The Use of Open Electronic Scientific and Educational Systems to Support the Professional Activities of Research and Teaching Staff of Ukrainian Universities and Scientific Institutions

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ABSTRACT

The article is devoted to the analysis and description of open electronic scientific and educational systems (OESES) and their use by scientific and pedagogical staff in Ukrainian universities and research institutions. The contribution of the use of open electronic systems by scientists and professors into the professional activity is considered. The results of experimental verification of the use of OESES and their impact on the research competence of teachers and researchers are presented. Based on the analysis of domestic and international research, the authors' own experience, the concept of open electronic educational systems designed to effectively organize and support research in education, pedagogy, social and behavioral sciences. The results of experimental research on the development of information and research competence of Ukrainian teachers and researchers during the use of open electronic systems are presented. The necessity of creating an environment for the development of information and research competence of university teachers and scientists is substantiated. The scientific novelty is based on the obtained results and is that it is proposed to include in the structure of such environment the following elements: scientific electronic libraries, electronic open journal systems (EOJS), scientometric databases, electronic social networks, and quality assessment systems for pedagogical tests, digital identification systems for scientists and scientific publications, software verification uniqueness of texts. Today, these tools are in demand and widely used for the organization of scientific and educational activities in educational institutions and research institutions around the world.

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CCS CONCEPTS

• **Open Electronic Scientific and Educational Systems** → Electronic libraries; Electronic scientific journals; Scientific databases; Social networks;

KEYWORDS

open electronic systems, open electronic scientific and educational systems (OESES), electronic libraries, electronic scientific journals, scientific databases, social networks, universities, teachers, researchers, pedagogical staff, information and research competence

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1 INTRODUCTION

The dynamic development of modern information technologies and the use of electronic forms of data have allowed to find new approaches to the use of information resources by teachers and scientists in universities and research institutions, as well as to organize the processes of publishing, storing and disseminating scientific information. In this context, open electronic resources play a significant role in creating the conditions to support research and the educational process.

In the "Strategy for the Development of the Information Society in Ukraine" [11] the importance of the Ukrainian segment of the Internet as one of the most important tools for the development of the information society and state competitiveness is a priority, in particular. At the state level, appropriate programs and projects are generated and reproduced, aimed at creating the necessary conditions, development and integration of information systems, networks, resources and information technologies to provide citizens and society with timely, reliable and complete information [2].

In modern conditions of high competition of universities and research institutions there are a number of important tasks of information and communication support of educational and scientific activities [3]. These activities include: creation of repositories of information resources, their organization and integration; development of means and methods of public access of users to electronic sources; ensuring the correct attribution of information resources with their authors, appropriate classification and organization in electronic systems; exchange of experience and cooperation of domestic and international researchers to accelerate the receipt of research results; evaluation of professional activity of scientific and scientific-pedagogical workers, productivity and efficiency of their research, in particular by citing published scientific works; the need to increase the level of motivation and interest of participants in the educational process to use electronic scientific and educational resources and services. One of the approaches to solve these problems is the use of OESES – automated information systems that contain data mainly educational and scientific, provide information support for education and science and technologically use computer information and communication platform for transportation and processing of information objects [33].

Open electronic scientific and educational systems are automated information systems (AIS) that contain data of mainly educational and scientific orientation, provide information support of education and science and technologically use computer information and communication platform for transport and processing of information objects and projects. Such systems make it possible to solve a wide range of tasks, including: search, storage, transmission, analytical and statistical processing of empirical data, evaluation of publishing activity of scientists, the level of efficiency of their scientific activity; evaluation of the effectiveness of scientific and pedagogical research, etc.

For scientific and pedagogical workers an important task today is the acquisition of knowledge, skills and abilities to combine with electronic scientific educational systems, bibliometric, webometric and scientometric databases, catalogs, creating author profiles and identifiers, features of publishing in domestic and international publications, increasing bibliometric indicators. It is important to develop competence in working with information resources in international information and analytical databases. Therefore, the possession of information and research competence by scientists is a necessary condition for successful professional activity in scientific institutions, higher education institutions and the system of postgraduate education. The problem today is the low level of information and research competence of research and teaching staff, the use of outdated approaches to learning and low motivation of the subjects of the educational process to use advanced ICT. Today, the digital competence of research and teaching staff and the ability to use the resources of open science is crucial for the competitiveness of the country's economy and for the development of the digital society as a whole. Implementation of the main provisions of the Digital Competence framework [1, 15], harmonization with the Digital Agenda [4] and EU Digital Single Market [16] are the topical initiatives that have an exceptional impact on education and science in Ukraine.

The aim of the paper is to identify tools of OESES that support the professional activities of research and teaching staff, and to investigate their impact on the level of information and research competence, and provide recommendations for Ukrainian specialists.

2 LITERATURE REVIEW

A significant number of scientists have studied the theoretical and practical aspects of the creation and use of OESES. Novitckii et al. [24] are developing models of information and analytical support for pedagogical research using electronic open electronic journal systems (OEJS). In particular, Novitckii et al. [24] have identified the following software components: electronic libraries (EB), OEJS, platforms for web conferencing, scientometric databases, tools for checking the texts of publications for anti-plagiarism, electronic social networks and more. The problem of functional features and main characteristics of software for creating electronic libraries, in particular on DSpace and EPrints platforms, in order to use them in higher education and research institutions was investigated in [24]. Nazarovets [23] studied the introduction of the Open Ukrainian Citation Index (OUCI) project, its functioning and development prospects. The use of the open electronic journal systems system as a cloud-oriented service of preservation and access to scientific resources within the project "Scientific Periodicals of Ukraine" in the Vernadsky National Library of Ukraine was described by Solovianenko [32].

Lugovyi et al. [21] studied experience of functioning of scientific periodicals in the conditions of digitalization, their indexation in domestic and international specialized digital publishing services and scientometric databases. Abuelrub and Hasan [8] developed

an evaluation framework that contains a set of basic criteria and quality indicators of electronic open journal systems, and it can be used for design, development and use of individual samples of EOJS. Brangier et al. [9] highlight the main functions of the digital library (archiving resources, ensuring the reliability and relevance of data, providing tools for analyzing materials, identification of scientific, educational institution and researcher, integration with social networks, encouraging users to self-archive knowledge exchange). The authors of [9] conclude that it is necessary to formalize the needs of users through the establishment of a user-oriented process of designing digital library. With this in mind, Tatnall and Davey [34] analyze the experience of creating a model for evaluating the quality of research based on the analysis of electronic library resources. They note that the model pays unjustifiably much attention to financial monitoring. Instead, the problems of communication of researchers working in separate or related fields of science and education are more relevant [34]. Dempsey and Malpas [13] study the evolution of the digital academic library. It has been established that libraries are moving from a digital repository model to a wide range of services, including research data management, analysis and visualization of experimental data, formation of electronic portfolios of researchers and laboratories, library support for young scientists, integration of library content into institutional management systems, training, providing infrastructure for research networks. Dempsey and Malpas [13], Essmiller et al. [14], Ozdemir and Hendricks [30] states a positive experience from the publication of university textbooks and manuals in open electronic libraries.

It is important to note the work of the network called DELOS Network of Excellence on Digital Libraries partially funded by the European Commission in the framework of the Information Society Technologies Program. This network provides an opportunity to join the community of professionals, educators and students at various stages in their academic careers to constantly update their knowledge on the use of digital libraries [5]. In particular, Castelli et al. [12] focus on interoperability issues as considered a key step to move from isolated digital archives and digital libraries towards a common information space that allow users to browse through different resources within a single integrated environment. Innocenti et al. [17] propose the vision and the policy that governs how a digital library is instantiated and run. They firstly presented the results of the experimental study indicating a high relevance for approaching policy interoperability not only from a technical perspective but also from an organisational and semantic point of view [17].

Since 2008, an attempt has been made to investigate and evaluate existing electronic open systems to support research in Ukraine. The following systems have been identified: Connexions / Rhaptos, DiVA (Digital VertenskapligaArkivet), GNU EPrints, DPubS, Open Journal System, Hyperjournal, Topaz. At the same time, we note that their use for the development of information and scientific competence of scientific and scientific-pedagogical workers is insufficiently reflected in methodological developments, curricula. From other hand Ovcharuk and Ivaniuk [26], Ovcharuk et al. [27, 28, 29] investigate the integration of the domestic education programs for teachers and students into the European learning environments using ICT. These researchers draw attention to the importance of achieving the required level of digital competence for teaching and learning that meets European frameworks and standards. When researching the level of competence of teachers, they found the need to pay attention to the development of training programs that contain information about learning environments and electronic educational systems necessary for the skilled performance of work in educational institutions [18, 22, 24, 25, 33].

3 RESEARCH METHOD

To achieve this goal, the authors used a number of methods: data analysis, generalization of the experience of using open educational and scientific systems by Ukrainian specialists. To verify the level of information and research competence of scientific and pedagogical workers, questionnaire and evaluation methods were used, questionnaires were used and mathematical processing of the obtained data was carried out. The authors also hypothesized the study. The research hypothesis was that if a specially developed methodology based on the use of OESES is introduced in the process of training and advanced training of scientific and scientific-pedagogical workers, it will be possible to increase the level of development of their information research competence.

4 RESEARCH RESULTS

The most common in the use of electronic educational systems by teachers and researchers include: electronic research libraries and repositories, electronic social and professional networks, digital identifiers of ratings of scientists, systems for collecting statistics of publications and achievements of scientists [6, 10]. That is why today the urgent task for scientific and scientific-pedagogical workers is to acquire knowledge, develop skills and abilities to combine with open electronic systems, collect statistics, process them and analyze them for effective research.

Electronic libraries which provide access to information resources in electronic form have a special role in expanding access to information for educators and researchers. Today they are part of the educational information space, as well as the national library and information fund of the country. Scientific electronic library is a distributed information environment of integrated educational and scientific academic resources, which allows accumulating, store and using publicly available collections of electronic documents through global data networks. According to Witten et al. [35], the most suitable for creating and maintaining the electronic libraries are software platforms DSpace and Eprints. Among these platforms, the Eprints system should be singled out, which is a convenient means to ensure the functionality of the scientific electronic library and support research on the implementation of tasks of analysis of psychological, pedagogical, methodological, special literature in accordance with the problems of these studies. In Ukraine the EPrints system is used in the following institutions of Ukraine: National Academy of Educational Sciences of Ukraine (http://lib.iitta.gov.ua/); Institute of Software Systems of National Academy of Sciences of Ukraine (http://eprints.isofts.kiev.ua/); The National University “Ostroh Academy” (http://eprints.oa.edu.ua/); Zhytomyr Ivan Franko State University (http://eprints.zu.edu.ua/); O. M. Beketov National University of Urban Economy in Kharkiv (http://eprints.kname.edu.ua/) and others.

The **EPrints** system supports a range of metadata sets, including Dublin Core, which is considered basic for the use of the OAI-PMH metadata exchange protocol (Open Archives Initiative – Protocol for Metadata Harvesting), which provides global access and search services. The Open Archives Initiative (OAI) develops and promotes interoperability standards in order to effectively disseminate electronic resources and increase the availability of exchange scientific information. The ERrints system satisfies all the requirements for the creation and maintenance of the library, namely: ensures the creation of electronic catalogs of library collections, their full functioning and development; increases the level of automation of libraries through the use of modern licensed software products; has the ability to use existing hardware; supports various file formats: HTML, PDF, Postscript, MS PowerPoint, MS Word, etc., can perform full-text and advanced searches, has flexible administration of access rights, etc. [31].

DSpace is open source repository applications that allows you to capture, store, index, preserve and distribute your digital material including text, video, audio and data. DSpace provides a way to manage materials and publications in a professionally maintained repository to give them greater visibility and accessibility over time. There are over 2000 digital repositories worldwide using the DSpace application for a variety of digital archiving needs. DSpace is most often used as an institutional repository – a platform that provides access to research output, scholarly publications, library collections, and more. It has three main roles: facilitates the capture and ingest of materials, including metadata about the materials; facilitates easy access to the materials, both by listing and searching; facilitates the long-term preservation of the materials [7].

The central place in the modern model of scientific communication is occupied by **electronic scientific journals**. In view of this spread, ICTs are gaining ground for the deployment and maintenance of scientific periodicals on the Internet – EOJS, that is an open source software platforms that provide the organization and decentralized remote management of the full cycle of the editorial and publishing process of electronic scientific journals, namely the support of the processes of submission, review, literary editing, correction, layout and publication of articles with their subsequent storage, distribution and indexing on the Internet. Electronic open journal systems today are the basis for coverage of scientific publications and research results of teachers and scientists, as well as the exchange of the most relevant information through editing and scientific communication of the participants of the publication. In particular, for the deployment and maintenance of electronic scientific journals on the Internet, electronic open journal systems serve as the open source software platforms that provide organization and decentralized remote control of the full cycle of the editorial and publishing process of electronic scientific journals, namely the support of submission processes. These systems support reviewing, literary editing, editing, layout and publication of articles with their subsequent storage, distribution and indexing on the Internet. One of the popular electronic open journal systems is **OJS** (https://pkp.sfu.ca/ojs) – a software platform to support the publishing and management of electronic scientific journals, developed within the Public Knowledge Project in 2001 in order to provide open access to research results and their dissemination on the Internet. It is the most widely used open source journal publishing platform in existence, with over 25,000 journals using it worldwide [31].

For effective and informed use of open educational systems, scientific and scientific-pedagogical workers must have a sufficient level of information and research competence. To identify the level and rating of the scholar the international **scientific databases** are used. The most popular and in demand in the use of international scientific databases are: Scopus, WoS, Google Scholar etc. The purpose of these databases is to track citations and ratings of scientists, research teams, to determine the impact factor of scientific publications, as well as their impact on the education sector.

A social networks are the virtual platforms that provides the means to communicate, support, create, build, display, and organize social contacts, including the exchange of data between users, and necessarily involves the prior creation of an account. The social network is a convenient way to interact between researchers from different countries and share experiences and disseminate research results, observe participants' reactions to discussions or information about certain issues (like it or not), invite people to participate in various scientific events, etc. The most common among scientists and teachers are social networks, which are filled with unique opportunities for learning and sharing experiences. Today we include: Instagram, Facebook and Twitter. For example, the Instagram network is now widely used among medical students for educational purposes. Today, Instagram has become one of the world's largest social networks, with more than 700 million registered users. Instagram can also be used for professional development and training. YouTube is a popular Internet host for hosting videos for free. Users can add, view and comment on certain videos. With its simplicity and ease of use, YouTube has become one of the most popular places to host videos. The service contains both professional and amateur videos, including video blogs. For example, this host has the ability download video tutorials, comment on them and conduct live stream.

In order to study the state of use of scientific and scientific and pedagogical workers of ICT tools in professional activities, to identify ICT tools that are used and can be useful for publishing and disseminating research results, as well as the attitude of scientific and scientific and pedagogical workers to use such tools in professional activities, the authors conducted an experimental study. It was important to determine the level of *information and research competence* of Ukrainian researchers and teachers. **Information research competence** of a teacher or researcher is presented as the most adequate, proportional set of professional, informational, communicative, personal qualities of the teacher, which allow him to achieve high results in both scientific and educational process. Determinant for the field of ICT in education and development of information and educational space of Ukraine is the creation of targeted information and educational environment for continuous development of information and research competence of pedagogical and scientific-pedagogical workers, librarians and education managers, acquainting them with new developments in ICT; advanced training of employees of IT divisions of methodical services, educational institutions, scientific institutions and education management bodies of pedagogical workers taking into account features of different levels of education, different types of educational institutions.

A specially developed methodology based on the use of OESES is introduced in the process of training and advanced training of scientific and scientific-pedagogical workers at the formative stage of the experimental study during 2019–2020. A training program was developed for scientific and scientific-pedagogical workers "Use of scientific electronic library services" (https://lib.iitta.gov.ua/717683/). The program includes four content modules, 2 of which belong to its invariant and 2 – to the variable component: electronic libraries, author profiles ORCID and Publons in scientific and pedagogical activities; services of scientific electronic libraries; editing services. The program is built on a modular system, according to the target category of students (users, editors of electronic libraries and administrators). 28 study hours are allocated for studying the educational material of the program. Training took place through lectures, seminars, practical independent or individual work, counseling, control measures to assess academic achievement. Learning process of students was implemented remotely and face-to-face on the basis of software platforms to support e-learning Moodle, Easygenerator, Wordpress, Prometheus and others.

Training and methodological support included a number of materials, namely: guidelines for students: "Using the services of the electronic library of the institution: guidelines" (https://lib.iitta.gov.ua/6259/), "Using the statistical module IRStats2 of the electronic library of the National Academy of Educational Sciences of Ukraine: methodical recommendations" (https://lib.iitta.gov.ua/705245/), "Recommendations on creation and use of the ORCID identifier for scientific and scientific-pedagogical workers: methodical recommendations" (https://lib.iitta.gov.ua/711636/), "Recommendations for users to include information resources in the Electronic Library of the National Academy of Educational Sciences of Ukraine" (https://lib.iitta.gov.ua/708197/); questions for self-control, lists of recommended sources, task cards for practical and training classes, presentations, test tasks, a set of individual practical tasks; questionnaires.

The main objectives of the training program were: to acquaint students with the theoretical and organizational foundations of the information infrastructure of the electronic library; to teach the creation and use of author profiles in ORCID and Publons in scientific and pedagogical activities; to form skills of search of actual scientific publications, authors and results of scientific researches, entering of own resources in storage, use of statistical services of electronic library; to form practical skills of the editor on formation of resources of the electronic library, filling in and editing of the form of the description of resources, search of deposits; formation of the library administrator's skills in the structure of the tree of subjects of the electronic library of the National Academy of Educational Sciences of Ukraine, performance of editing functions, work with system tools, configuration of subjects of the electronic library of the National Academy of Educational Sciences of Ukraine; increasing the level of information and research competence of scientific and scientific-pedagogical workers.

The following components of information-research competence of scientific and scientific-pedagogical workers were determined: value-motivational, cognitive, operational-activity and research component. A value-motivational includes: awareness of the need to use OESES in the professional activities of the scientists and interest in obtaining relevant, additional information about their functions; systematic use of OESES in the process of conducting scientific and pedagogical research. A cognitive component includes: knowledge about basic concepts regarding the use of OESES in research work; awareness of existing OESES support for scientific and pedagogical research. Operational component includes: the ability to select the optimal OESES at each stage of scientific and pedagogical research; ability to use the necessary OESES functionality to solve a specific research problem. The research component includes: rapid response to the emergence of new OESES in the course of research; ability to deepen knowledge, skills and abilities to work with OESES.

Assessment of the levels of formation of information and research competence of students was carried out at three levels: basic, intermediate and high. At the beginning and at the end of the training the developed questionnaires were used [20].

The purpose of the formative stage was to test the effectiveness of the developed methodology based on the use of OESES to increase the level of development of information research competence of scientific and scientific and pedagogical workers in the process of their training and retraining. Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Educational and Scientific Institute of Continuing Education of the National Aviation University, Zhytomyr Ivan Franko State University and scientific institutions of the National Academy of Educational Sciences of Ukraine became the experimental base of the research at the formative stage. 142 respondents took part in the pedagogical experiment, 71 of them were included in the experimental group (EG) and 71 – in the control group (CG). In the process of the formative stage of the pedagogical experiment, data processing, comparison of research results, their analysis were carried out; description of the progress and conduct of research based on methods of statistical data processing, generalization, comparison and design of the results obtained at the beginning and end of the formative stage of the experiment in CG and EG. At the beginning and at the end of the formative stage in CG and EG, the levels of development of information and research competence of scientific and scientific-pedagogical workers at basic, intermediate and high levels were assessed. For this purpose, survey and testing methods were used. EG was trained in accordance with the method of using OESES for the development of this competence of scientific and scientific-pedagogical workers. On the basis of Institute for Digitalisation of Education of the NAES of Ukraine and in the above institutions were held trainings, seminars, workshops on scientometrics and the use of OESES to develop their competence, scientific and scientific-pedagogical staff developed by the authors of the article teaching materials described in the work [19]. In addition, research and teaching staff trained in EG were trained as trainers for colleagues. Scientific and scientific and pedagogical workers, who have expressed a desire to study traditionally, in particular independently, entered the CG.

The results of the survey at the ascertaining stage of the experimental study showed that among the most actively used by scientific and scientific-pedagogical workers in their professional activities OESES are domestic scientific electronic libraries and electronic professional publications (89% of respondents), platforms for online conferences / webinars (79%), foreign electronic scientific libraries (71%), as well as resources for creating personal identifiers of scientists (61%). About half of scientists use scientometric

databases (54%), cloud research and education services (50%), blogs of scientists / teachers and sites of international projects (46%). Significantly less scientists use information and analytical portals, systems and catalogs (39%) and systems for checking scientific texts for plagiarism (29%).

The personal profile of a scientist in scientometric systems Google Scholar and "Bibliometrics of Ukrainian Science" have 282 (86%) scientific and scientific-pedagogical workers, 223 (68%) – have the author's identifier ORCID, and 105 (32%) – Publons (ResearcherID), in Scopus scientometric database did not register any of the respondents. 46 (14%) respondents do not have a profile on any of the above-mentioned resources. 69 (21%) respondents use a Web of Science product such as the Web of Science Core Collection and 36 (11%) researchers use the Journal Citation Report and Essential Science Indicators. 223 (68%) respondents do not use this scientometric database at all. The presence of a personal profile in the Electronic Library of the National Academy of Educational Sciences of Ukraine was confirmed by 282 (86%) researchers and tracking statistics on the publication and dissemination of own scientific materials using the statistical module of the IRStats2 library – 200 (61%). Among the most used by scientific and scientific-pedagogical workers in the professional activity of cloud scientific-educational services were Google Scholar – 233 (71%), Google Docs – 128 (39%), Microsoft Office 365 – 127 (39%) and One Drive – 105(32%); and social networks Facebook – 292 (89%), Google+ – 141 (43%) and LinkedIn – 128 (39%).

Electronic scientific and educational systems were used by scientific and scientific-pedagogical workers in their professional activities usually for the following purposes: to search for information on the research problem – 282 (86%); publication of scientific works – 223 (68%); scientific communication – 210 (64%); conducting seminars, web conferences – 200 (61%); for joint work with colleagues – 164 (50%); collection of statistical data – 141 (43%); monitoring – 128 (39%); conducting surveys – 128 (39%); rating determination – 105 (32%); distance learning – 95 (29%); creation of websites and blogs – 59 (18%).

Regarding the question of which electronic scientific and educational systems are useful in professional activities, 223 (68%) respondents did not provide answers at all. Other respondents noted the importance of using electronic libraries – 59 (18%), electronic scientific publications – 36 (11%), cloud services Google and Microsoft – 37 (11%), as well as – 13 (4%) – Telegram channels, Google Scholar services, platforms for webinars and conferences, EBSCO resources, etc.

To determine the levels of development of the value-motivational component of information research competence of scientific and scientific-pedagogical workers at the formative stage of the experiment, the obtained data are compared with general estimates of the levels of development of components of this competence, which are given in table 1.

The values at the beginning and end of the stage of the pedagogical experiment in CG and EG were obtained as the arithmetic mean of the relative values of individual scores of scientific and scientific-pedagogical workers in CG and EG, respectively. Analysis of the results of the pedagogical experiment led to the conclusion: at the beginning of the pedagogical experiment the level of development of the value-motivational component of information research competence in CG was 21%, in EG 24% and was below baseline (<30%), and at the end of pedagogical experiment development of the value-motivational component of competence increased to 49% of the basic level (30-50%), and in EG – to 75% (51-75%) of the intermediate level. The dynamics of changes between the levels of development of the value-motivational component is 23% higher in EG than in CG. The implementation of pedagogical influences in the process of purposeful learning on the development of the value-motivational component of the ID competence of scientific and scientific-pedagogical workers forms awareness of the need to use OESES in the professional activity of a scientist and stimulates interest in obtaining relevant, additional information use of OESES in the process of conducting scientific and pedagogical research. The dynamics of changes in the levels of development of the value-motivational component at the beginning and end of the pedagogical experiment between CG and EG is presented in figure 1.

Table 1: General assessments of the levels of development of the components of information and research competence of scientific and scientific and pedagogical workers

Level	Indicator
Basic	30–50%
Medium	51–75%
High	76–100%

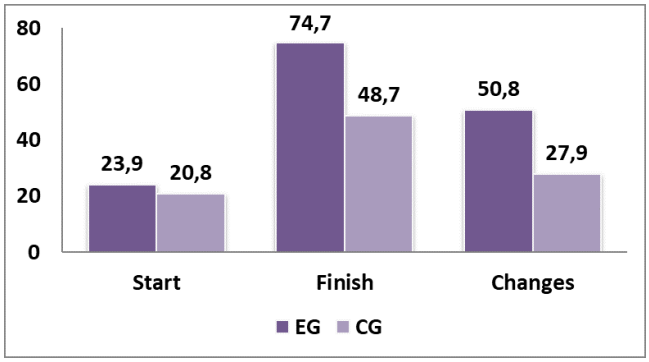

Figure 1: Dynamics of changes in the cognitive component at the beginning and end of the pedagogical experiment between CG and EG (arithmetic mean of the relative values of individual scores).

The analysis of the results of the pedagogical experiment allowed to reach the following conclusion: at the beginning of the pedagogical experiment the level of development of the cognitive component of information and scientific competence of scientific and scientific-pedagogical workers in CG was 30%, in EG 34% and was at the basic level the end of the pedagogical experiment in the CG group increased to 75% of the average level (51–75%), and in the EG – to 94% (76–100%) of the high level. The dynamics of changes between the levels of development of the cognitive component is 16% higher in EG than in CG. The increase in the level of development of the cognitive component in the experimental group is due

to the fact that scientific and scientific-pedagogical workers have been trained in the appropriate method of using open electronic scientific-educational systems for the development of information and scientific competence of scientific and scientific-pedagogical workers.

At the beginning of the pedagogical experiment the level of development of the operational component of information research competence in CG was 24%, in EG 26%, which is below the baseline (<30%), and at the end of the pedagogical experiment in CG the level of development of operational component ID increased to 51% and reached an average (51–75%), and in EG – up to 80% (76–100%) of a high level. The dynamics of changes between the levels of development of the value-motivational component is 27% higher in EG than in CG.

At the beginning of the experiment, the level of the research component of the competence in CG was 24%, and in EG 29% (30-50%), which is below the baseline level. At the end of the experiment, the level of the research component of information research competence in CG was 68% and corresponded to the average level (50–75%), and in EG – 90% (75–100%) and corresponded to a high level. The dynamics of changes in the research component at the beginning and end of the pedagogical experiment between CG and EG is presented in figure 2.

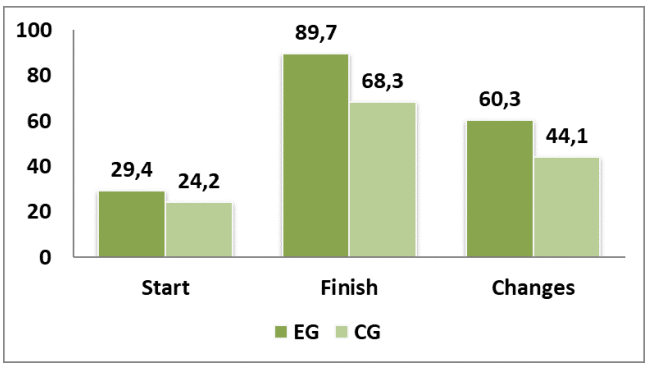

Figure 2: Dynamics of changes in the levels of development of the research component at the beginning and end of the pedagogical experiment in CG and EG (arithmetic mean of the relative values of individual scores).

After elaboration of the components of information research competence of scientific and scientific-pedagogical workers (value-motivational, cognitive, operational-activity and research) the value of information-research competence in general was determined as the arithmetic mean of the corresponding values of its components. Analysis of the results of the pedagogical experiment on all components of the competence of scientific and scientific-pedagogical workers allowed us to conclude: at the beginning of the pedagogical experiment the level of information research competence of scientific and scientific-pedagogical workers in CG was 25% and in EG 28% below baseline (<30%), and at the end of the pedagogical experiment in CG the level of the competence increased to 58%, which corresponds to the average level (51-75%), and in EG – to 83%, which corresponds to a high level (75-100%). The dynamics of changes in the levels of development of the competence of scientific and scientific-pedagogical workers at the beginning and end of the pedagogical experiment between CG and EG is presented in figure 3.

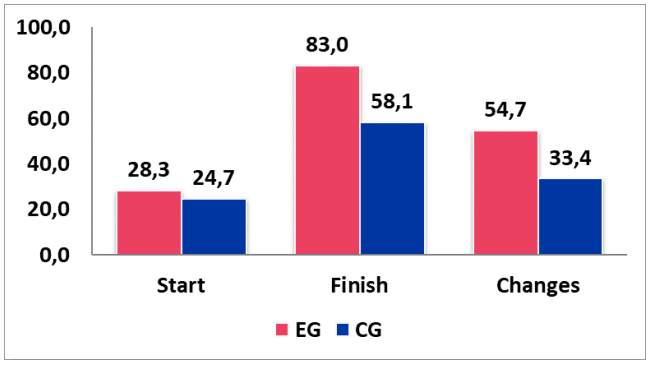

Figure 3: Dynamics of changes in the levels of development of information research competence of scientific and scientific-pedagogical workers at the beginning and end of the pedagogical experiment between CG and EG (arithmetic mean of relative values of individual scores).

After analysis, we conclude that at the beginning of the pedagogical experiment of information research competence of researchers and pedagogical workers in CG and EG were below baseline, and at the end of the pedagogical experiment in CG the level of this competence increased to medium, and in EG to high level.

5 CONCLUSIONS AND RECOMMENDATIONS

The problem of using OESES for the development of information and research competence of scientific and pedagogical workers is relevant and needs further study. The analysis of publications and Internet resources shows that OESES is a popular tool in the organization of educational and scientific activities. For their effective application it is necessary to develop appropriate methods that determine the development of information and research competence of scientists. Analyzing the obtained experimental data, we can state:

(1) Electronic professional publications, digital libraries, platforms for online conferences, scientometric databases, electronic social networks, digital identification systems for scientists and scientific publications are the OESES that are most often used in the activities of domestic scientific and pedagogical workers. Unjustifiably little attention in Ukraine is paid by researchers to the use of information and analytical portals, software for automatic tracking of text matches and borrowing sites of international projects, as evidenced by the results of the observational experiment, own publications on the uniqueness of the text.
(2) The vast majority of Ukrainian scientific and scientific-pedagogical workers are aware of the need to use OESES in their own professional activities. The introduction of the author's

methodology allowed to significantly increasing the indicators of the value-motivational component of the information and scientific competence.

(3) The development of the operational component of the information and scientific competence is most dynamic in the process of purposeful, systematic and comprehensive use of OESES. In this regard, a combined approach can be considered, which is a combination of technical, editorial, administrative requirements, intrinsic motivation and personal beliefs of scientists. Therefore, it is necessary to form in each researcher not only the belief in the need for systematic use of OESES, but the conscious need to conduct research with their help. We can also recommend conducting the series of trainings on how to use OESES for scientific and scientific-pedagogical workers that will contribute to the formation of their readiness to use new technologies and to reach modern open science resources by Ukrainian specialists.

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