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INFORMATION SUPPORT OF E-LEARNING: UKRAINIAN CHALLENGES AND CASES DURING THE WAR

Abstract

The work is devoted to the description of the e-learning environment as an element of the information system for ensuring the activities of the university. The relationship between the processes of building a digital economy and digitalization of the educational system is shown. Due to the global pandemic and military actions Ukraine during 2019-2022 there was a certain evolution from classroom learning (until 2020) – to distance learning synchronous (2020 – early 2022) and asynchronous learning (starting from February 24, 2022). Based on bibliometric analysis, it is possible to formulate the purpose of the article: a description of a student-oriented university information system and an asynchronous e-learning system that allows to motivate a student to study, activate his role in the educational process and establish contact with a tutor. The general characteristics of the information system for ensuring the activities of the university (Ukrainian case) are presented in terms of the relationship of each of its blocks with the educational environment of e-learning. Examples of blocks of such an information system are given and a classification of elements of the e-learning environment is given. In the example of the case of the Ukrainian university, the structure of the e-learning environment is shown, which solves the problems of creating content and algorithms for online and remote learning, including asynchronous.

Keywords: *asynchronous learning, bibliometric analysis, information system, learning system*

Streszczenie

Praca poświęcona jest opisowi środowiska e-learningowego jako elementu systemu informacyjnego zapewniającego działalność uczelni. Pokazano związek między procesami budowania gospodarki cyfrowej a cyfryzacją systemu edukacji. Ze względu na globalną pandemię i działania wojskowe na Ukrainie w latach 2019-2022 nastąpiła pewna ewolucja od nauczania stacjonarnego (do 2020 r.) – do nauczania na odległość synchronicznego (2020 – początek 2022 r.) i asynchronicznego (począwszy od 24 lutego 2022 r.). Na podstawie analizy bibliometrycznej można sformułować cel artykułu: opis uniwersyteckiego systemu informacyjnego zorientowanego na studenta i asynchronicznego systemu e-learningowego, który pozwala zmotywować studenta do nauki, aktywować jego rolę w procesie edukacyjnym i nawiązać kontakt z tutorem. Ogólna charakterystyka systemu informacyjnego zapewniającego działalność uniwersytetu (przypadek ukraiński) została przedstawiona w kontekście relacji

każdego z jego *bloków* ze środowiskiem edukacyjnym e-learningu. Podano przykłady bloków takiego systemu informacyjnego oraz klasyfikację elementów środowiska e-learningowego. Na przykładzie ukraińskiego uniwersytetu przedstawiono strukturę środowiska e-learningowego, które rozwiązuje problemy tworzenia treści i algorytmów dla nauczania online i zdalnego, w tym asynchronicznego.

Słowa kluczowe: *asynchroniczne uczenie się, analiza bibliometryczna, system informacyjny, system uczenia się*

Introduction

Russia's war against Ukraine, which began in 2014 with Donbass, in 2022 escalated into a full-scale war. This has led to many socio-economic problems (Lukianenko, Simakhova 2023, p. 129-138): deaths from hostilities, refugees, large numbers of wounded and maimed, closures, destruction of Ukrainians' homes and infrastructure, unemployment, poverty, restrictions on the use of national land due to its partial occupation, and damage mining, shelling and pollution of Ukrainian territories; reduction of the labor force employed in productive production; reduction of consumer spending; reorientation of public expenditures in favor of the military sphere; rising inflation, psychological trauma of Ukrainians, etc.

The International Monetary Fund (IMF) as of March 7 forecasts a 10% decline of the Ukraine's economy in 2022 and expects the inflation to rise to 20% because of war (Levchuk 2022). Ukraine's direct and indirect economic losses will also be determined by such global threats as the slowdown in the world economy due to the destruction of established supply chains, rising prices for raw materials and energy resources, increasing global confrontation and defense spending, which we believe will further reduce Ukraine, up to 30%. The country must face an important task – building a new digital economy in Ukraine that will not harm nature, transforming society in accordance with the principles of democracy and justice, preserving and developing those exceptional social changes that took place on the wave of patriotism in the face of aggression. At the same time, the new system must be very stable and resilient, using all the achievements of digitalization

of the world economy, as safe as possible from destruction due to new challenges and threats. The education system did not stay away from these processes. Ukraine has had the practice of relocated universities for 8 years (from Luhansk and Donetsk oblasts to the Western oblasts of Ukraine). Two years of pandemics have provided online learning and online accreditation experience (Stukalo, Simakhova 2020, p. 3673-3678).

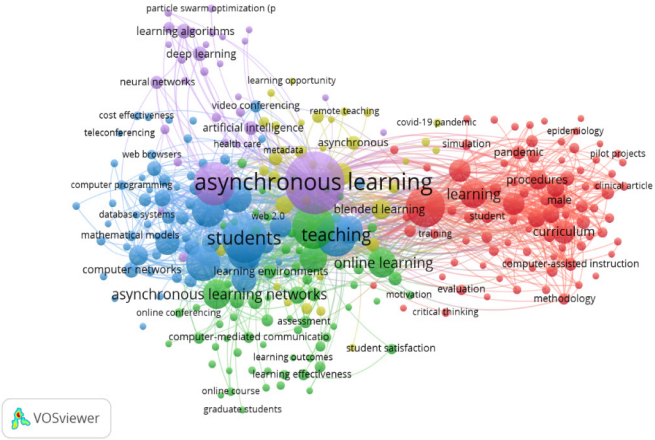
Significant threats in the field of education are associated with a huge number of IDPs (over 10 million people), and over 8 million of people have crossed the borders of Ukraine since 24 February 2022 (UNHCR 2022). These are mostly young people and children, future students, and entrants. Under such conditions, the use of online learning by Ukrainian universities during the admission campaign is extremely important (Simakhova, Artyukov, Shamarlouskaya 2022, p. 1-15).

Online learning can be done synchronously and asynchronously. Synchronous learning tools have been widely used during the pandemic for two years. During the war, asynchronous learning is becoming increasingly important, as all participants in the educational process are no longer territorially in one city, they can be scattered in different regions and even be in different countries. In addition, not everyone has the same Internet access, different curfews, and the level of security from the war (Zatonatska, Dluhopolskyi, Wołowiec, Podskrebko, Maksymchuk 2022, p. 110-113). Thus, during the war, synchronous learning is not always acceptable for the above reasons. So, in Ukraine during 2019-2022 there was a certain evolution from classroom learning (until 2020) – to distance learning synchronous (2020 – early 2022) and asynchronous learning (starting from February 24, 2022).

Literature review

Bibliometric analysis of the keyword phrase *asynchronous learning* was conducted for 975 articles published in the period 1991-2022 (Figure 1).

Figure 1. *Keywords map for asynchronous learning in 1991-2022*



Source: composed by authors by VOSviewer in Scopus database

The results of the bibliometric analysis show that the scientists paid the main attention to the tools of asynchronous learning, assessing their effectiveness and the motivation of students to *learn* certain tools. At the same time, the results of the bibliometric analysis for the keyword *learning systems* and its relationship with other keywords (phrases) within the map presented above in different periods of the publication of articles are interesting (Figures 2-3). As can be seen from the cluster structure, online learning is becoming a competitor in the form of blended learning, and the emergence of remote learning is becoming a trend in the light of the development of new technologies. Certain restrictions on the process of blended learning are imposed by the global situation with the development of the coronavirus pandemic. The consequence of this is the strengthening of the positions of asynchronous learning as the best option for conducting a dialogue with a student who is motivated to learn and is prone to critical thinking (Zatonatska, Wołowiec, Dluhopolskyi, Podskrebko, Maksymchuk 2023).

Figure 2. *Cluster learning systems in publications for the period of 1991-2012*

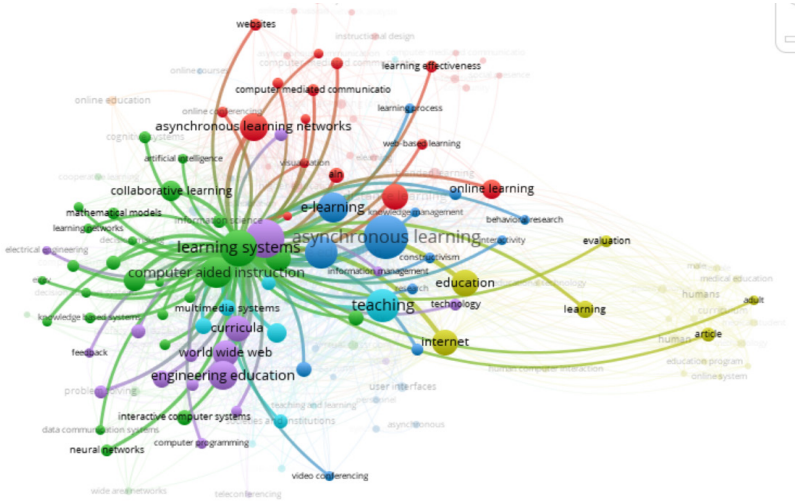


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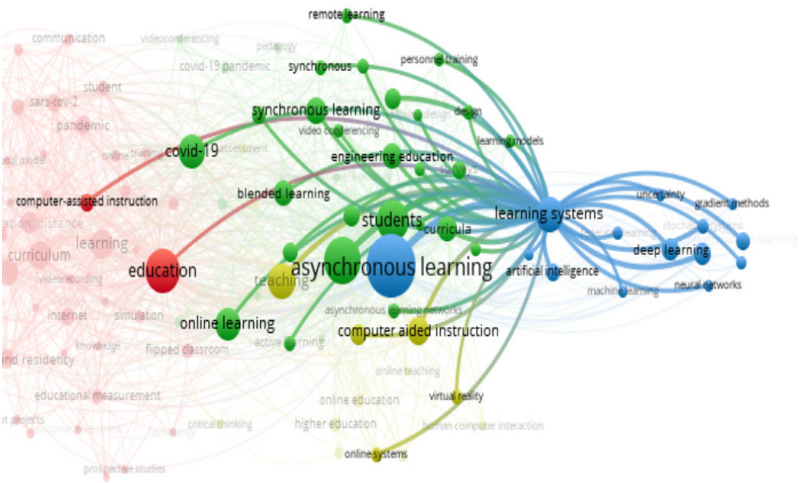
Figure 3. *Cluster learning systems in publications for the period of 2013-2022*



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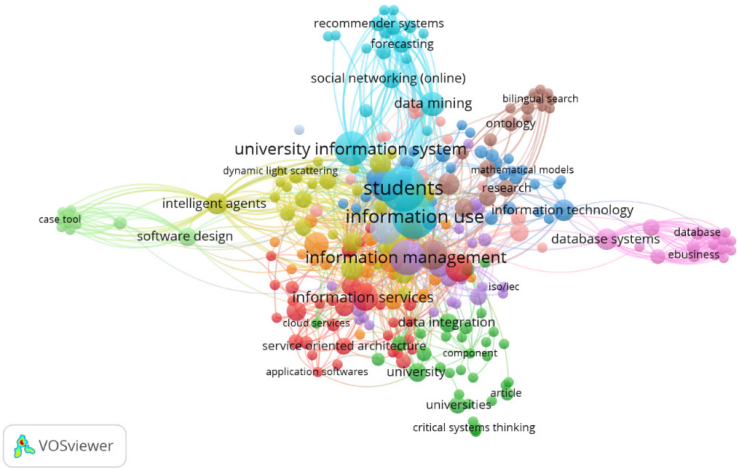
To ensure effective transfer of knowledge and skills in asynchronous learning, several components are important:

- active role of the student in the learning process;
- availability of a developed and optimized university information system;
- effective procedures for interaction between a student and a tutor;
- effective tools for *involving* students in the learning process.

A bibliometric analysis for the key phrase *university information system* was carried out for 476 articles published over the period 1991-2022 (Figure 4).

Figure 4. *Keywords map for the query university information system in 1991-2022*



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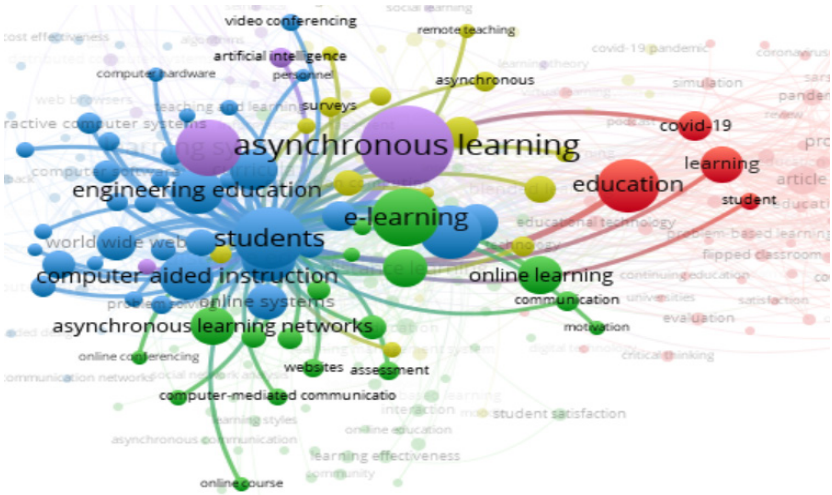
Comparing the maps for the key phrases *asynchronous learning* and *university information system*, one can see that the student is a key figure in research related to the choice of teaching tools and information system building tools at the university. In the context of student-centered learning, the results of bibliometric analysis confirm the thesis about the need to find ways to increase the student's degree of *enthusiasm* for learning. In the existing teaching paradigm, which is professed by the world's leading universities, the student must

first engage in self-study. However, this does not detract from the importance of creating an attractive learning cover that matches the modern idea of learning by students, when at any opportunity they turn to their gadgets for help.

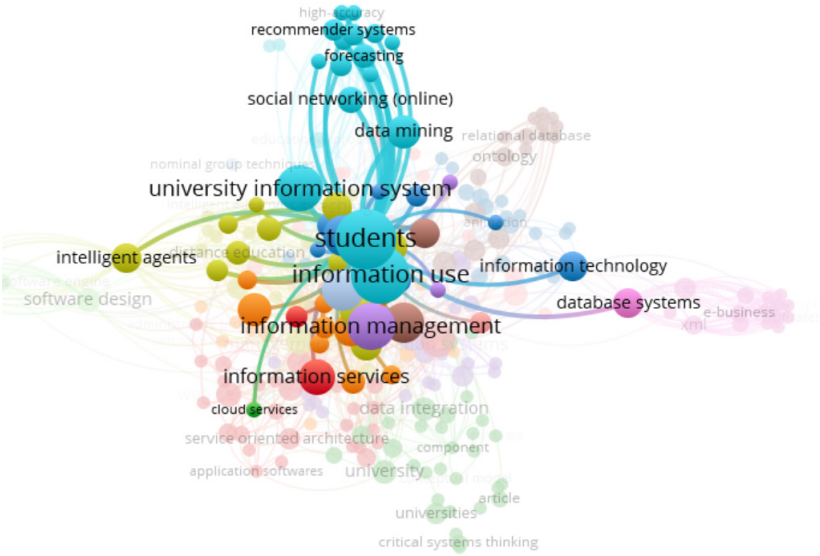
What is the place of the student in the works devoted to asynchronous learning and information systems at the university? The answer to this question can be given by the analysis of the *student* cluster within the obtained maps for the key phrases *asynchronous learning* and *university information system* (Figures 5-6). Scientists are studying the role of students in providing an effective information management system and choosing optimal information technologies (Figure 5). In fact, this is the first step in creating a student-friendly e-learning environment and providing the necessary level of networking (Figure 6).

Figure 5. *Cluster student in the keyword map for the query asynchronous learning*



Source: composed by authors by VOSviewer in Scopus database

Figure 6. *Cluster student in the keyword map for the query university information system*



Source: composed by authors by VOSviewer in Scopus database

Addressing the scientists who studied the issues of asynchronous learning, it should be noted the research of A. Artino (Artino 2015, p. 272-276), M. Shahabadi and M. Uplane (Shahabadi, Uplane 2015, p. 129-138), M. Berezytskyi and V. Oleksyuk (Berezytskyi, Oleksyuk 2016, p. 51-63), who considered the theory and development of asynchronous learning, factors influencing students' choice of this technique. Authors E. Alqurashi (Alquarashi 2019, p. 133-148) and W. Bao (Bao 2020, p. 113-115) analyzed student satisfaction with online learning. In her publication, L. Bennett (Bennett 2020) discusses the benefits of asynchronous learning: teach or train at scale, flexibility, convenience, reinforce learning, more learner control.

The topic of e-learning has been paid attention to in many scientific works, starting with the introduction of distance learning with the beginning of COVID-19, in particular: V. Shevchenko et al. (Shevchenko, Malysh, Tkachuk-Miroshnychenko 2021, p. 1-16), H.I. Falfushynska et al. (Falfushynska, Buyak, Tereshchuk, Torbin, Kasianchuk 2021, p. 261-273). E-learning became even

more relevant with the outbreak of a full-scale war on February 24, 2022, an article by L. Matviichuk et al. (Matviichuk, Stefano, Hnedko 2020, p. 295), I. Levenok, O. Sydorenko (Levenok, Sydorenko 2022, p. 275-278).

Creation of an effective system for providing e-learning, as well as the e-learning environment itself, is the prospect of successful university activities in providing such areas:

1. achievement of sustainable development goals, in particular Goal 4 *Quality education*, Goal 8 *Decent work and economic growth*, Goal 9 *Industry, innovation and infrastructure*, Goal 17 *Partnerships for the goals* (Vorontsova, Vasylieva, Bilan, Ostasz, Mayboroda 2020, p.6-26, Artyukhov, Volk, Surowiec, Skrzypek-Ahmed, Bliumska-Danko, Dluhopolskyi, Shablystyi 2022, p. 11468, Artyukhov, Volk, Vasylieva, Lyeonov 2021);
2. systematic digitalization of educational activities as an element of the strategy for the transition to a digital economy (Artyukhov, Volk, Dluhopolskyi, Mieszajkina, Myśliwiecka. 2023, 7771, Vorontsova, Vasylieva, Lyeonov, Artyukhov, Mayboroda 2021, p. 242-245);
3. intensive marketing and knowledge management, transfer of knowledge and innovations (Yarovanko, Bilan, Lyeonov, Mentel 2021, p. 369-387);
4. creation of a favorable environment for internal and external quality assurance of education (Lyeonov, Vasylieva, Bilan, Bagmet 2021, p. 272-291), including the preservation of the scientific and educational potential of universities in the post-pandemic and post-war period;
5. support for the image of the national educational system in international rankings (Artyukhov, Vasylieva, Lyeonov 2021, p. 148-154); e-learning and its support in various regions (Skrynnyk, Vasilyeva 2020, p. 1314-1328, Naamati Schneider, Meirovich 2020, p. 115-121, Altinay, Dagli, Altinay, Altinay 2020, p. 09-14, Boyko, Turko, Dluhopolskyi, Henseruk. 2021, p. 660; Polianovskyi, Zatonatska, Dluhopolskyi, Liutyi 2021, p. 595-613); quality of education assessment by stakeholders (Dluhopolskyi, Knysh, Oleksiv, Smyrna, Panchenko 2021, p. 68-82; Volk, Artyukhov, Lyeonov 2022, p. 590-593, Akpoviroro, Adeleke 2022, p. 83-93, Ogunleye, Afolabi, Ajayi, Omotayo 2023, p, 83-89, Hafez, Salam, Farid, Farouk

2023, p. 67-77, Liuta, Lieonov, Artyukhov, Sushko-Bezdenezhnykh, Dluhopolskyi 2021, p. 158-164;

6. economic aspects of education quality;
7. technologies for involving students in assessment activities;
8. the impact of learning on the formation of the entrepreneurial university.

Thus, on the basis of bibliometric analysis and literature review, it is possible to formulate the purpose of the article – description of a student-oriented university information system and an asynchronous e-learning system that allows to motivate a student to study, activate his role in the educational process and establish contact with a tutor (Zatonatska, T., Wołowiec, T., Dluhopolskyi, O., Podskrebko, O., Maksymchuk 2023).

Methodology and results

The information base for this study is based on scientific articles, monographs by Ukrainian and foreign authors and the authors' own empirical research.

Scopus scientometric database was used for bibliometric analysis. Bibliometric analysis tool – VOSviewer.

The main method of the study was bibliometric analysis using the VOSviewer software tool to analyze the relationships between different categories and build maps to visualize the interconnectedness between them in publications indexed by the Scopus database. The bibliographic analysis was carried out using the keywords: asynchronous learning, learning systems, university information system for 1991-2022.

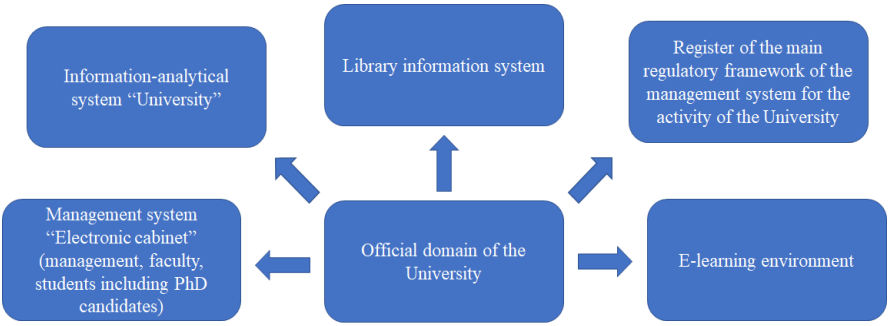
The bibliographic analysis is effective for studying the dynamics of the publication of articles on the topic of e-learning, their citation, number and other criteria.

In the process of long studies of university information system and asynchronous e-learning system as Ukrainian case, there have been determined.

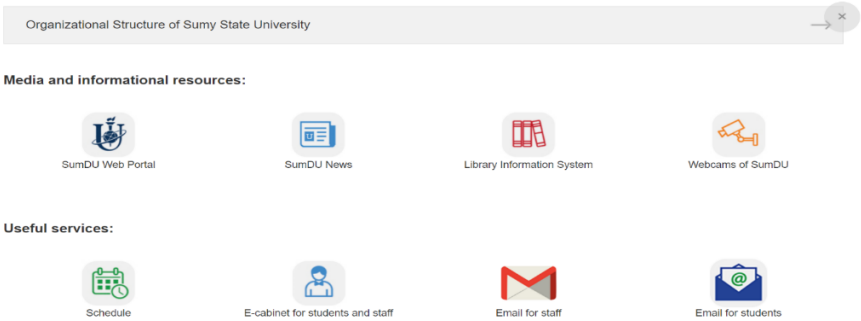
- the university life support information system consists of a number of blocks, each of which is directly or indirectly a part of the e-learning environment (Figure 7);

Figure 7. *University information system (on the example of Sumy State University)*

a. general structure



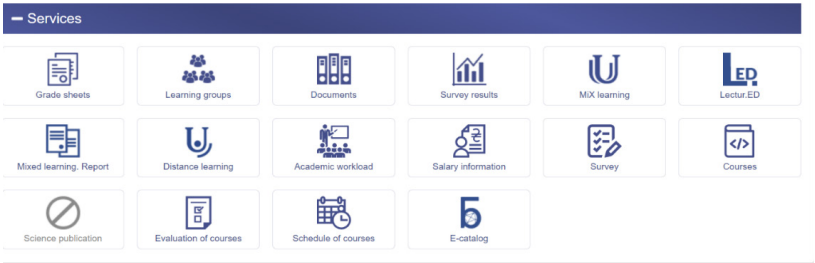
b. organizational structure



Source: Sumy State University, 2023

- block *Official domain of the University* – a coordinating navigator element;
- block *Information-analytical system "University* – ensuring the process of managing educational activities;
- block *Management system "Electronic cabinet* – services for communication of participants in the educational process (Figure 8);
- block *Register of the main regulatory framework of the management system for the activity of the University* – normative support, algorithms and procedures for the implementation of the educational process;
- *Library information system* block – providing access to educational materials and electronic subscription services (Figure 9);
- block *E-learning environment* – the actual learning environment (Figure 10).

Figure 8. *Management system Electronic cabinet*

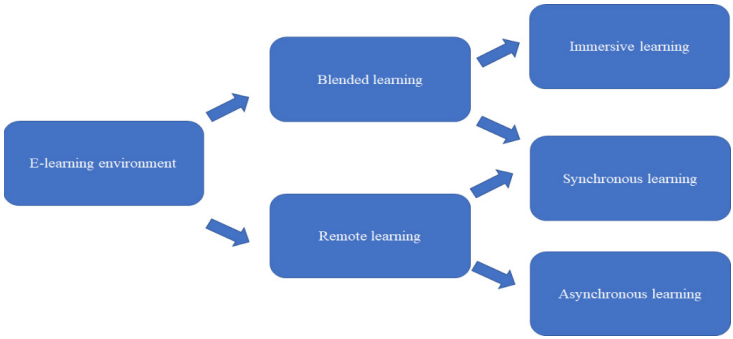


Source: Sumy State University Electronic Cabinet, 2023

Figure 9. *Library information system*

a. general structure

b) organizational structure



Source: Sumy State University Library, 2023

Figure 10. *E-learning environment (on the example of Sumy State University)*

Source: Sumy State University E-learning, 2023

Conclusions

The information system for organizing the educational activities of the university includes autonomous blocks, which at the same time are important links in the process of ensuring the quality of e-learning. The e-learning environment, including asynchronous, requires not only content creation, but also organizational and technical support for online, blended, or remote learning.

An effectively organized e-learning system will create an effective environment in which the goals of sustainable development will be achieved through the provision of quality education and the achievement of economic growth. The use of various types of distance learning, as Ukraine's experience in wartime shows, can be useful for other countries under certain circumstances regarding movement restrictions (K. Kovtoniuk, O. Diachenko, N. Novikova, Y. Holovnia, O. Dluhopolskyi 2021, p. 83-84).

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