

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/358382724>

The experience of designing a single information and educational environment of the university "NMU Digital"

Article in Educational Technology Quarterly · February 2022

DOI: 10.55056/etq.10

CITATIONS

8

READS

39

7 authors, including:



Iu L Kuchyn

Bogomolets National Medical University

79 PUBLICATIONS 279 CITATIONS

[SEE PROFILE](#)



Oleksandr Naumenko

Bogomolets National Medical University

33 PUBLICATIONS 62 CITATIONS

[SEE PROFILE](#)



Svitlana Lytvynova

Institute for Digitalization of Education

88 PUBLICATIONS 350 CITATIONS

[SEE PROFILE](#)



Oleksandr Burov

Institute of Information Technologies and Learning Tools, Ukraine, Kiev

49 PUBLICATIONS 453 CITATIONS

[SEE PROFILE](#)

The experience of designing a single information and educational environment of the university “NMU Digital”

Yuriy L. Kuchyn¹, Oleksandr M. Naumenko¹, Oleg M. Vlasenko¹,
Svitlana H. Lytvynova², Oleksandr Yu. Burov², Inna I. Kucherenko¹ and
Pavlo V. Mykytenko¹

¹Bogomolets National Medical University, 13 Taras Shevchenko Blvd., Kyiv, 01601, Ukraine

²Institute for Digitalisation of Education of the National Academy of Educational Sciences of Ukraine, 9 M. Berlynskoho Str., Kyiv, 04060, Ukraine

Abstract. The publication considers theoretical and practical approaches to the design and creation of a single information and educational environment of the Bogomolets National Medical University. The main factors that were taken into account in the development of information and educational environment of the university are identified and substantiated. The basic educational and methodical resources that ensure the functioning of the information and educational environment of modern Medical (Pharmaceutical) Higher Educational Establishment (M(P)HEE) are given. The peculiarities of the educational process at the university are analyzed and the scheme of interaction of the educational-methodical department with the faculties of the university is given. A model of information and educational environment of the Bogomolets National Medical University “NMU Digital”. The list of works related to the educational process performed by the structural units of the university in the automated control system is highlighted. The main advantages of use and functionality of the automated control system, electronic document management system and distance learning platform are revealed and analyzed. The results of an online survey of research and teaching staff and students of different faculties on determining the level of digital orientation are analyzed.

Keywords: digital transformation, information and educational environment, distance learning, automated control system

1. Introduction

Today, every governmental institution (health care is no exception) requires qualified professionals who have a high level of digital skills and are able to work with new technologies. Digital transformation (digitalization) of all spheres of public life, including education and science, is

✉ kuchyn2@gmail.com (Y. L. Kuchyn); naumenko16@ukr.net (O. M. Naumenko); omv13@ukr.net (O. M. Vlasenko); s.h.lytvynova@gmail.com (S. H. Lytvynova); burov.alexander@gmail.com (O. Yu. Burov); innanmu2018@gmail.com (I. I. Kucherenko); mikitenko_p@npu.edu.ua (P. V. Mykytenko)
🌐 <http://nmuofficial.com/rektor/> (Y. L. Kuchyn);
<https://iitlt.gov.ua/structure/departments/technology/detail.php?ID=49> (S. H. Lytvynova);
<https://iitlt.gov.ua/eng/structure/departments/technology/detail.php?ID=281> (O. Yu. Burov)
📞 0000-0002-9667-1911 (Y. L. Kuchyn); 0000-0002-9001-7580 (O. M. Naumenko); 0000-0002-0979-851X (O. M. Vlasenko); 0000-0002-5450-6635 (S. H. Lytvynova); 0000-0003-0733-1120 (O. Yu. Burov); 0000-0002-0734-6544 (I. I. Kucherenko); 0000-0003-1188-4334 (P. V. Mykytenko)



© Copyright for this paper by its authors, published by Academy of Cognitive and Natural Sciences (ACNS). This is an Open Access article distributed under the terms of the Creative Commons License Attribution 4.0 International (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

an important area of higher education not only because of the pandemic, but also in general through global trends and national policy [22].

According to the draft of the Concept of digital transformation of education and science for the period up to 2026 [8], the resolution of the Cabinet of Ministers of January 30, 2019 No. 56 [4] and priority areas and tasks of digital transformation for the period up to 2023 approved by the Cabinet of Ministers of Ukraine dated February 17, 2021 No. 365-r [5] the existing system of education and science must undergo radical digital changes and meet global trends in digital development for the successful realization of each person's potential. Acquisition of digital competencies is a basic need of a modern specialist, so the education system (Medical (Pharmaceutical) Higher Educational Establishment – M(P)HEE) should ensure the formation of digital competencies of students and research and teaching staff [17], as well as initiate the introduction of digital infrastructure and electronic services.

The digital transformation of higher medical education is an integral part of the digital society as a whole, where there is a rapid filling of the world with digital technologies, systems, as well as with their help to establish communication and data exchange. These processes contribute to the development of digital competencies of the subjects of the educational process and are aimed at building an innovative, open and secure digital environment of the university.

Problems of design, implementation and use of an open cloud-oriented educational and scientific environment of a higher education institution have been the subject of research by Bezverbnyi and Shyshkina [1], Bykov et al. [3], Glazunova et al. [11], Kogatin et al. [16], Oleksiuk and Spirin [23], Oleksiuk et al. [24], Osadcha et al. [25], Spirin et al. [27]. The researches of Fedorenko et al. [9], Hurzhii, Kartashova and Lapinsky [12], Kartashova et al. [13, 14] are devoted to the analysis of informatization of general secondary and higher education in Ukraine. The study of some features of informative terminology is revealed in the publication of Zhaldak [31]. Morse and Varchenko-Trotsenko [21] considers the design of the model of effective learning environment of the university using information technology. The research of Spirin and Vakaliuk [28] is devoted to the definition of criteria and establishment of appropriate indicators for the selection of open web-based learning technologies, Trius and Sotulenko [30] talks about problems of creating distance learning support systems for health professionals. Franchuk [10] analyzes and systematizes the most common web-based computer systems in higher education. Stuchynska, Belous and Mykytenko [29] consider approaches to the design and creation of a cloud learning environment for medical students. Marin [19] describes different practices which attempted to enact a digital university: MOOCs and videoconferencing apps used for lecturing. Michaeli et al. [20] investigate the digital changes that have taken place in medical school that are related to the pandemic COVID-19. Rosenman and Swanson [26] discusses the advantages and disadvantages of using digital platforms and wearables, as well as the problems of "Digital Health" in Medical School. Maltese [18] offers new methodologies, data models, authority control mechanisms, and system infrastructures that are able to support a broader range of services in digital university.

2. Methods

Purpose of the article is presentation of design experience and general approaches to creating a single information and educational environment of Bogomolets National Medical University “NMU Digital”.

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

- method of system analysis, comparison and generalization for theoretical substantiation and development of information and educational environment of the Bogomolets National Medical University “NMU Digital”;
- bibliosemantic method – for the study of psychological and pedagogical, scientific literature, regulations on the design of information and educational environment, the use of automated control systems and distance learning technologies;
- empirical methods – conversations with students and teachers, analysis of ways to use learning materials management systems;
- questionnaire – in order to determine the level of digital orientation of students and research and teaching staff of the university;
- modeling – to develop the information and educational environment of the university and analyze its functionality.

3. Results and discussion

First of all, it is necessary to consider the essence of the concepts of “digital competence” and “digitalization of education” to understand the need for the formation of certain skills in the subjects of the educational process when working in the information and educational environment. In the Recommendations of the European Parliament and of the Council [7], digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking. Carretero, Vuorikari and Punie [6] defines the digital competence not only as the ability to use the latest digital technologies, but also as the ability to use these digital technologies in a critical, collaborative and creative way. In particular, this publication identifies five main structural components of digital competence, namely:

- 1) literacy of information operations (viewing, searching, filtering data, information and digital content; evaluation of data, information and digital content; data, information and digital content management),
- 2) communication and cooperation (interaction through digital technologies; sharing of digital technologies; involvement in active public activities through digital technologies; cooperation with the help of digital technologies; network etiquette; digital identity management),

- 3) creation of digital content (digital content development; integration and processing digital content; copyright and licenses; programming),
- 4) security (device protection; protection of personal data and privacy; protection of health and well-being; protection of the environment),
- 5) problem solving (solving technical problems; identifying needs; creative use of digital technologies; defining spaces in numbers competence).

According to Bykov, Spirin and Pinchuk [2], digitalization of education “is a modern stage of its informatization, which involves saturation of information and educational environment with electronic-digital devices, tools, systems and electronic communication between them, which actually allows integrated interaction of virtual and physical, that is, it creates a cyberphysical educational space”. In turn, the information and educational environment will be understood as a continuum of spatio-temporal, socio-cultural, activity, communicative, informational and other factors that appear as conditions for interaction between the developing individual and the objective world of higher education, which are purposefully created and arise spontaneously. Obviously, for effective interaction between the user and the information and educational environment, the subject of the educational process must have established digital competencies.

The results of the analysis of scientific and pedagogical literature allow us to interpret concept of “informational and educational environment” as a continuum of spatio-temporal, socio-cultural, activity-oriented, communicative, informational, and other factors that appear as conditions of interaction between the developing individual and the objective world of higher education that are purposefully created and arise spontaneously. Kasatkin and Tverezovska [15] gives another interpretation of this concept, namely as a system-organized set of tools, information resources, interaction protocols, hardware and software, and organizational and methodological supports, focused on meeting the educational needs of users. In particular, the educational environment of M(P)HEI is a necessary component of the holistic mechanism of professional socialization, life, and professional situations that ensure the entry of students into professional life.

The results of the analysis of scientific and pedagogical literature allowed to identify the main factors that were taken into account in the design and creation of information and educational environment of the university, namely: widespread use in the educational process of computer-based learning technologies; practical implementation of distance learning technologies; providing ICT support for research; wide introduction of digital technologies in education management at different levels; use of cloud technologies; taking into account the features of different computer technology platforms. In the course of digitalization, it is necessary to consider such principles as:

- ensuring access to data and knowledge;
- compliance with the system;
- focus on the development of a single information and educational environment;
- organization of communication, partnership and international cooperation;
- ensuring digital security and management priorities.

Analyzing the experience of organizing training with the help of distance technologies in institutions of higher medical (pharmaceutical) education, it can be stated that important

educational and informational and methodological resources for the formation of the educational environment are:

- official portal of the institution of higher education;
- structured media library;
- thematic collection of video, audio materials, printed materials, methodical materials that provides the maximum visualization of educational, scientific and methodical activity, satisfies the interests of real and potential consumers of educational services in terms of the content of educational activities;
- virtual library – an electronic library with educational, educational and methodical, methodical literature, catalogs of other electronic libraries;
- distance learning courses or their elements as a form of organization and implementation of educational activities and self-education of students using ICT.

Information and educational environment of the Bogomolets National Medical University is based on the use of the latest technologies and provides the educational process with electronic textbooks and teaching aids in relevant disciplines, guidelines for the use of various web services, resources, and creates conditions for: introduction of pedagogically balanced learning models, use of cloud and mobile-oriented learning environments, use of various virtual laboratories, monitoring of academic achievements and disclosure of personal abilities of students.

In figure 1 shows a model of information and educational environment of the Bogomolets National Medical University “NMU Digital”. First of all, all electronic data of entrants are entered by the staff of the Admissions Committee into the Unified State Electronic Database on Education (USEDE) and as soon as the entrant is enrolled in the number of university students, he/she immediately becomes part of the digital environment. All data of the entrant goes to the ACS, and thanks to the integration of the ACS with the university distance learning platform LIKAR NMU, students of our university will have access to video and teaching materials on the YouTube distance learning channel in the disciplines taught to them this or that semester. Orders on the movement of the contingent (enrollment, transfer, deduction or academic leave) of students are formed in the ACS and transferred to the electronic document management environment (electronic management system – EMS), and from there to the necessary departments.

Let’s consider the features of training at Bogomolets National Medical University, which are due to the “specific” organization of both the educational process and its structure. These features include: different duration of initial classes (1, 2, 3 and 5 hours); availability of monodisciplines (the department of a certain faculty teaches the same discipline for students of different faculties); academic disciplines for students of the faculty are taught by scientific and pedagogical employees of the departments belonging to other faculties. Analyzing the scheme of interaction of the educational and methodical department with the faculties of the university (figure 1) it can be traced that the students of the pharmaceutical faculty have academic disciplines taught by different departments, which in turn belong to different faculties, for example:

- faculty of training of foreign citizens (disciplines: “Information Technology in Pharmacy”, “Higher Mathematics and Statistics”, “Latin”);
- medical faculty No. 1 (“Human Anatomy”);
- medical faculty No. 4 (“Hygiene and Ecology”).

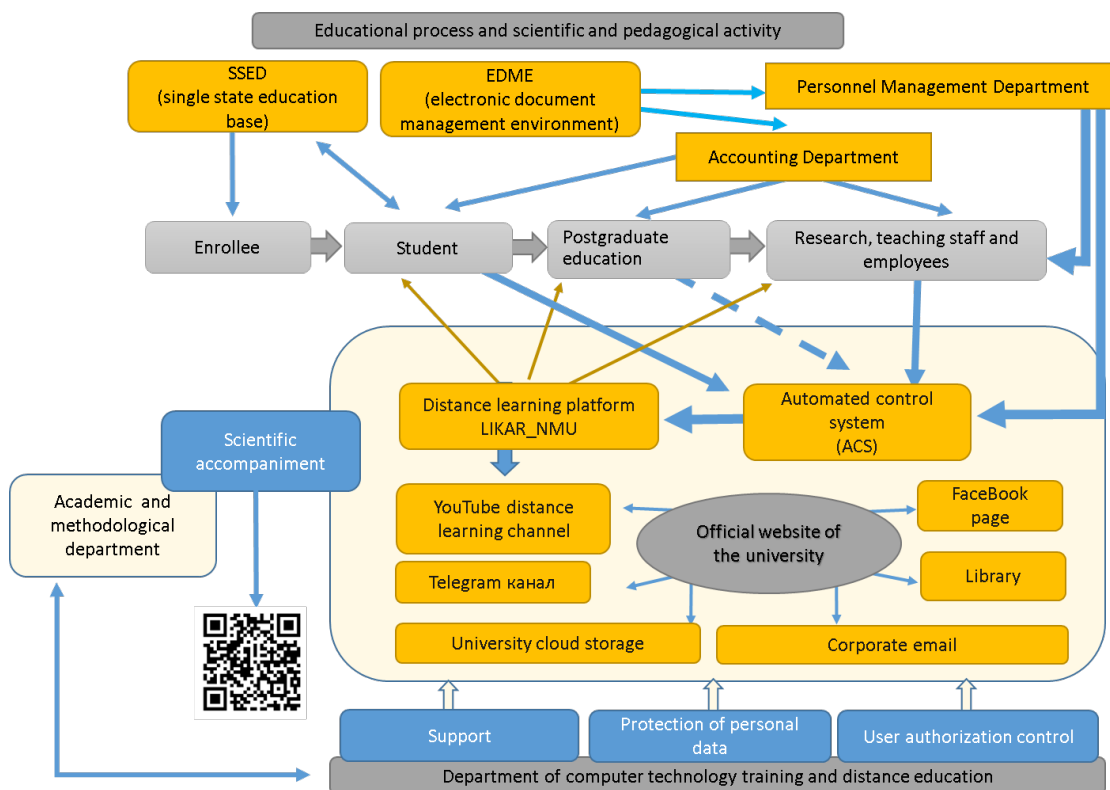


Figure 1: Model of information and educational environment of the Bogomolets National Medical University “NMU Digital”.

Sometimes one department is taught by several departments, for example, the discipline “Life Safety, Fundamentals of Bioethics and Biosafety” will be divided between the Department of Hygiene and Ecology No. 3 of the Medical Faculty No. 4, and the Department of Philosophy, Bioethics and History of Medicine.

In accordance with figure 2, the logical sequence of interaction is as follows: the educational and methodical department calculates the pedagogical load and forms the schedule of educational classes; faculties (dean, deputy dean, methodologists, dispatchers, inspectors) form lists of student groups, monitor academic performance, make curricula into the automated control system (ACS), etc. Having received the previously mentioned information from the educational and methodical department and faculty, the responsible persons from the department assign teachers in the schedule by groups, publish thematic plans for disciplines (calendar-thematic plans of lectures, practical and seminar classes, as well as independent work of students) syllabuses and regulations. classes, final modular controls. In addition, they fill in grade journals, attend lectures, and fill in information on academic performance.

During the period of adaptive quarantine and digitalization of education it is important to ensure not only students’ access to educational and methodical material, but also a reliable communicative component between students, departments, faculties and educational and methodical department and other structural units of Bogomolets National Medical University,

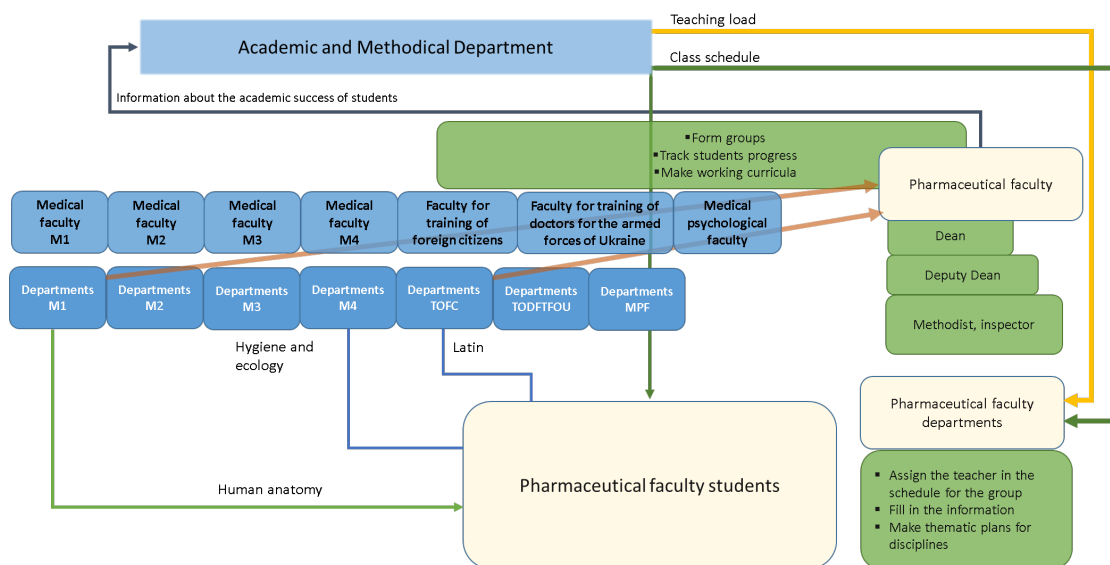


Figure 2: Scheme of interaction of the educational and methodical department with the faculties of the university.

as well as automation of processes related to the placement or completion of information. Especially important is the support and assistance to research and teaching staff of the university in organizing the provision of quality educational services.

At present, it is important to install a new ACS module, namely its synchronization with the ACTION application. In particular, the following documents are available for “sharing”:

- Passport of a citizen of Ukraine in the form of an ID card;
- Biometric passport;
- Registration number of taxes;
- Internally Displaced Persons (IDP) certificate;
- Child’s birth certificate.

In addition to working in the ACS, research and teaching staff carry out organizational and pedagogical activities on the distance learning platform LIKAR NMU (develop and fill distance learning courses and YouTube distance learning channel). Three modules are available on the LIKAR NMU distance learning platform: distance learning; deanery; the organizational structure (figure 3).

The scientific and pedagogical staff of the university developed almost 2000 video recordings of lectures and video recommendations for practical and laboratory work, which were uploaded to the YouTube distance learning channel of Bogomolets National Medical University. The mantis is placed (figure 4). The channel currently has more than 3,000 subscribers.

In order to optimize the information support and counseling of higher education students, teachers, course managers and faculty members responsible for educational work, support chats were created in Viber and Telegram messengers. In addition to the organizational and control function, the university administration together with the educational and methodical

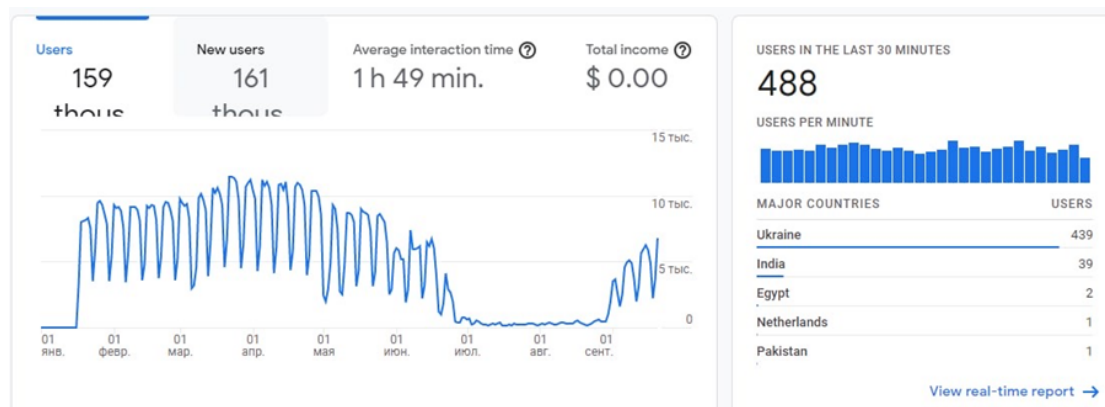


Figure 3: Attendance statistics of the LIKAR NMU distance learning platform.

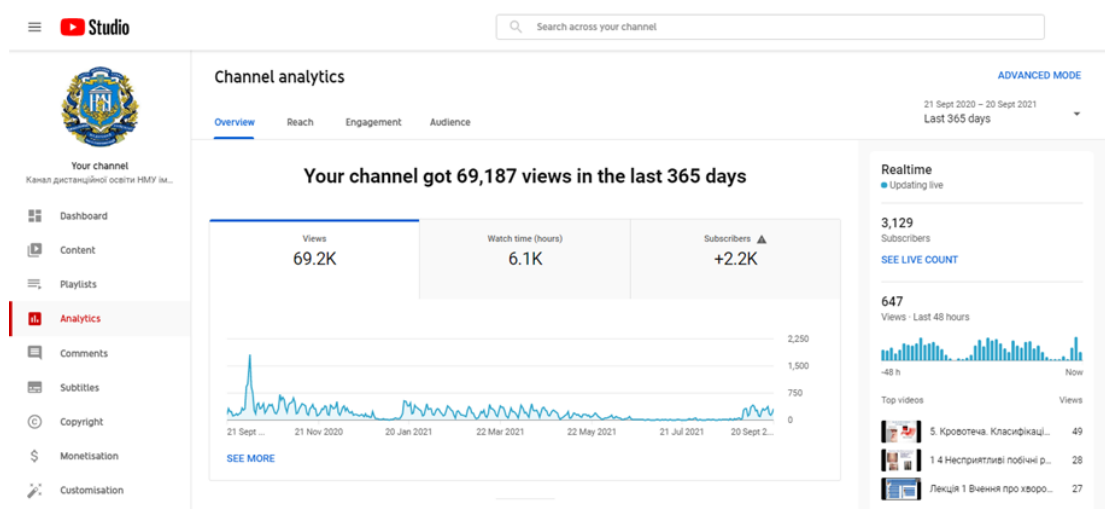


Figure 4: Analytics of views of the YouTube distance learning channel of Bogomolets NMU.

department and the department of computer technology of learning and distance education provides constant scientific support, updating instructions, publishing methodical materials and scientific articles placed in the rubric “Distance learning” on the official website of the university, as well as step-by-step video instructions for teachers were recorded and posted on the distance learning channel.

With regard to postgraduate education, this includes interns and students of advanced training or technical improvement courses. In fact, we have former students of our university, information about which was stored in the ACS and on the platform LIKAR NMU and new users. Data on graduates is stored on the distance learning platform, and software was developed for unregistered users, which solved the problem of fast data transfer from the spreadsheet, and registration of users absent in the ACS (figure 5). This software application is designed for local use.

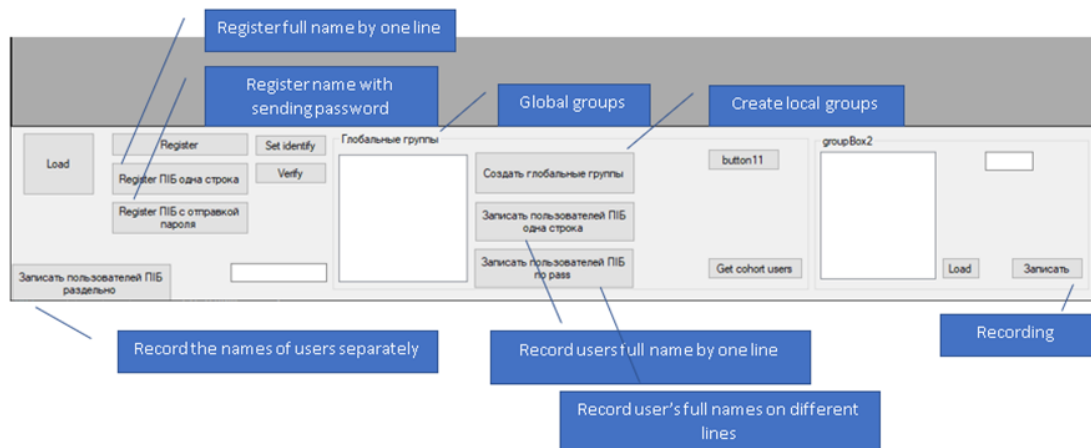


Figure 5: Application window for optimizing user registration without an ACS account.

In addition, a special module on the LIKAR NMU platform has been developed for advanced training and technical improvement courses, which allows generating certificates confirming the completion of training courses. These certificates indicate the educational institution, name, subject of the training course and the date of completion.

An important role in the interaction between structural units is played by the environment of electronic document management (EMS). Thanks to EMS, the hierarchy of management actions of the university administration, structural units and faculties is clearly traced and adhered to. Quite convenient is the fact that the order or order of the university can be immediately sent to all necessary users for review, signature or review. The head of the structural unit has the opportunity to review the status of execution of the order and find out whether all colleagues are performing their duties properly. This is quite convenient, especially when there is a powerful institution and structural units are located in different parts of the city, you do not need to spend time and resources on the way to the office building and waiting in line for signatures under offices, most importantly to have constant access to the Internet.

In the process of designing an information and educational environment of the university, it was expedient to establish the readiness of the teaching staff and students of different faculties to use digital technologies in their activities. In order to determine the level of digital orientation of research and teaching staff and students of Bogomolets National Medical University a questionnaire was conducted. A total of 939 respondents took part in the survey, of which 87 were faculty, 817 were full-time students and 38 were part-time students (figure 6, 7).

Respondents were asked to rate their own components of digital competence on a 5-point scale:

- Respondents rated information literacy as follows: 37% – by 5 points, 46% – by 4 points, 14% – by 3 points, 2% – by 2 points, 1% – by 1 point.
- Respondents rated communication and cooperation as follows: 45% – by 5 points, 38% – by 4 points, 13% – by 3 points, 3% – by 2 points, 1% – by 1 point.

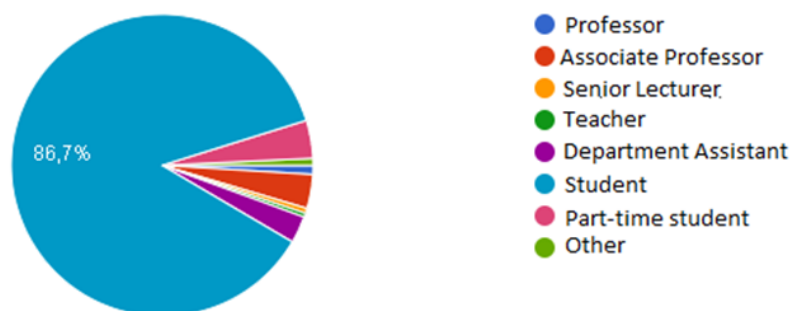


Figure 6: Distribution of respondents depending on the position / form of education.



Figure 7: Distribution of respondents depending on the faculty.

- Respondents rated the creation of digital content as follows: 25% – by 5 points, 36% – by 4 points, 27% – by 3 points, 8 – by 2 points, 4% – by 1 point.
- Respondents rated data protection as follows: 29% – by 5 points, 33% – by 4 points, 27% – by 3 points, 7% – by 2 points, 4% – by 1 point.
- The solution of technical problems was assessed by the respondents as follows: 23% – by 5 points, 33% – by 4 points, 30% – by 3 points, 9% – by 2 points, 5% – by 1 point.

As can be seen from the results of the answers to this question, most respondents assess themselves at a sufficient level of digital competence. It was also suggested to assess one’s own level of interest in the use of digital tools:

- Work on the global Internet: 65% respondents have a high level, 30% respondents have a medium level, and 5% respondents have a low level.
- Visualization: 63% respondents have a high level, 34% respondents have a medium level, and 3% respondents have a low level.
- Ensuring cybersecurity: 45% respondents have a high level, 38% respondents have a medium level, and 17% respondents have a low level.

- Scientific communication: 51% respondents have a high level, 40% respondents have a medium level, and 9% respondents have a low level.
- Electronic documents: 53% respondents have a high level, 38% respondents have a medium level, and 9% respondents have a low level.
- Mobile devices: 71% respondents have a high level, 24% respondents have a medium level, and 5% respondents have a low level.

It can be stated that the majority of respondents are interested in using digital tools when working on the global Internet and with mobile devices, at least in ensuring cybersecurity of data.

In response to the questionnaire “In your opinion, what are the main requirements to be met during the digital transformation of education?”, distance learning technologies were identified in the first place, research learning and blended learning in the second and third, respectively (figure 8).

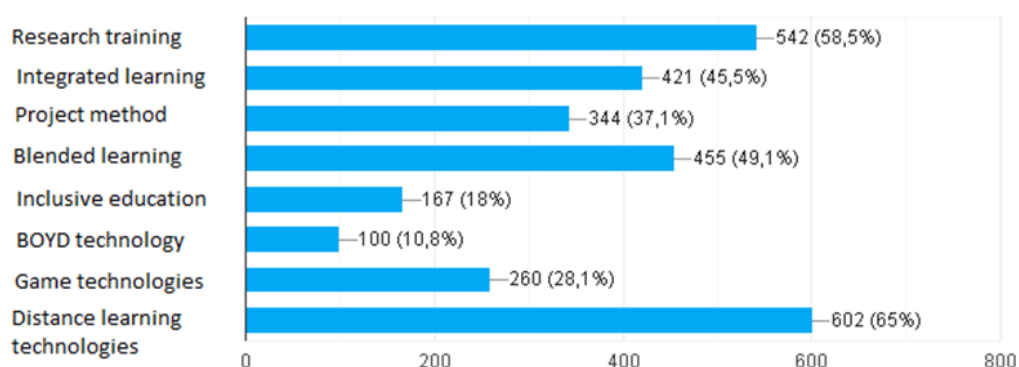


Figure 8: Distribution of respondents’ answers to the main requirements should be provided during the digital transformation of education.

To the question “Do you have the skills to create digital content?” the following answers were received: 51.9% of respondents have a basic level (I create simple digital content (text, tables, images, audio files) in at least one format), 39.5% of respondents have a medium level (I create complex digital content in different formats (for example, text, tables, images, audio files) and have the skills to create web pages or blogs); 8.6% of respondents have a high level (I create complex multimedia content in different formats, using a variety of digital tools and environments, I can create a website).

To the questionnaire question “Do you have the skills to create digital content online in cloud storage (for example, Google Drive or Dropbox)?” such answers were received, 58.4% indicated that “yes”, 41.6% – “no”.

To the question “Do you have the skills to use e-mail and messengers (for example, Viber, Telegram or WhatsApp) in professional activities?” the following answers were received, 97.1% – said “yes”, 2.9% – “no”.

Having studied the attitude of respondents to the organization of the educational and information environment of Bogomolets National Medical University we can note that 44.4% are

completely satisfied, 37.9% are undecided, and 17.7% are dissatisfied. Analyzing satisfaction with the quality of information support, the following results were obtained: 44.5% were completely satisfied, 35.5% were undecided and 20% were dissatisfied.

4. Conclusions and prospects for further research

The designed single information and educational environment “NMU Digital” unites all participants of educational and scientific activity, providing space for communication and data exchange, simplifies and modernizes management processes at the university. The implementation of the proposed concept aims to ensure: a qualitatively new level and effectiveness of the university; development of a unified information educational environment of the university; high level of quality of training and advanced training of students; increasing the efficiency and effectiveness of research; high level of digital competence of university employees.

The information and educational environment developed at the university consists of many components. Its organization involves not only the use of modern digital technologies, such as automated document management system, distance learning platform, automated control system, YouTube, telegram channel, official website, but also establishing communication between all structural units of the university, creating conditions for the formation of digital competence in order to work in the information and educational environment of the university.

Analysis of the results on the level of digital orientation of teaching staff and students of Bogomolets National Medical University gives grounds to conclude that a significant number of respondents need to improve their digital competence. Most users have high skills in working on the Internet and with mobile applications, this applies mainly to students. In our opinion, it is possible to expand knowledge in other directions by updating the content of computer science disciplines. As for the teaching staff, web trainings and seminars should increase their digital competence. Tracking the dynamics of digital competence changing is a prospect for future research, as the process of creating information and educational environment of the university is long and is implemented in stages. The results of the conducted sociological research will contribute to the creation of new opportunities for adjustment, development, and functioning of the informational and educational environment of the university.

Prospects for further research are aimed at developing proposals for ways to develop digital competence of students and research and teaching staff of the university. The proposed concept for the design of information and educational environment of the university needs constant improvement and in our opinion, the results of sociological research will help create new opportunities for adjustment, development and functioning of the information and educational environment of the university.

References

- [1] Bezverbnyi, I.A. and Shyshkina, M.P., 2022. The use of serverless technologies to support data processing within the open learning and research systems. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.

- [2] Bykov, V., Spirin, O. and Pinchuk, O., 2020. Modern tasks of digital transformation of education. *Unesco Chair Journal "Lifelong Professional Education in the XXI Century"*, 1, pp.27–36.
- [3] Bykov, V.Y., Vernygora, S.M., Hurzhii, A.M., Novohatko, L.M., Spirin, O.M. and Shyshkina, M.P., 2019. The design and use of the open cloud based learning and research environment of a university. *Information technologies and learning tools*, 74(6), p.1–19. Available from: <https://doi.org/10.33407/itlt.v74i6.3499>.
- [4] Cabinet of Ministers of Ukraine, 2019. Resolution "On some issues of digital development". Available from: <https://zakon.rada.gov.ua/laws/show/56-2019-%D0%BF#Text>.
- [5] Cabinet of Ministers of Ukraine, 2021. Order "On some issues of digital transformation". Available from: <https://zakon.rada.gov.ua/laws/show/365-2021-%D1%80#Text>.
- [6] Carretero, S., Vuorikari, R. and Punie, Y., 2017. *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Luxembourg: Publications Office of the European Union. Available from: <https://doi.org/10.2760/38842>.
- [7] Council Recommendation of 22 May 2018 on key competences for lifelong learning (Text with EEA relevance), 2018. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2018.189.01.0001.01.ENG&toc=OJ:C:2018:189:TOC.
- [8] Draft concept of digital transformation of education and science for the period up to 2026, 2021. Available from: <https://mon.gov.ua/storage/app/media/news/2021/05/25/tsifrovizatsiigromadskeobgovorennya.docx>.
- [9] Fedorenko, E.H., Velychko, V.Y., Stopkin, A.V., Chorna, A.V. and Soloviev, V.N., 2019. Informatization of education as a pledge of the existence and development of a modern higher education. *CEUR Workshop Proceedings*, 2433, pp.20–32.
- [10] Franchuk, V., 2020. *Methods of teaching informative disciplines in pedagogical universities using web-oriented systems*. Kyiv: National Pedagogical Dragomanov University Publishing House.
- [11] Glazunova, O.G., Korolchuk, V.I., Parhomenko, O.V., Voloshyna, T.V., Morze, N.V. and Smyrnova-Trybulska, E.M., 2022. Methodology for using cloud-oriented environment for flipped learning of the future IT specialists. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.
- [12] Hurzhii, A., Kartashova, A. and Lapinsky, V., 2018. Informatization of general secondary education in Ukraine. *Reports of the XIII International Scientific Conference Modern Advances in Science and Education*. Netanya, Israel, pp.9–13.
- [13] Kartashova, L.A., Gurzhi, A.M., Zaichuk, V.O., Sorochan, T.M. and Zhuravlev, F.M., 2022. Digital twin of an educational institution: an innovative concept of blended learning. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.
- [14] Kartashova, L.A., Prykhodkina, N.O., Makhynia, T.A., Tymoshko, H.M., Sholokh, O.A. and Zhuravlev, F.M., 2022. Social media as a strategic tool in school management: experience of Ukraine and USA. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.

- [15] Kasatkin, D. and Tverezovska, N., 2011. Information and educational learning environment: history, classification and functions. *Sci notes Ternopil Volodymyr Hnatiuk Natl Pedagog Univ. Series: Pedagogy*, 3, pp.190–196.
- [16] Kolgatin, O.H., Kolgatina, L.S., Ponomareva, N.S., Shmeltser, E.O. and Uchitel, A.D., 2022. Systematicity of students' independent work in cloud learning environment of the course "Educational Electronic Resources for Primary School" for the future teachers of primary schools. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.
- [17] Kuzminska, O., Mazorchuk, M., Morze, N., Pavlenko, V. and Prokhorov, A., 2019. Study of Digital Competence of the Students and Teachers in Ukraine. *Communications in computer and information science*, 1007, pp.148–169. Available from: https://doi.org/10.1007/978-3-030-13929-2_8.
- [18] Maltese, V., 2018. Digital transformation challenges for universities: Ensuring information consistency across digital services. *Cataloging & classification quarterly*, 56(7), pp.592–606. Available from: <https://doi.org/10.1080/01639374.2018.1504847>.
- [19] Marin, L., 2021. The digital university. *On the possibility of a digital university: Thinking and mediatic displacement at the university*. Cham: Springer International Publishing, pp.57–77. Available from: https://doi.org/10.1007/978-3-030-65976-9_4.
- [20] Michaeli, D., Michaeli, D., Keough, G., Strotzer, Q. and Michaeli, T., 2021. Digital medical education and students' mental health: effects of the COVID-19 pandemic in Germany. *The journal of mental health training, education and practice*. Available from: <https://doi.org/10.1108/JMHTEP-03-2021-0035>.
- [21] Morse, N. and Varchenko-Trotsenko, L., 2015. Using wiki-technology to organize the learning environment of a modern university. *Open educational e-environment of a modern university*, 1, pp.115–125.
- [22] Morze, N.V. and Strutynska, O.V., 2021. Digital transformation in society: key aspects for model development. *Journal of physics: Conference series*, 1946(1), p.012021. Available from: <https://doi.org/10.1088/1742-6596/1946/1/012021>.
- [23] Oleksiuk, V. and Spirin, O., 2022. The experience of using cloud labs in teaching Linux operating system. *Communications in Computer and Information Science*.
- [24] Oleksiuk, V.P., Oleksiuk, O.R., Spirin, O.M., Balyk, N.R. and Vasylenko, Y.P., 2020. Some experience in maintenance of an academic cloud. *CEUR Workshop Proceedings*, 2879, pp.165–178.
- [25] Osadcha, K.P., Osadchyi, V.V., Kruglyk, V.S. and Spirin, O.M., 2022. Analysis and summarization of the experience of developing adaptive learning systems in higher education. In: S. Semerikov, V. Osadchyi and O. Kuzminska, eds. *Proceedings of the Symposium on Advances in Educational Technology, AET 2020*. University of Educational Management, Kyiv: SciTePress.
- [26] Rosenman, D. and Swanson, W.S., 2020. Digital health in medical school. *Academic medicine*, 97(7). Available from: <https://doi.org/10.1097/ACM.0000000000003359>.
- [27] Spirin, O., Oleksiuk, V., Balyk, N., Lytvynova, S. and Sydorenko, S., 2019. The blended methodology of learning computer networks: Cloud-based approach. *CEUR Workshop Proceedings*, 2393, pp.68–80.

- [28] Spirin, O.M. and Vakaliuk, T.A., 2017. Criteria of open web-operated technologies of teaching the fundamentals of programs of future teachers of informatics. *Information technologies and learning tools*, 60(4), p.275–287. Available from: <https://doi.org/10.33407/itlt.v60i4.1815>.
- [29] Stuchynska, N.V., Belous, I.V. and Mykytenko, P.V., 2021. Use of modern cloud services in radiological diagnostics training. *Wiadomości lekarskie*, 74(3), pp.589–595. Available from: <https://doi.org/10.36740/WLek202103205>.
- [30] Trius, Y. and Sotulenko, O., 2017. Creating a distance learning support system for health professionals based on Moodle. *Automation and computer-integrated technologies in production and education: state, achievements, development prospects: materials All-Ukrainian scientific-practical Internet conference (AKIT-2017)*. Cherkasy: ChNU B. Khmelnytsky, p.259–261.
- [31] Zhaldak, M.I., 2019. Some features of ukrainian informatic terminology. *Naukovyi chasopys NPU imeni M.P. Drahomanova. Serii 2. Kompiuterno-orientovani systemy navchannia*, (21 (28)), p.3–9. Available from: [https://doi.org/10.31392/NPU-nc.series2.2019.21\(28\).01](https://doi.org/10.31392/NPU-nc.series2.2019.21(28).01).