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Open Education and Open Science is a Key Agenda for University Libraries

The **objective** of this research is to examine the scientific studies worldwide on OE, determine the main characteristics and trends in the development of OE and analyze the world academic libraries' experience in promoting Open Science (OS) and wider use of scientific research results. **Methods.** To assess data based on the Library internet resources usage descriptive statistics and observation methods were exploited. **Results.** The focus was made on the necessity of providing free access to educational resources in Ukrainian universities in various scenarios of uncertainty and challenges, especially at times of war. In terms of our investigation, we analyzed the role of the VSPU Library in creating environment for open educational resources and made an attempt to evaluate the effectiveness of implementation of the EU's open science policy. **Conclusions.** The findings revealed the gradual implementation of the principles of OE in the pedagogical university, which is beneficial for both students and educators to get free access to relevant educational content, while enhancing institutional reputation of the university and library professionals.

Keywords: open education (OE); open science (OS); open educational resources (OER); university libraries; VSPU Library; digital content; university students; institutional repository

Introduction

Open science and open education have been transforming the landscape of academic and educational environment leading to the refining of communication technologies, distance learning methods, and acquiring the necessary skills. The concept of open education (OE) involves integrating all forms of human learning, fostering synergy in understanding the openness of the world and promoting free access to diverse information systems with emphasis on a learner-centered approach, the development of information literacy, and a shift in the teacher's role.

The principles of open education enable the formation of a modern digital learning environment, the development of open educational resources and their integration into curricula, highlighting the viability and value of open educational tools in teaching and learning. They also facilitate the adoption of open educational resources (OER) allowing users to freely access, use, distribute, and redistribute high-quality, flexible educational materials.

The issues related to open access to academic and educational knowledge have long been in focus of Ukrainian and foreign scholars. However, this topic remains relevant, particularly

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today, as Ukraine faces numerous challenges that need to be articulated. On the one hand, there is a need to create conditions for education in times of war and forced migration, and on the other, it is essential to support European integration processes and consider globalization trends.

The idea of providing fast and free access to open science and open education simultaneously emerged in both academic and librarian communities. Although, librarians, as advocates for knowledge openness, education and library innovation had begun promoting the initiative of open access to information resources much earlier, they are still facing a number of challenges caused by internal and external factors. The diversity of interpretations of open education characteristics presented in recent academic studies indicate diverse perspectives on the subject which requires further research. Moreover, significant disparities in addressing open-access issues still exist among European Community members. Despite similar directions in implementing OER in higher education libraries across different countries, national differences exist in library approaches and practices due to varying levels of technological development and financial support.

For the purpose of the future implementation of Open Educational Resources in the VSPU library, the study on the current state of OER development in both foreign and Ukrainian libraries was conducted. In the course of our research, we made an attempt to analyze Ukrainian and foreign scholars' publications in the international scientometric databases to identify relevant studies on OE, the functional value of electronic documents, and the creation and purpose of OER.

The purpose of our study is to investigate the current state of the introduction of OE and OS in the VSPU Library, analyze the dynamics of digital resources use and explore the strategic objectives of the VSPU Library in creating comfortable environment for OER and ensuring access to national and world educational and scientific information resources.

Methods

In order to assess data sets both quantitative and qualitative analyses were employed. To determine the role and significance of OE, and evaluate the effectiveness of open-access resources, the study exploited descriptive statistics and observations. A content analysis of international and Ukrainian scientific resources was carried out to explore the involvement of academic libraries in the creation of an OER ecosystem.

The authors who have been involved in the creation of institutional repositories examined research publications, conducted observations, and made comparisons based on their own experience, as well as their educational and instructional applications. The respondents were represented by both the faculty and students.

Website and repository statistics were generated using Google Analytics, which allows detailed tracking of page visits for any selected period. To improve visibility and coherence of some specific measurements, the assessment of digital resource use and services in particular, the Counter standard was used. However, the reliability of certain indicators based on the Counter still provides no guarantee.

Results and Discussion

Fundamentally, the concept of OE implies the removal of barriers to learning, meaning that every individual can receive an education regardless of their place of residence, age, nationality, or physical condition. It also includes government support for education in the form of various benefits and scholarships and the application of innovative teaching technologies (*Vidkryti Naukovi Praktyky*, 2023).

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A crucial factor in ensuring the functionality of OE and OS is the creation of open educational resources (OER) ecosystem and their active use. The goals and methods of advancing and developing OER firstly defined in Open Education Declaration were later promoted as open-access resources by the UNESCO Declaration. Further, the discussions centered on integrating OER into national education systems, showcasing best practices for implementing OER, and formulating relevant recommendations. Library professionals were identified as key stakeholders in formal, non-formal, and informal education therefore, libraries play a crucial role in balancing the efforts of educators and authors with mechanisms that assist in the search, creation, organization, preservation, publication, and dissemination of OER online.

Since Open Educational Resources (OER) are considered to be educational materials that are fully accessible under a free license or are placed in the public domain, they are crucially important for the effective functioning of modern digital learning environments in higher education institutions. Through information and communication technologies the users can freely access a wide range of high-quality and flexible educational materials, distribute, and redistribute them (Havrilova & Voronova, 2019). Among the benefits pointed out by Ukrainian scholars, open textbooks in digital format can be static PDFs, HTML-based with hyperlinks, adaptable fonts, and adjustable page sizes and interactive e-texts containing videos, quizzes, pop-up glossaries, and instructor comments (Kolesnykova, Gorbova, Shcherbatiuk, 2022; Kolesnykova, 2023). Open textbooks serve as an alternative to commercial textbooks and are commonly adopted by university publishers (Buist-Zhuk & Nieborg, 2022).

During various risks and unpredictability, the global education system is undergoing transformation and adaptation to new complex situations that change the traditional learning process and human interaction, utilizing virtual and online education (Cuaton, 2020). With the rapid transition to distance and blended learning, OER are recognized by universities worldwide as the most promising approach. Thus, the librarians' roles must be well-established, substantial, and influential considering historical, cultural, educational, financial, and other aspects in adopting OER (Elder, 2019).

Due to the pioneers of the OER movement worldwide, practical support for open education through OER is a desirable area of activity for most U.S. and Canada academic libraries, which focus on OER publishing management, library training sessions, seminars, conferences, the use of publishing platforms, and marketing published OER (Pate & Thornton, 2022). Although, significant changes are taking place in library services across America driven by Open Data as a fundamental part of Open Science, scholars confirm that academic libraries face increasing challenges in hosting and supporting open big data, as this leads not only to the expansion of traditional library services but also to the adoption of new roles and responsibilities. This includes, but is not limited to, developing support models for research data management, assisting in data governance, enhancing librarians' data literacy skills, integrating library services into research and education by participating in grants, and more (Tzanova, 2020).

According to the studies analyzed, in Europe tremendous work implementing principles of OE and OS has been carried out by the European Network of Open Education Librarians, a public organization, which is a community of European researchers who share educational values and advocate for OE (European Network). ENOEL librarians, through numerous activities and tools, aim to recognize libraries in higher education as key, trusted partners in making educational resources and practices open and accessible to all, in line with UNESCO's Recommendation on OER (Santos-Hermosa, Proudman, & Corti, 2022).

We have to admit that along with the successful functioning of European academic libraries and a high degree of understanding of both open science and citizen science and their applicability for society and research, there exist common barriers such as resources, funding, strategy, and lack

of policy (Kaarsted et al., 2023). The worth mentioning is Croatian scholars' research aiming to map practices related to the development and implementation of OER in European higher education institutions in the field of Library and Information Science (LIS) during the COVID-19 pandemic (Mićunović, Rako, & Feldvari, 2023). Some researchers suggest how digital libraries can be best utilized for knowledge access and shared in the new digital market, emphasizing the role of the European Open Science Cloud and the strategy for unified digital market (Stefanova & Stefanov, 2022).

Rather disturbing tendency among academic staff has been revealed in the survey conducted by Finnish scholars, when most of them either lack awareness of open science or are unwilling to implement it, since incentives and career advancements still favor traditional research methods (Saarti, Rosti, & Silvennoinen-Kuikka, 2020). In terms of beneficial and challenging aspects libraries have been experiencing, the scholars admit that libraries, in general, find more challenges than opportunities in the areas of resource provision, cultural change, and policymaking. In contrast, libraries see more benefits than challenges in Open Education practices and developments in the institutional environment (Santos-Hermosa, Proudman, & Corti, 2022).

Regarding open educational resources, copyright compliance is crucially important and deals with the issues of respecting copyright: the rights of the author, the rightsholder and the rights of the user in digital and print environments. Thus, librarians and information professionals must continuously clarify the boundaries of exceptions and limitations to creator rights; respect hard boundaries of rights where they exist; make use of ambiguity in the law (*Pro Avtorske Pravo*, 2022) to fully occupy the public policy space created for users' rights; and articulate the associated rights, such as access to and preservation of works for society's benefit. (Owen, 2022).

Currently, academic researchers and library experts are unanimous regarding the important services in academic libraries which should include consultations on copyright and open licensing; information literacy, including open education; training/learning sessions; management and storage services; search services; collection management and collaboration with educational publishers; metadata for indexing digital resources; and joint creation of OER with instructors. The emphasis should be put on the implementation of literacy courses or relevant modules in general educational disciplines of higher educational institutions aiming to help learners acquire skills of critical information perception and open access to valuable high-quality information (Buchatska, Zarichna, Matiienko, & Khurtenko, 2024).

Considering that academic libraries in Ukraine have actively implemented the ideas of openness for almost two decades, today they continue supporting the philosophy and practices of open scientific research. The situation academic libraries in Ukraine faced due to the full-scale war has, on the one hand, posed challenges characterized by uncertainty in various operational aspects, and on the other hand, served as a significant factor for qualitative changes in library work. Taking into consideration the inability to provide physical access to educational resources, university libraries have acutely felt the need for modern Ukrainian electronic textbooks and free open-access textbooks in their collections to support the educational and research missions of their institutions.

Over the past few years, first the COVID-19 pandemic and then the full-scale russian-Ukrainian war have forced the Ukrainian educational and research environment to switch largely to remote teaching and learning. These circumstances require the implementation of open online access to educational resources, being a unique complex of information content that represents the personal scientific and methodological achievements of the university's faculty, along with primary and supplementary educational materials hosted on distance learning platforms and institutional repositories (Terentieva, 2023). The role of academic libraries in ensuring access to digital resources is crucial, as they serve as key intermediaries between information resources and

users' educational needs, thereby facilitating effective learning and development (Ponomarenko, 2023).

An extensive experience of the Scientific Library of the Ukrainian State University of Science and Technologies (Dnipro) by providing digital resources, digital products (as a library publisher), and online services to support education and research may be beneficial for many academic libraries. Scientific research, a pilot project, and established OER support practices at the university and its scientific library have contributed to the launch of a pool of modern Ukrainian open textbooks with a single access point, the Open Educational Resources Search Index (OERSI) (Kolesnykova, Corti, & Buist-Zhuk, 2022).

Taking into consideration the experience analyzed above, the faculty representatives and librarians of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University joined their efforts to implement the best world practices in the University Academic Library supporting OE policies and finding effective arguments for educators in adopting and adapting OER. We believe that activities provided by academicians in promoting information literacy and the Library's initiatives aiming to improve learning conditions and quality for higher education students were effective and successful.

The VSPU Library, as an information center, has focused on disseminating the results of scientific research and educational and methodological materials in the global information space. Prior to this, the Internet project "Library 2.0" which was implemented from 2014 to 2019, enabled the Library to provide users of the Internet with access to resources and services across all core areas of its activity. Within the framework of the "Library 2.0" project, the following initiatives were introduced: an institutional repository; a virtual reference service and a full-text electronic archive of the library's publications, including a "Digital Collection of Valuable and Rare Publications."

Several regional Internet projects were launched and continue to be implemented on an ongoing basis. Among them: a biographical project titled "A Life Connected with Podillia"; an informational and bibliographic project titled "Vinnychchyna in the Library's Electronic Catalog Database" and a bibliographic project titled "Vinnychchyna on the Internet."

The Library has created a significant array of internet resources of various orientations, unified through a single access window via the Library's website. Thus, the available resources and services have enabled the Library's quick adaptation to serving users under martial law conditions. Using various methods, the Library promotes the latest educational standards, including open access resources. (Lazarenko et al., 2022).

As observed from Figure 1, considerable progress with regard to the availability of various resources has been made by librarians under supervision of institutions and faculties since 2014. In response to the evolving needs of the academic community, the university library is actively engaging with the principles of open science and open education. The Library website features content (http://library.vspu.edu.ua/html/naukovi_sajti.htm), which comprises links to the Institutional Repository (IrVSPU), textbooks, and educational manuals.

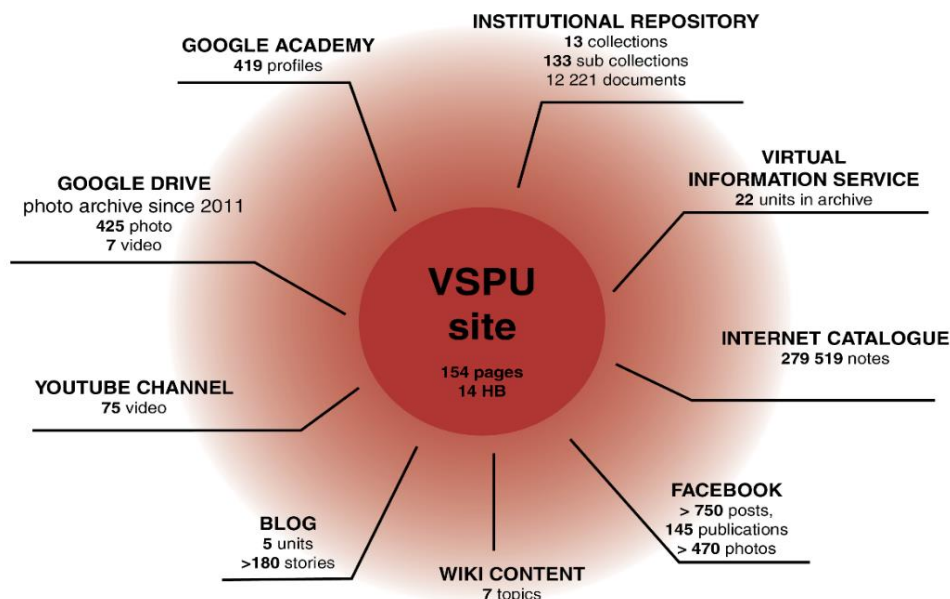


Fig. 1. VSPU electronic library: Library's presence on the global Internet (2024)

The results of our investigation indicated that the Library's professionals took considerable efforts to launch the Institutional Repository, which is one of the key components of the research e-infrastructure that ensures open access to educational materials and research findings. The Library's website hosts an Institutional Repository (<https://dspace.vspu.edu.ua/>), which is registered in the international directories OpenDOAR and ROARMAP.

At the beginning of our study we estimated the value of repositories which enable the self-archiving of academic and educational documents and represent an effective method of implementing the "green" route to open access (Kaliuzhna, 2023) as well as serve as platforms for presenting and disseminating scholarly output that may not be suitable for publication in peer-reviewed journals or that must comply with open access mandates (Demetres, Delgado & Wright, 2020).

The usage statistics of the Library's Internet resources during 2020–2024 are introduced in *Table 1* according to the category. We observed a gradual increase of users' interest in full-text electronic resources and the Website visits in pandemic years (2020–2021) and a slow decrease starting from 2022. The statistics are compiled based on sessions (up to 30 minutes).

The number of Virtual Reference Service visits shows the same dynamics of sharp decline after 2020 and minimal usage since. From the data collected it becomes evident that a high Institutional Repository usage in 2022 can be explained by the time it was launched (2020) involving faculty representatives and librarians. However, it dropped to 1,798 in 2022 and continued downward to 845 in 2024, aligning with the reported technical issues and power cuts.

The findings of the study presented below reveal a clear trend of increasing use of educational resources notwithstanding the circumstances. The highest levels of Internet resource usage occurred during the quarantine years (2020–2021) which was affected by the transition to

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online learning. Even with the beginning of the russian invasion the results indicate an increase in accessing the Library's Internet resources and document downloads.

The most striking result to emerge from the data is Online Catalog usage with the steady high levels in 2020–2022, notable drop in 2023 and crucial return to the levels of 2020.

Table 1

Usage statistics of the library internet resources visits (2020–2024)

Years	2020	2021	2022	2023	2024
Resources	Visits				
Website (sessions)	93 330	209 790	199 176	116 408	70 000
Virtual Reference Service	780	137	137	58	65
Institutional Repository (sessions)	83 990	93 434	1 798	1 449	845
Online Catalog (i.ua counter)	191 150	182 997	187 226	116	223 492
WOS, Scopus (WOS statistics)	3 815	3 815	4 402	11 800	12 155
YouTube (embedded counter)	4 190	5 782	7 244	7 085	4 336
Blog (embedded counter)	2 455	5 149	3 604	4 925	5 216
TOTAL	379 708	501 104	403 587	141 841	316 109

There are several explanations to the outcomes presented in Figure 2 which reveals a slight decline in the Library's site usage in 2023. First of all, it can be attributed to technical issues such as the temporary unavailability of the electronic catalog and institutional repository; secondly, which respectively influenced the first reason, power cuts and blackouts caused by severe russian attacks during that period of wartime.

Although performance was not ideal, we dare to conclude that the data demonstrate a marked expansion of accessible resources and users' interest in them in the VSPU Library during the 2023–2024 academic year. It can be assumed that the free access and use of educational resources is beneficial for both students and educators, which leads to improving learning conditions and quality for higher education students, while enhancing the institutional reputation of the university, and library professionals. The recent research confirms that works published in open access (OA) formats are downloaded more frequently and disseminated more rapidly and widely within academic and educational communities. (Lazarenko et al, 2022).

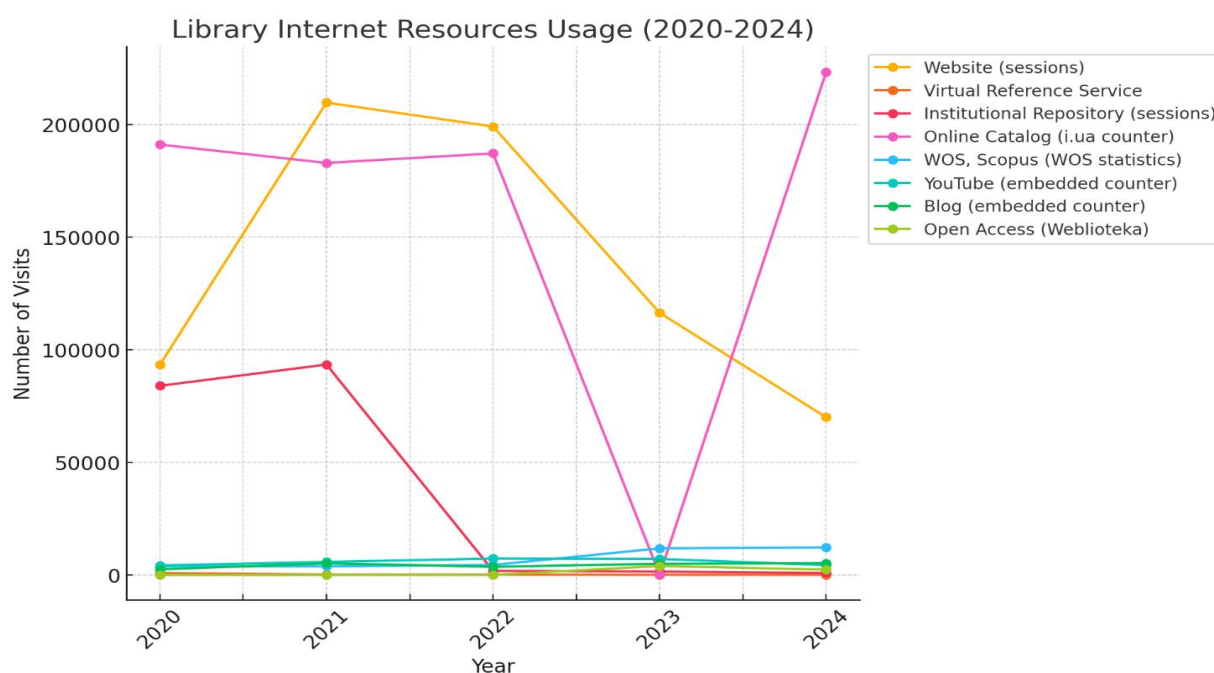


Fig. 2. The VSPU library internet resources visits (2020–2024)

Building on both national and international experience in open education, and taking into account the successful practices of the Scientific Library of the Ukrainian State University of Science and Technology (SL USUST), the VSPU Library is adopting a “step-by-step” approach. This initiative, implemented in close collaboration with university researchers, aims to develop a new trajectory in digital publishing – the production of original, open-access textbooks.

Among the priority areas of the Library’s work are the further development of a powerful electronic library providing free and unrestricted access to information; maintaining the institutional repository; promoting the effectiveness of scientific research on teaching methodologies for specific academic disciplines; implementing modern scientific advancements and best practices in the educational process; and creating and ensuring access to open electronic resources.

Through coordinated efforts between academic staff and library professionals, the university expects to significantly expand its presence in both national and international academic networks, enhance its scientometric performance, and ensure the high-quality preparation of future educators.

Conclusions

The findings of this study support the idea that libraries play a crucial role in facilitating access to OE and OS for all stakeholders in the educational process. They contribute to improving the quality of education by enhancing its accessibility, effectiveness, and innovativeness, and serve as essential agents in the accumulation and preservation of open digital resources. By utilizing open digital resources, academic libraries can expand students’ access to relevant educational content and provide high-quality learning materials for academic development and self-education.

Hence, the study supports the conclusion that the implementation of OE and OER is particularly relevant in the context of the current global uncertainties. Therefore, the active

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involvement of libraries in supporting OER will help address the major challenges in the organization of information support for academic and scientific activities in Ukrainian higher education institutions during the most critical crisis, the full-scale war with the Russian Federation.

Although Ukrainian universities and the VSPU Library have made initial steps in this direction, particularly in developing Ukrainian-language text-based resources, more concerted efforts are required. The first step is to foster a broader understanding of open education and open science, clearly define the role of academic libraries in this movement, study established practices from both international and local institutions, and develop an implementation strategy and toolkit.

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(Вінниця, Україна), e-mail: slava2444789@gmail.com, ORCID 0009-0000-6624-8461**Відкрита освіта та відкрита наука – важлива адженда бібліотек закладів вищої освіти**

Мета цієї статті – проаналізувати світові наукові дослідження про відкриту освіту (ОЕ), визначити основні характеристики та тенденції розвитку відкритої освіти та проаналізувати досвід світових академічних бібліотек щодо пропагування відкритої науки (ОС) та сприяння вільному доступу до результатів наукових досліджень. **Методика.** Для оцінки даних на основі використання інтернет-ресурсів бібліотеки було застосовано описову статистику та методи спостереження. **Результати.** Акцент було зроблено на необхідності забезпечення безкоштовного доступу до освітніх ресурсів в українських університетах за різних сценаріїв невизначеності та викликів, особливо у воєнний час. У рамках нашого дослідження ми проаналізували роль бібліотеки ВДПУ у формуванні середовища вільного доступу до освітніх ресурсів та зробили спробу оцінити ефективність впровадження політики ЄС щодо відкритої науки. **Висновки.** Результати дослідження показали поступове впровадження принципів відкритої освіти в педагогічному університеті, що є сприятливим як для студентів, так і для викладачів, оскільки вони отримують вільний доступ до відповідного освітнього контенту, одночасно підвищуючи інституційну репутацію університету та бібліотечних фахівців.

Ключові слова: відкрита освіта (ОЕ); відкрита наука (ОС); відкриті освітні ресурси (OER); університетські бібліотеки; бібліотека ВДПУ; цифровий контент; студенти університету; інституційний репозиторій

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