was as follows: 10 points – 22%, 9 points – 14%, 8 points – 27%, 7 points – 11%, 6 points – 5%, 5 points – 6%, 4 points – 5%, 3 points – 4%, 2 points – 3%, 1 point – 2% **(Figure 2)**.

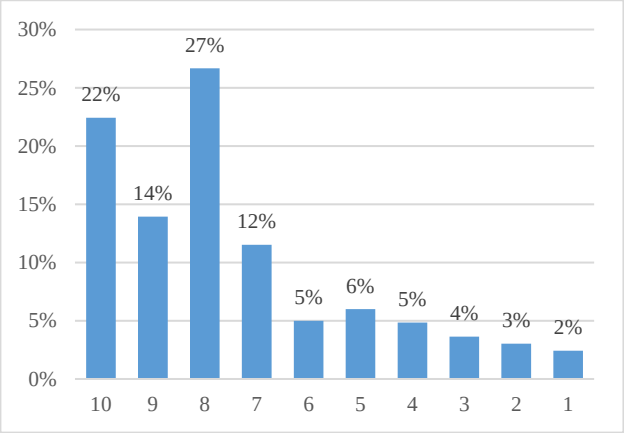

Figure 2. Distribution of respondents' answers on the importance of knowledge and skills acquired in the process of studying computer science disciplines for the professional activity of a pharmacist

As can be seen from the results of the questionnaire, employees of the pharmaceutical industry are quite active in applying the knowledge and skills acquired in the process of studying computer science disciplines in their professional activities. However, there is still a share of respondents who either use little or no information technology in their professional activities. Professional activity is motivated by a set of motives that determine its effectiveness and efficiency. Therefore, it is advisable to find the factors that form the motivational complex of the use of information technology by employees of the pharmaceutical industry.

According to the Ukrainian pedagogical dictionary, motivation – a system of incentives that encourages people to specific forms of activity or behavior. In other words, motivation determines the system of factors that determine the behavior of the specialist and is a characteristic of a particular process that stimulates and provides behavioral activity at a certain level.

R. Ryan's Internal Motivation Questionnaire was used for the survey, adapted by V. Klymchuk and O. Musica. The purpose of the questionnaire was to assess the level of intrinsic motivation to use information technology in the professional activities of pharmaceutical workers. Intrinsic motivation is the performance of a certain activity due to interest in it, subjective sense of its value, and the behavior is due to factors that are not directly related to environmental influences and physiological needs of man.

The questionnaire contained 14 questions, the answers to which were ranked on four subscales: job satisfaction, efforts, awareness of existing competence, personal self-realization. The maximum score that can be obtained for each subscale – 5 points, the minimum – 1 point on the subscale "effort", and (-1) point on the other three. The questions were as follows:

1. The work was boring.
2. I performed the task of my own free will.
3. While working, I felt quite qualified.
4. I spent a lot of energy.
5. I would call this work interesting.
6. I am satisfied with the result of the work.
7. I worked with enthusiasm.
8. It was difficult for me to understand and complete this task.
9. Nobody forced me to do tasks.
10. I think I did a good job.
11. I worked with pleasure.
12. I think I had a choice to do or not do.
13. I have put a lot of effort into doing this work.
14. My refusal to work would lead to negative conclusions.

As noted in, this technique is research, not diagnostic, so its use to analyze the motivation of one subject will not give a valid and reliable result, the questionnaire should be used to compare the parameters of internal motivation of two or more groups of subjects. In our study, respondents were divided into two groups: group №1 – graduates who assessed the importance of acquired knowledge in computer science disciplines from 6 points to 10; group №2, rated such significance from 1 to 5 points. **Table 1** shows the results of the distribution of respondents for each subscale.

Table 1. Generalized distribution of respondents by subscales

Subscale \ Scale	Number of respondents (%) who got into each subscale							
	Group №1				Group №2			
	from 1 to 2	from 2 to 3	from 3 to 4	from 4 to 5	from 1 to 2	from 2 to 3	from 3 to 4	from 4 to 5

Pleasure from activity	13	29	35	24	34	26	21	18
Efforts made	9	31	40	20	42	21	18	18
Awareness of the formed competence	8	26	46	20	39	16	21	24
Personal self-realization	14	23	31	32	50	13	24	13

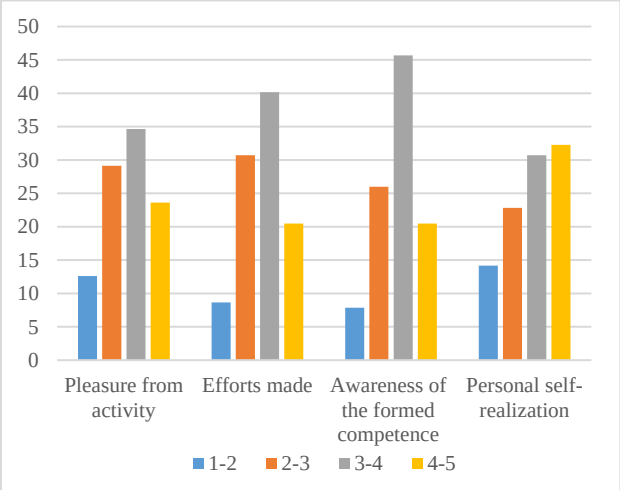

Figure 3. The results of the distribution of the first group of respondents

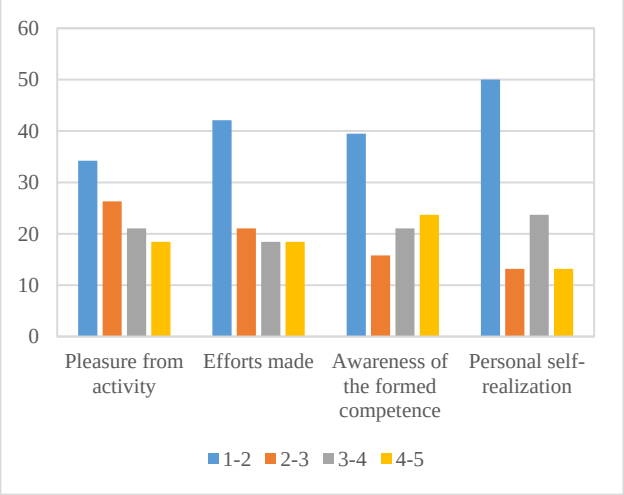

Figure 4. The results of the distribution of the second group of respondents

Since no test standards have been set for the questionnaire, and the number of points scored on each subscale is an indicator of differences in the level of internal motivation to use information technology in professional activities, depending on the number of points scored, summarized results on each subscale were grouped as shown in **Figures 3** and 4. A comparison of the results obtained for each of the subscales is not correct, as each respondent has different scores for each of them, but this approach allows for a comparison of two selected groups that differently assessed the significant knowledge of computer science disciplines for the professional activity of a pharmacist.

The analysis of the results of the answers of the respondents of the first and second groups gives grounds to state the existence of differences in the average indicators. The first group is dominated by the share of answers of respondents, whose answers are rated from 3 to 4 points, their percentage is 38%; in the second group, the largest share falls on the answers, which are estimated from 1 to 2 points – 41%. However, if you look at the results on individual subscales, you can be sure that there are cases when the second group is higher than in the first (for example, "Awareness of competence"). The selected groups are not homogeneous and, since the surveyed samples of respondents are random, the samples are independent, and the scale is a scale of names with 4 categories, so to establish statistically significant differences in averages, in the first and second groups Pearson's nonparametric criterion was used ($\alpha = 0.05$):

$$\chi^2 = \sum \frac{(f - f_t)^2}{f_t}. \quad (1)$$

where f is the empirical frequency, f_t is the theoretical frequency.

$$f_t = \frac{\sum f_i \sum f_j}{n}. \quad (2)$$

where $\sum f_i$ is the sum of frequencies on the corresponding row, $\sum f_j$ – is the sum of frequencies on the corresponding column, n – the total number of observations.

According to the table of points of critical regions χ^2 - distribution for the number of degrees of freedom $\nu = (k-1)(C-1) = (2-1)(4-1) = 3$ at the level of significance $\alpha = 0.05$, a critical the value of $\chi^2_{cr} = 7.8$. After the calculations, the empirical value of $\chi^2_{emp} = 19.23$ was obtained. Since this value is more than critical, there is reason to believe that the differences between the distributions are statistically significant. The averaging of indicators does not allow the interpretation of the general level of motivation, but it allows to confirmation of statistically significant differences in the studied group. Given that the number of points is an indicative indicator, the greater the number of points on the subscales means a higher level of internal motivation to use information technology in professional activities.

Conclusion

The modern pharmaceutical industry needs well-trained highly qualified specialists who, in addition to special professional training, properly and effectively use modern information and communication technologies in professional

activities, work with large data sets, strive for research, self-education, and self-improvement.

The study suggests that there is a relationship between the level of intrinsic motivation and readiness to use information technology in professional activities. The group, which underestimated the importance of acquired knowledge of information technology in pharmacy, has a lower level of intrinsic motivation on all 4 subscales.

It should be noted that R. Ryan's questionnaire allows studying only the internal motivation of respondents, while ignoring the positive and negative factors of external motivation, such as material incentives, prestige, and criticism, which sometimes leads to passivity and lack of initiative.

Prospects for further research are to identify ways to improve information knowledge and skills of future masters of pharmacy and analysis of professional trajectories of graduates of pharmaceutical faculties M(F)IHE.

ACKNOWLEDGMENTS: We would like to thank the administration of the Bogomolets National Medical University for comprehensive support and research assistance.
CONFLICT OF INTEREST: None
FINANCIAL SUPPORT: None
ETHICS STATEMENT: None

REFERENCES

1. Strategy for the development of higher education in Ukraine for 2021-2031. Available from: https://mon.gov.ua/storage/app/media/rizne/2020/09/25/rozvitku-vishchoi-osviti-v-ukraini-02-10-2020.pdf
2. Law of Ukraine "On Higher Education" of 01.07.2014 № 1556-VII. Available from: https://zakon.rada.gov.ua/laws/show/1556-18#Text
3. Spirin OM. Information-communication and information competencies as components of the system of professionally-specialized competencies of a computer science teacher. Inf Technol Learn Tools. 2009;5(13). Available from: https://journal.iitta.gov.ua/index.php/itlt/article/view/183/169.
4. Kucherenko II. Analysis of the results of knowledge control in the discipline "Information Technology in Pharmacy" for students of the Faculty of Pharmacy of NMU named after OO Worshipers. All-Ukrainian scientific-practical magazine "Director of school, lyceum, gymnasium". Special thematic issue "International Chelpanovsky psychological and pedagogical readings". Kyiv: Gnosis, 2019;I(24):247-55.
5. Mykytenko PV, Kucherenko II. The use of educational materials management systems in the process of computer training of medical students. Phys Math Educ. 2021;2(28):63-70.
6. Mykytenko PV, Lapinsky VV. Design of interdisciplinary integration of medical informatics. Inf Technol Learn Tools. 2020;75(1):26-41. doi:10.33407/itlt.v75i1.3569.
7. Kuchyn IL, Vlasenko OM, Gashenko IA, Mykytenko PV, Kucherenko II. Creating the informational and educational environment of the University based on the distance learning platform LIKAR_NMU. Arch Pharm Pract. 2021;12(2):66-74. doi:10.51847/5zZerOAbwA
8. Dobrovolska AM. Formation of IT competence of future specialists within the framework of the pedagogical system model implementation. Young Sci. 2017;5(45):312-24.
9. Saenko MS, Morokhovets GYu. The use of information and communication technologies in future professional activities in the process of studying medical informatics. High School. 2018;3(180):18-21.
10. Reva TD, Nizhenkovska IV, Chkhalo OM, Stuchynska NV. Status and prospects of development of national higher pharmaceutical education. Med Perspect. 2020;25(2):19-25. doi:10.26641/2307-0404.2020.2.206336
11. Reva T, Kucherenko I, Nizhenkovska I, Stuchynska N, Konovalova L, Burmaka O, et al. Digital Component of Professional Competence of Masters of Pharmacy in the Framework of Blended Learning. Arch Pharm Pract. 2021;12(1):98-102. doi:10.51847/avsEptmZsN
12. Pushkarova Y, Chkhalo O, Reva T, Zaitseva G, Bolotnikova A. Using Information Technology in Teaching of the Course “Analytical Chemistry” in Bogomolets National Medical University. Arch Pharm Pract. 2021;12(3):89-93. doi:10.51847/dvMCSbO1SE
13. Pelo IM, Reva TD, Nizenkovska IV, Kozak ND, Konovalova LV. Trends in the professional training of pharmacy specialists in Ukraine. Med Perspekt. 2020;25(3):4-8.
14. Stuchynska N, Sokolova T. Research of communicative activity of medical university students in social networks. Inf Technol Teach Aids. 2011;23(3). Available from: http://journal.iitta.gov.ua/index.php/itlt/article/view/425
15. Carretero S, Vuorikari R, Punie Y. DigComp 2.: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, EUR 28558 EN, Publications Office of the European Union, Luxembourg; 2017. doi:10.2760/38842.
16. Kuchyn Y, Naumenko O, Vlasenko O, Lytvynova S, Burov O, Kucherenko I, et al. The experience of designing a single information and educational environment of the university" NMU Digital". Educ Technol Q. 2022. doi:10.55056/etq.10
17. European Union. Recommendation of the European Parliament and to the Council of 18 December 2006 on key competencies for lifelong learning. Off J Eur Union. 2006. Available from: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:EN:PDF
18. Smirnova ZV, Golubeva OV, Chaykina ZV, Mukhina MV, Kaznacheeva SN. The Role of the Digital Economy in the Management System of Service Organizations. In: Popkova E.G., Sergi B.S. (eds) Economic Issues of Social Entrepreneurship. Palgrave Macmillan, Cham. 2021. doi:10.1007/978-3-030-77291-8_2
19. Draft standard of higher education of the second (master's) level, field of knowledge 22 Health care, specialty 226 Pharmacy, industrial pharmacy. Available from: https://mon.gov.ua/storage/app/media/vyshcha/naukovo-metodychna_rada/proekty_ standartiv_VO/226-magistr-farmatsii-promslova-farmatsiya-mon-ukraini.doc
20. Goncharenko SU. Ukrainian pedagogical dictionary / S.U. Goncharenko. Kyiv: Lybid; 1997. 376 p.
21. Kuatbekov A, Vershitskaya E, Kosareva I, Ananishnev V. E-Learning as a basis for the development of media competences in students. J Inf Sci. 2021. doi:10.1177/01655515211040656
22. Ryan RM. Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. J Pers Soc Psychol. 1982;43(3):450-61.
23. Klimchuk VO, Gorbunova VV. Internal motivation of youth educational activity: theory, methods, development program: monograph. Zhytomyr: Publishing house. ZhSU named after I. Franko; 2014. 110 p.