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**ВЕКТОРИ РОЗВИТКУ СУЧАСНОЇ ОСВІТИ:
ДУХОВНІСТЬ, ВЗАЄМОДІЯ,
КОМУНІКАЦІЯ, КОМПЕТЕНТНІСТЬ**

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Рецензенти:

Вовк Мирослава Петрівна – доктор педагогічних наук, професор, завідувач відділу змісту і технологій педагогічної освіти, Інститут педагогічної освіти і освіти дорослих імені Івана Зязюна НАПН України (м. Київ).

Логвиненко Тетяна Олександрівна – доктор педагогічних наук, професор, завідувач кафедри соціальної педагогіки та корекційної освіти Дрогобицького державного педагогічного університету (м. Дрогобич).

За загальною редакцією

доктора педагогічних наук, професора, Авшенюк Н. М.,

доктора педагогічних наук, професора Товканець Г. В.

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У монографії розглянуто питання розвитку освіти в умовах повсякчасних суспільних викликів і трансформацій та акцентовано увагу на проблеми комунікації, взаємодії, плекання духовності особистості та формування компетентностей в освітньому процесі. Відображено погляди дослідників України, Словаччини, Польщі, Чехії, Румунії, Угорщини на вирішення актуальних завдань професійної підготовки та педагогічної освіти в контексті інноваційного європейського простору освіти і науки.

Адресується фахівцям, які займаються науковою і професійно-педагогічною діяльністю з означеної проблеми, докторантам, аспірантам та студентам педагогічних спеціальностей; усім, хто цікавиться актуальними проблемами розвитку сучасної освіти.

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1.3. CHALLENGES AND OPPORTUNITIES OF SCIENTIFIC COMMUNICATION IN THE AGE OF INFORMATION TECHNOLOGIES

KUŠNÍR Jaroslav, KRAVCHENKO Tetiana

Introduction. The importance of science communication in today's world is crucial and cannot be overstated. Scientific communication is a cornerstone of academic circles, which contributes to the dissemination of knowledge, the development of interdisciplinary cooperation and the stimulation of scientific and research progress. Thanks to effective methods of scientific communication, researchers can exchange ideas, find new solutions to complex problems, and implement innovations. It also plays a key role in popularizing science among a wide audience, which contributes to raising the level of awareness and involvement of society in scientific achievements.

Science communication is the process of transferring scientific knowledge from researchers to a wide audience, including the public, politicians, and other scientists. The primary goal of science communication is to provide a clear and accurate presentation of scientific data to support informed and evidence-based decision-making.⁷³

Scientific communication plays a key role in the dissemination of new knowledge and promotes its use in various spheres of life. It makes it possible to understand scientific achievements, supports innovation and promotes the development of scientific literacy in society. That is why we consider the study of challenges and opportunities of science communication in the age of information technologies urgent.

Results of scientific research. *Historical development of scientific communication*

The history of scientific communication is closely related to the development of science as such. In ancient times, knowledge was transmitted orally or through handwritten texts. With the invention of printing in the 15th century, scientific knowledge became more accessible

⁷³ Яхонтова Т.В. Лінгвістична генеологія наукової комунікації. Львів: Вид-во ЛНУ імені І. Франка, 2009. 379 с.

through printed books and journals. In the 20th century, the development of mass media, such as radio and television, greatly expanded the possibilities for the dissemination of scientific knowledge. Today, digital technologies, including the Internet and social media, provide instant access to scientific information for a global audience.

There are several basic models of scientific communication:

- scarce
- dialogical
- involvement of the public

The deficit model is based on the assumption that the public's lack of knowledge is the main obstacle to understanding science. This model is focused on the transfer of information from experts to a "scarce" audience.

The dialogue model emphasizes the importance of two-way communication between scientists and the public, where both sides can learn from each other.

The model of public involvement involves the active involvement of the public in scientific processes, for example, through public discussions or involvement in scientific research.⁷⁴

Scientific communication is an important component of the scientific process. It not only promotes the dissemination of new discoveries, but also supports the integration of knowledge, which is necessary for the further development of science. Effective communication allows scientists to share their results, receive feedback, critically evaluate data, and stimulate further research⁷⁵.

Thus, scientific communication serves as the basis for the formation of scientific knowledge, the improvement of scientific literacy and the support of innovations in society.

Scientific communication is a key tool for the dissemination of new knowledge among scientists, specialists in other fields, and the general public. It includes a variety of methods, such as the publication of scientific articles, presentations at conferences, public lectures, as well as the use of digital platforms, social networks and multimedia technologies.

⁷⁴ Bucchi, M., & Trench, B. (2008). *Handbook of Public Communication of Science and Technology*.

⁷⁵ Burns, T. W., O'Connor, D. J., & Stockmayer, S. M. (2003). Science communication: A contemporary definition. *Public Understanding of Science*, 12(2), 183-202

One of the main goals of scientific communication is to provide access to new discoveries and research results. This allows not only to raise awareness of scientific achievements, but also to facilitate their implementation in practice, which can lead to innovation and technological progress.

Effective scientific communication promotes the development of science and technology through the dissemination of new knowledge and research results. This allows other scientists to build their research on the basis of already achieved results, which accelerates scientific progress and the introduction of new technologies. For example, the results of research on the impact of climate change on marine ecosystems can be used to develop policies and strategies for environmental protection.

The ethics of scientific communication includes the principles of honesty, accuracy, objectivity and responsibility in the dissemination of scientific knowledge. It is important to avoid exaggeration, distortion or selective presentation of data. Ethical norms also include ensuring the availability of information for a wide audience, including people with different levels of education and knowledge, as well as respect for the intellectual property and copyright of other scientists.⁷⁶

The media plays an important role in scientific communication, acting as an intermediary between scientists and the public. Mass media can help disseminate research results, make them accessible and understandable to a wide audience. It is important that journalists and scientists cooperate to ensure the accuracy and comprehensibility of the information presented. The use of various media channels, such as television programs, Internet platforms, social networks, podcasts and videos, allows reaching a larger audience and contribute to the popularization of science.

Thus, scientific communication is an important means for the dissemination of new knowledge, promotes the development of science and technology, requires compliance with ethical standards, and actively uses the media to achieve its goals.

Digital technologies have radically changed the landscape of scientific communication. They facilitated access to scientific knowledge, made the exchange of information faster and more efficient. Online

⁷⁶ Menasche L. Writing a Research Paper / L. Menasche. Ann Arbor: The University of Michigan Press, 1997. 178 p.

platforms allow researchers from different parts of the world to collaborate in real time, disseminating research results instantly. This contributes not only to the rapid dissemination of new discoveries, but also to increasing the transparency and reproducibility of scientific research.⁷⁷

Social media has become an important tool for scientists wishing to promote their research. They provide an opportunity not only to quickly disseminate scientific news, but also to interact with a wide audience, receive feedback and discuss results. Platforms such as Twitter, ResearchGate, and LinkedIn help scientists build professional networks and attract funding for new projects.

Traditional media such as newspapers, magazines and television also play an important role in popularizing science. They help convey complex scientific concepts to a wide audience, increasing the general scientific literacy of society. Journalists and science communicators work to make science news accessible and interesting to people without special education.

For effective science communication, it is important to use a variety of strategies, including creating clear and engaging materials, using visualizations and infographics, and actively engaging with audiences through social and traditional media. In addition, it is important to take into account the cultural and linguistic characteristics of the target audience for the most effective dissemination of scientific knowledge.

Digital technologies, social media, and traditional media play a key role in modern scientific communication, contributing to the dissemination of new knowledge, the development of science and technology, and the improvement of scientific literacy in society⁷⁸.

Methods of increasing the effectiveness of scientific communication

Scientific communication is an integral part of the process of scientific research. It promotes the dissemination of new knowledge, the

⁷⁷ Кравченко, Т. М. Формування цифрової компетентності здобувачів другого (магістерського) рівня вищої освіти у процесі вивчення основного компоненту “Наукова комунікація англійською мовою”, як пріоритетна проблема / Т. М. Кравченко // Міжнародний науковий журнал “Освіта і наука” [Електронний ресурс] / голов. ред.: Щербан Т. Д.; заст. голов. ред.: Jerzy Piwowarski; Гоблик В. В. – Мукачєво-Ченстохова : РВВ МДУ; Академія ім. Я. Длугоша, 2022. – Вип. 2(33). С.126-133.

⁷⁸ Allen, G., & Lightman, B. (2018). *The Popularization of Science: 1650-2000*. Routledge.

establishment of connections between scientists, and the introduction of new technologies into various spheres of life. However, the effectiveness of scholarly communication depends on many factors, including the use of modern technologies, structuring of messages, and compliance with ethical standard.

Use of multimedia technologies in scientific communication

Multimedia technologies open up new opportunities for scientific communication. They allow presenting complex ideas in a more visual and understandable form. The main multimedia tools that can be used in scientific communication include:

- videos and animations – these tools allow visualizing processes and phenomena that are difficult to explain with words or static images;
- interactive presentations – using software such as Prezi or PowerPoint allows creating dynamic presentations that can interactively respond to user actions;
- webinars and online conferences – platforms for video conferences, such as Zoom or Microsoft Teams, allow conducting scientific discussions and presentations in real time with the possibility of feedback;
- social networks and blogs – these platforms allow the rapid dissemination of scientific information and the involvement of a wide audience in the discussion of new research.⁷⁹

Writing scientific papers is a necessary component of the researcher's work.

Clear and logical structure of the work, introduction, literature review, methodology, results, discussion and conclusions, as well as clarity and conciseness, clear and precise wording, avoidance of overly complex sentences and specialized terms, argumentation supported by reliable sources, compliance with design requirements that established by scientific journals or conferences, will make a scientist's research understandable to the public.

The presentation of scientific works is an important element of the dissemination of scientific knowledge. Thus, visual materials such as graphs, tables and charts to illustrate the main results will help the

⁷⁹ Lansiquot, R. D. (2015). *Multimedia Technologies in the Classroom*. Springer.

audience to better understand the researcher's work. As a result, it will contribute to the spread of new knowledge and the introduction of innovations in various fields of science and technology.

International aspect of scientific communication

Scientific communication, which goes beyond national borders, plays an important role in the development of science and technology. International cooperation makes it possible to combine the efforts of scientists from different countries to solve global problems, exchange knowledge and experience, and promote innovation. The key aspects of international scientific communication are, in particular, international conferences and symposia, translation of scientific works, international cooperation and training in scientific communication.

International conferences and symposia are one of the main platforms for the exchange of knowledge and experience between scientists of different countries. They provide an opportunity to present research results, discuss current issues, establish new contacts and establish cooperation.

Symposia, although less well-known than conferences, are an integral part of academic life. These events, usually focused on narrower topics, are a place for in-depth analysis and discussion of specific scientific issues. Organized as a series of lectures or discussions, they create a unique platform for professionals from different fields to exchange thoughts, ideas and new research.

One of the key benefits of participating in symposia is their ability to provide in-depth analysis of a topic. Compared to conferences, which often include a wide range of papers on different topics, symposia usually focus on one specific topic. This allows participants to gain a deeper understanding of the problem, study, or issue being discussed. They can take a closer look at aspects of a topic they are interested in and work together to find solutions or solve complex problems.

Another advantage is the specialized audience that gathers at symposia. Because these events usually focus on a specific topic or industry, attendees can interact with professionals who have deep knowledge in that area. This creates a favorable environment for the exchange of ideas, experiences and new approaches. In such environment, you can find collaborators for joint research, find answers to difficult questions or even develop new concepts.

In general, symposia play an important role in the development of science and promote the exchange of knowledge and ideas among specialists. Their focus on in-depth analysis and specialized audiences make them valuable forums for the academic community to tackle the most challenging problems and develop new lines of research.

Participation in international conferences and symposia contributes to raising the level of scientific work, receiving feedback from leading specialists, as well as expanding the professional network of contacts. Publications in conference proceedings allow to expand the audience and increase the impact of scientific works. To ensure the availability of scientific knowledge at the international level, the translation of scientific works and the use of multilingual communication are important. Translation makes scientific results available to a wider audience. The high quality of the translation will avoid inaccuracies and misinterpretations.

The use of several languages in scientific communication facilitates the integration of scientists from different countries and cultures, which is especially important for international research projects and publications.

International cooperation in science

International cooperation in science allows us to join forces to achieve common goals and solve global problems. International projects often have access to more funding, resources and expertise, which increases the chances of research success. Cooperation can be initiated through joint projects, participation in international grant programs, as well as through personal contacts established during conferences and symposia.

Learning scientific communication

Effective scholarly communication requires specific skills and knowledge that can be developed through specialized training, such as scholarly communication courses and trainings that help scholars master the skills of writing scholarly articles, preparing presentations, and speaking at conferences.

Mastering scientific communication skills improves the quality of scientific works, improves the ability of scientists to convey their ideas to the audience, and increases the chances of successful international cooperation.

The international aspect of scientific communication is an important component of modern science. Participation in international conferences, translation of scientific works, international cooperation and training in scientific communication contribute to the development of science and technology, and also help to solve global problems facing humanity⁸⁰.

Development of scientific communication courses for undergraduates and graduate students

Scientific communication is an important component of the training of modern scientists. It includes the ability to effectively write scientific articles, present research results, communicate with colleagues and engage the public in scientific discussions. Developing science communication courses for undergraduates and graduate students helps provide them with the necessary skills for a successful scientific career.

The use of interactive teaching methods is a key factor in the training of future scientists. Interactive methods make it possible to involve students in active participation in the learning process and contribute to more effective assimilation of knowledge. Such methods include:

- discussion clubs – regular meetings where students can discuss scientific articles and research, exchange ideas and receive feedback from peers.
- role-playing and simulations – simulation of real situations, for example, presentations at a conference or defense of a thesis, helps students practice skills in practice.
- workshops and seminars – intensive trainings devoted to specific aspects of scientific communication, such as writing scientific articles, preparing posters or speaking at conferences.
- preparation of presentations – students create and present their scientific research, receiving feedback from teachers and peers⁸¹.

Scientific supervisors play a key role in teaching scientific communication. They act as mentors and role models, helping students learn the necessary skills and guiding their development. Research supervi-

⁸⁰ Brossard, D., & Scheufele, D. A. (2013). Science, New Media, and the Public. *Science*, 339(6115), 40-41.

⁸¹ National Science Teaching Association (NSTA). (2020). *Effective Teaching Strategies for Science Education*. Retrieved from <https://www.nsta.org/effective-teaching-strategies>.

sors provide support and advice on writing research papers, participating in conferences and publishing research. Supervisors provide constructive feedback at all stages of research paper preparation, helping students improve their skills. It is important that academic supervisors motivate students to actively participate in scientific events, encourage them to write articles and prepare presentations.

One of the important aspects of scientific communication is the ability to convey research results to a wide audience. This includes interaction with the public, popularization of science and participation in popular science events.

Scientists must be able to explain complex scientific concepts to a general audience simply and clearly. This may include writing popular science articles, giving lectures to the general public, or participating in television and radio programs. The use of modern means of communication, such as social networks and blogs, allows for quick and effective dissemination of scientific knowledge.

Public events allow scientists to interact directly with the public and attract new people to science.

Therefore, the development of scientific communication courses for undergraduates and graduate students is an important element of the training of modern scientists. The use of interactive teaching methods, the active role of scientific leaders and the involvement of the public in scientific discussions contribute to increasing the effectiveness of scientific communication and help future scientists to successfully implement their research at the international level.

Popularization of science among a wide audience

Popularization of science is an important task of modern society. It contributes to raising the level of scientific awareness among citizens, forms a positive attitude towards science and technology, and also attracts young people to scientific activities. In this context, science communication plays a key role in shaping public opinion, overcoming challenges and using opportunities to effectively interact with lay audiences.

The role of scientific communication in the formation of public opinion is undeniable. Scientific communication has a significant impact on the formation of public opinion about science and technology. It helps the public understand complex scientific concepts, appreciate the importance of research and its impact on everyday life. Scientific

communication contributes to increasing the level of knowledge about science among citizens, helps them better understand modern achievements and their impact on society. Effective communication of scientific results contributes to the formation of trust in scientific research and institutions engaged in science. An informed public is better able to support science and technology initiatives and can make informed decisions in areas related to science and technology⁸².

Communicating with lay audiences has its challenges and opportunities. Major challenges include the complexity of scientific concepts, mistrust of science, and the impact of misinformation. Many scientific concepts are difficult to understand, which can make it difficult to explain them to a general audience. Certain populations may be skeptical of science, requiring additional efforts to build trust.

In the modern information space, misinformation is often spread, which can distort scientific facts and mislead the public.

At the same time, there are significant opportunities for effective scientific communication:

- the use of modern technologies – social networks, online platforms and mobile applications allow quick and wide dissemination of scientific information;
- interactive forms of interaction – the use of interactive methods, such as webinars, online courses and virtual exhibitions, helps to attract the audience and increase their interest in science;
- cooperation with the media – partnership with mass media helps to spread scientific knowledge through popular communication channels⁸³.

Forms and means of scientific communication

Effective scientific communication can take place through a variety of forms and means, each with its own advantages and disadvantages:

- popular science articles and books – writing articles and books in a form accessible to the general public helps to explain complex scientific concepts.

⁸² Bonney, R., & Dickinson, J. (2012). *Citizen Science: Public Participation in Environmental Research*. Cornell University Press.

⁸³ Lewenstein, B. V. (2011). *Models of Public Communication of Science and Technology*. In: Dierkes, M., & von Grote, C. (Eds.). *Between Understanding and Trust: The Public, Science and Technology*. Routledge.

- lectures and public speeches – holding lectures and public speeches allows directly interact with the audience, answer questions and explain important aspects of scientific research.
- television and radio – programs on television and radio make it possible to reach a wide audience and popularize science through interesting and interactive formats.
- social networks – the use of social networks for the dissemination of scientific information allows quickly attract a large number of people and maintain active feedback.
- exhibitions and scientific festivals – the organization of scientific exhibitions and festivals promotes the popularization of science through interactive exhibits, demonstrations and experiments.

Popularization of science among a wide audience is an important task for modern society. Effective science communication helps shape public opinion, overcome challenges, and seize opportunities to engage with lay audiences. The use of various forms and means of communication contributes to increasing the level of scientific awareness and support of scientific initiatives among the public.⁸⁴

Popularization of science is an important task of modern society. It contributes to raising the level of scientific awareness among citizens, forms a positive attitude towards science and technology, and also attracts young people to scientific activities. In this context, science communication plays a key role in shaping public opinion, overcoming challenges and using opportunities to effectively interact with lay audiences. Let's consider the main aspects of the popularization of science, the role of scientific communication, challenges and opportunities, as well as the forms and means of scientific communication.

Scientific articles and monographs are the main forms of dissemination of scientific knowledge. They provide detailed coverage of studies, their methodology, results and conclusions.

Scientific articles are published in peer-reviewed journals, which guarantees a high level of quality and reliability of the information presented. The structure of a research paper usually includes an introduction, literature review, methods, results, discussion, and conclusions.

⁸⁴ Bonney, R., & Dickinson, J. (2012). *Citizen Science: Public Participation in Environmental Research*. Cornell University Press.

The main advantages of scientific articles are the speed of publication. Usually, scientific articles are published faster than monographs. Articles usually focus on specific aspects of the study. Articles are published in journals that are accessible to the wider scientific community.

Monographs are detailed studies of specific topics or problems. They may contain a generalization of the results of numerous studies or new theoretical developments. The main advantages of monographs are in-depth coverage of the topic (monographs allow to consider the subject of research in detail), systematization of knowledge (they can systematize knowledge in a certain field of science), long-term value (monographs have a long-term scientific value and can be used as the main sources of information for a long time).

Modern technologies open up new opportunities for scientific communication through webinars and online platforms.

Webinars allow scientists to share their knowledge and research with a wide audience via the Internet. They can be interactive, allowing participants to ask questions and participate in discussions.

The advantage of webinars is their accessibility to a wide audience regardless of geographical location. It is necessary to pay attention to interactivity, since participants can actively participate in webinars, ask questions and discuss the presented materials.

Online platforms such as ResearchGate, Academia.edu, and others allow scholars to publish their research, share knowledge, and collaborate with colleagues.

We note that the advantages of online platforms are:

- wide distribution – research can be made available to a wide audience;
- networking opportunities – scientists can find colleagues, exchange ideas and collaborate on projects;
- access to resources – online platforms provide access to a large number of scientific works and resources.

Scientific communication is an integral part of the scientific process, but its nature is constantly changing under the influence of new technologies, the role of the Internet and the growing needs of the scientific community. The influence of these factors shapes the future of scientific communication.

The use of virtual and augmented reality has the potential to make science communication more interactive and engaging. The interactivity of these technologies can allow researchers to communicate and collaborate even over long distances, creating virtual laboratories and simulations that facilitate the exchange of ideas and research results.

Artificial intelligence will play an important role in the future of scholarly communication, enabling the analysis of large volumes of data, the automation of peer review and scholarly translations. With the help of machine learning algorithms, artificial intelligence systems can automatically review and analyze scientific texts, which contributes to a more efficient selection of materials and improves the quality of scientific communication.

The growing popularity of online publications allows scientific researchers to disseminate their scientific knowledge faster and more efficiently. Electronic journals and repositories enable rapid publication and access to research results, reducing the time between research completion and publication.

The use of social networks for scientific communication can significantly expand the audience to which the conclusion of scientific research has reached. Wide access to information about new research and the opportunity to discuss its results in the community help to increase transparency and interaction in the scientific environment.

We should note that the needs of the scientific community are also changing.

The future of scholarly communication will require greater interdisciplinary interaction. Modern scientific problems often require an integrated approach covering various scientific disciplines. Ensuring effective communication between scientists from different fields of knowledge becomes an important condition for solving complex scientific challenges.

Globalization of the scientific community will promote international cooperation and exchange of knowledge. The growing mobility of scientific personnel and the rapid exchange of information via the Internet make scientific communication more accessible and dynamic.

Scientific articles, monographs, conferences, symposia, webinars and online platforms are important means of scientific communica-

tion. The future of this field promises new technologies and changing approaches that will make it possible to spread knowledge even more effectively and promote scientific progress.⁸⁵

Trends in the development of scientific communication

Scientific communication plays a crucial role in the dissemination of knowledge, the development of innovations, and the integration of scientific achievements into everyday life. In the modern world, which is rapidly developing under the influence of information technologies, scientific communication is undergoing significant changes and developments.

The use of digital technologies for the publication of scientific works, the holding of conferences and symposia has a significant impact on the scientific community and the processes of knowledge exchange. The main key aspects are:

- accessibility and speed – digital technologies allow the scientific community to easily access and quickly exchange new information. Instead of waiting for journal publication, researchers can quickly publish their work in online repositories or relevant platforms;
- global access – digital technologies enable the scientific community from around the world to communicate and collaborate, regardless of geographic location. This makes it possible to hold international conferences and symposia where researchers can exchange ideas and collaborate on projects;
- preservation and archiving – digital platforms allow the preservation and archiving of scientific works, providing long-term access to them. This helps in preserving scientific data and ensuring its availability for future research;
- interactivity and audience involvement – digital technologies can create interactive environments for presentations of scientific works, which allows the audience to actively participate in discussions, ask questions and exchange opinions even in a virtual format;
- reducing the environmental footprint – the use of digital technologies can help reduce the environmental footprint of scien-

⁸⁵ Ziman, J. (2000). *Real Science: What It Is, and What It Means*. Cambridge University Press.

tific activities, as there is no need to print and forward large volumes of documents.⁸⁶

In general, the use of digital technologies in scientific activities expands communication opportunities, facilitates the rapid exchange of knowledge and promotes the development of scientific research. Online platforms such as ResearchGate and Academia.edu facilitate knowledge sharing and collaboration among scholars.

The dissemination of open access scientific publications makes scientific knowledge available to the general public free of charge. The growing number of open access journals contributes to the wider dissemination of scientific results. An increase in the number of interdisciplinary studies reflects a growing recognition of the limitations of traditional disciplinary boundaries. This trend highlights the complexity of contemporary challenges that often require multifaceted approaches for comprehensive understanding and effective solutions. Interdisciplinary research brings together experts from diverse fields, encouraging collaboration and the exchange of ideas that can lead to innovative breakthroughs. By fostering a culture of collaboration, interdisciplinary studies not only advance knowledge but also address real-world problems more effectively. This shift towards interdisciplinary approaches signifies a broader evolution in academia, emphasizing the importance of holistic perspectives and the integration of various disciplines to tackle complex issues facing society today. Interdisciplinary approaches allow solving complex scientific problems from different perspectives.

We believe that in today's world it is impossible to do without the use of social networks and blogs to popularize science and involve the public in discussing scientific topics. The activity of scientists in social networks contributes to the wider dissemination of scientific ideas.

Modern technologies open up new opportunities for scientific communication. Using the Internet allows reaching a wider audience, including the lay public. Thanks to social networks, blogs, online courses and webinars, scholars can spread their knowledge far beyond the academic environment⁸⁷.

⁸⁶ Nisbet, M. C., & Scheufele, D. A. (2009). What's Next for Science Communication? Promising Directions and Lingering Distractions. *American Journal of Botany*, 96(10), 1767-1778.

⁸⁷ Dijk, J. A. G. M. (2020). *The Network Society*. Sage Publications.

Challenges and opportunities of scientific communication in the age of information technologies

One of the main challenges of modern scientific communication is information overload. A huge amount of scientific publications and information makes it difficult to find relevant research. Every year, thousands of new scientific articles in various fields of knowledge are published in the world, and it is often difficult for scientists to navigate in this ocean of information. As a result, even important discoveries may go unnoticed or underestimated.

Information overload also threatens the effectiveness of scientific research. Scientists are forced to spend a significant part of their time searching for and evaluating scientific information, which reduces the productivity of their work. To overcome this challenge, it is necessary to develop effective methods of sorting and assessing the quality of scientific information. One of these methods can be the application of machine learning algorithms for automatic selection of the most relevant and high-quality publications.

Another serious challenge is the growing distrust of science. The spread of misinformation and pseudoscience can lead to public distrust of scientific research.

To combat disinformation, it is important to actively popularize science and increase scientific literacy among the population. Scientists and educational institutions should work to create accessible and understandable resources that explain complex scientific concepts. In addition, it is necessary to develop critical thinking and skills to assess the reliability of information among citizens.

Successful scientific communication requires a comprehensive approach to solving the problems of information overload and mistrust of science. Development of new technologies for efficient sorting and evaluation of scientific information, as well as active popularization of science can contribute to overcoming these challenges and ensure sustainable development of the scientific sphere in the future.

Scientific communication faces a number of ethical challenges that require increased attention and solutions. One of the main ethical issues is the issue of authorship. It is important to correctly determine the contribution of each author to the scientific work and avoid situations where someone illegally attributes authorship. Plagiarism, that is, the

use of someone else's ideas without proper citation, is another serious problem that undermines the credibility of science and scientists.

Conflict of interest can also affect the quality and objectivity of scientific research. Scientists must openly declare any financial or personal interests that may influence the results of their work. Ensuring transparency and honesty in scientific publications is a key aspect for maintaining high standards of scientific ethics.⁸⁸

In today's world, where information spreads at an incredible speed, scientific literacy and critical thinking are becoming necessary skills for every person. Scientific literacy involves an understanding of basic scientific principles and methods, the ability to evaluate scientific evidence and draw reasonable conclusions. Critical thinking helps identify biases, analyze arguments, and separate fact from opinion.

Increasing scientific literacy contributes to the development of a society capable of making informed decisions in various fields, from medicine to ecology. Teaching critical thinking from an early age helps to form independent thinkers who are able to adequately respond to the challenges of the modern world.

Wider audience coverage helps increase scientific literacy and critical thinking among the population. It also allows new people to be involved in scientific discussions, increasing interest in science and contributing to its development. However, for the effective use of these opportunities, it is important to ensure the availability and comprehensibility of scientific information for a wide audience.

Conclusions. The trends in the development of scientific communication reflect changes in society and technologies, which require new approaches to the dissemination of scientific knowledge. Challenges and opportunities arising in the era of information technologies encourage the scientific community to search for innovative methods of communication. The use of modern technologies, interactive formats and interdisciplinary approaches will help make scientific communication more effective and accessible to a wide audience.

Increasing scientific literacy and critical thinking is an integral part of successful scientific communication. Addressing ethical issues such as authorship, plagiarism, and conflicts of interest, as well as ensuring

⁸⁸ Kleinert, S. & Wager, E. (2011). Ethical issues in publishing in the digital age. *Research Ethics*. 7(3).

transparency and honesty in scientific publications, are key to maintaining credibility in science. The use of the Internet and modern technologies provides an opportunity to reach a wider audience and promote the development of scientific literacy among the population. These measures will help to form informed decisions and sustainable development of society.

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1.4. ПОЛІТИКА ЗАБЕЗПЕЧЕННЯ ЕКОСИСТЕМИ ЦИФРОВОЇ ОСВІТИ У ФІНЛЯНДІЇ

Кирил КОТУН

Наприкінці 2023 року Організацією економічного співробітництва та розвитку (далі – OECD) було опубліковано аналітичний звіт «Прогноз OECD щодо цифрової освіти на 2023 рік. На шляху до ефективної екосистеми цифрової освіти» (*OECD Digital Education Outlook 2023. Towards an Effective Digital Education Ecosystem*)⁸⁹. Цей звіт надає порівняльний тематичний аналіз того, як країни формують або можуть сформувати свою цифрову екосистему; окреслює різні інформаційні системи для учнів (або інформаційна система управління освітою – EMIS), системи управління навчанням, цифрові платформи оцінювання, навчання та професійна орієнтація; виокремлює компоненти екосистеми цифрової освіти в країнах; обґрунтовує можливість розвитку цифрової компетенції вчителів їх використання і новітні можливості у різних країнах; окреслює можливості щодо штучного інтелекту в освіті, а також зазначає як країни можуть максимально використати свою цифрову екосистему, щоб вона була надійною, корисною, ефективною та справедливою.

У Аналітичному звіті⁹⁰ зазначено як країни OECD та партнери керують цифровим переходом і наскільки вони готові до освітньої

⁸⁹ OECD (2023), *OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem*, OECD Publishing, Paris, <https://doi.org/10.1787/c74f03de-en>

⁹⁰ OECD (2023), *OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem*, OECD Publishing, Paris, <https://doi.org/10.1787/c74f03de-en>



МУКАЧІВСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ

89600, м. Мукачево, вул. Ужгородська, 26

тел./факс +380-3131-21109

Веб-сайт університету: www.msu.edu.ua

E-mail: info@msu.edu.ua, pr@mail.msu.edu.ua

Веб-сайт Інституційного репозитарію Наукової бібліотеки МДУ: <http://dspace.msu.edu.ua:8080>

Веб-сайт Наукової бібліотеки МДУ: <http://msu.edu.ua/library/>