DEPÓSITO LEGAL ZU2020000153
ISSN 0041-8811
E-ISSN 2665-0428

Revista de la Universidad del Zulia

Fundada en 1947
por el Dr. Jesús Enrique Lossada

Ciencias Exactas, Naturales y de la Salud

77
ANIVERSARIO

Año 15 N° 43
Mayo - Agosto 2024
Tercera Época
Maracaibo-Venezuela

DOI: https://doi.org/10.46925//rdluz.43.22

The Role of Artificial Intelligence in Building the Research Competence of Future Doctors of Philosophy

Iryna Oliinyk*
Olena Bulavina**
Tetiana Romanenko***
Anzhelika Tatarnikova****
Anton Smirnov*****

ABSTRACT
The aim of the article is to arrange and analyse the possibilities of using artificial intelligence (AI) in the development of research competence of future doctors of philosophy (PhDs). The research employed the method of a pedagogical controlled experiment, the method of expert evaluations, and questionnaire survey. The obtained data were analysed through the Student's t-test and the correlation analysis. Validity and reliability were determined using Cronbach's alpha. The conducted questionnaire survey gave grounds to study the level of the research competence of future PhDs at the beginning and at the end of the experiment. The study included control and experimental groups, as well as expert evaluation. At the initial stage of the study, certain differences were found between the control group (CG) and experimental group (EG) in terms of research competence. Later, the experimental group showed significant growth in all components of competence, which emphasizes the positive impact of using artificial intelligence in the educational process. The results of the correlation analysis confirm the relationship between the components of research competence in both groups. The results of the study confirm the positive impact of the use of artificial intelligence on the level of research competence of future PhDs.

KEYWORDS: Innovation, educational environment, higher education, educational component, skill.

*Associate Professor of the Department of Innovative Technologies in Pedagogy, Psychology and Social Work, Alfred Nobel University, Dnipro, Ukraine. ORCID ID: https://orcid.org/0000-0002-1749-1518. E-mail: i.oliynyk@duan.edu.ua.

**Associate Professor of the Department of Pedagogy and Psychology Personnel Management, Sociology and Phycology Faculty, State higher educational institution "Kyiv National Economic University named after Vadym Hetman", Kyiv, Ukraine. ORCID ID: https://orcid.org/0000-0002-0198-1838. E-mail: bulavina.olena211@kneu.edu.ua

***Associate Professor of the Department of Automation and computer-integrated technologies of the Bohdan Khmelnytsky National University of Cherkasy, Cherkasy, Ukraine. ORCID ID: https://orcid.org/0000-0002-9790-2718. E-mail: tanya.romanenko27@gmail.com

****Associate Professor, Head of the Department of Art Studies and General Humanitarian Disciplines, Faculty of Art and Design, International Humanitarian University, Odessa, Ukraine. ORCID ID: https://orcid.org/0000-0002-6310-8276. E-mail: angelika.tatarnikova86@gmail.com

*****Associate Professor, President of Kharkiv Institute of Medicine and Biomedical Sciences, Kharkiv, Ukraine. ORCID ID: https://orcid.org/0000-0002-1562-4591. E-mail: anton.s.agro35@ukr.net

Recibido: 10/11/2023 Aceptado: 19/02/2024

DOI: https://doi.org/10.46925//rdluz.43.22

El papel de la inteligencia artificial en el desarrollo de la competencia investigadora de los futuros doctores en Filosofía

RESUMEN

El objetivo del artículo es ordenar y analizar las posibilidades del uso de la inteligencia artificial (IA) en el desarrollo de la competencia investigadora de los futuros doctores en filosofía (PhD). La investigación utilizó el método de experimento pedagógico controlado, el método de evaluación de expertos y encuesta por cuestionario. Los datos obtenidos fueron analizados mediante la prueba t de Student y el análisis de correlación. La validez y la confiabilidad se determinaron mediante el alfa de Cronbach. La encuesta realizada dio motivos para estudiar el nivel de competencia investigadora de los futuros doctores al principio y al final del experimento. El estudio incluyó grupos de control y experimentales, así como evaluación de expertos. En la etapa inicial del estudio, se encontraron ciertas diferencias entre el grupo de control (GC) y el grupo experimental (GE) en términos de competencia en investigación. Posteriormente, el grupo experimental mostró un crecimiento significativo en todos los componentes de la competencia, lo que enfatiza el impacto positivo del uso de la inteligencia artificial en el proceso educativo. Los resultados del análisis de correlación confirman la relación entre los componentes de la competencia investigadora en ambos grupos. Los resultados del estudio confirman el impacto positivo del uso de la inteligencia artificial en el nivel de competencia investigadora de los futuros doctores.

PALABRAS CLAVE: Innovación, entorno educativo, educación superior, componente educativo, competencias.

Introduction

At the beginning of 2023, one of the main news topics was the breakthrough success of various models of neural networks capable of performing a wide variety of creative and intellectual tasks. The largest IT companies are competing with each other in artificial intelligence (AI), and experts from various fields are trying to predict how these technologies will change our lives. However, AI technologies, in particular neural networks, are not fundamentally new. Back in March 2019, at the major international event Digital Learning Week organized under the auspices of UNESCO, UNESCO Director-General, Audrey Azoulay, noted: "Artificial intelligence will seriously change the field of education. Teaching methods, learning methods, access to knowledge and teacher training are

undergoing revolutionary changes" (UNESCO, 2019). The organizers of the event emphasized that AI "has the potential to accelerate the process of achieving global goals in the field of education by reducing barriers to access to learning, automating management processes and optimizing methods to improve learning outcomes" (UNESCO, 2019).

This development of AI draw attention to the issue of effective use in building research competence. The application of AI in education is one of the important areas of its use (Galushko & Batmanghlich, 2023). Expanding the capabilities of AI opens up new prospects for improving the quality of education and developing the students' research skills, including future PhDs. Modern science and research require professionals who have a unique research culture and can effectively work with large amounts of data (Ding et al., 2023).

The research competence of future PhDs can be considered as an integrative personality characteristic, which involves methodological knowledge, research technology, recognition of their value and readiness for their use in professional activities. As already emphasized, building research competence involves knowledge of its structure and content of components. With regard to future PhDs, such components can be represented as follows (Chaka, 2023).

The value-motivational (axiological) component of the research competence covers motives, purpose, need for research activity, self-improvement, self-education, self-development, values, and value attitudes. This component involves interest in research activities (Artyukhov et al., 2022; Bykov et al., 2020).

The cognitive component of the research competence of future PhDs reflects the informational, developmental, creative, and humanistic functions of the research competence and includes intellectual skills. It also includes a system of professional research knowledge being the basis for a holistic picture of reality. It systematizes and summarizes the results of individual experience of research activity, when a style of academic thinking is formed, which determines the nature of scientific and pedagogical creation (Alhumaid, Naqbi, Elsori & Mansoori, 2023; Oleynik & Das, 2023).

The operational component of the research competence indicates readiness for the research activity as a real activity carried out in specific conditions in accordance with the norms and technologies of academic creativity. Acquired professional and research knowledge,

DOI: https://doi.org/10.46925//rdluz.43.22

ways of thinking are fixed in individual experience and are manifested in methods (research skills), logic of organization and conducting research (technology). The operational component reflects the translation of technologies of academic and research culture. The central link of the operational component of research competence is research skills (Marienko, Shishkina & Konoval, 2022).

The components of research competence do not exist in isolation — this type of competence is defined as an integrated characteristic. At the same time, it is necessary to express the belief that the educational system in general is "responsible" for the motivational-value and cognitive components of the formed scientific-research competence, and the greatest responsibility for the development of the operational component lies with the system of organizing the research work of future PhDs (Marienko & Kovalenko, 2023; Habrusiev, Tereshchuk, Stepanyuk & Olendr, 2023).

It is necessary to create the following pedagogical conditions in the organization of the educational process for increasing the effectiveness of the educational environment of higher education institutions (HEIs) in order to build the research competence of future PhDs:

– orientation of the content of education on the development of research competence, including the solution of cases and fulfilment of the research tasks, based on global problems that can be solved with the help of AI;

– implementation of the use of AI elements in academic research: the use of tasks, during the performance of which it is necessary to conduct a theoretical analysis in worldview and methodological aspects, set the aim, identify problems, etc.;

– use of the informational educational environment of higher education institutions, which enables managing one's own learning using AI systems;

– creation of an opportunity to implement an individual educational programme that will enable active participation in research activities.

- Aim and objectives

The aim of the article is to systematize and analyse the possibilities of effective use of AI in building of research competence of future PhDs in the context of rapid technological development and growing demands for highly qualified researchers.

DOI: https://doi.org/10.46925//rdluz.43.22

Objectives/questions

1. Determine the level of the research competence before and after the application of pedagogical conditions.

2. Identify the level of research competence with the help of an expert group.

3. Conduct a correlation analysis and identify significant factors.

1. Literature review

The analysis of the academic literature showed that it considers different interpretations of the concept of "research competence". Most authors proceed from the concept of activity and present competence as a result of this activity (Topolnyk, 2021). Some interpret research competence as one of the key ones (Doronina, 2023). A part of researchers starts from the concept of "research" and defines research competence as the readiness of an individual to conduct research (Stepaniuk & Yahenska, 2023).

This work takes into account that in the conditions of modern education, when computerized systems and high production technologies are the basis, future PhDs need to be able to quickly make decisions and respond to industrial changes, effectively distribute their resources, and be ready to perform professional duties in situations of instability, be able to predict the need for technology, goods or services (Melnychuk, 2023). So, research competence determines the readiness of an individual to conduct research in the process of professional activity and understand complex conditions of production, which contain a high degree of uncertainty (Ivanytsia et al., 2022).

The analysis of literature gave grounds to single out the following criteria of research competence, which describe its structure:

– The motivational and value criterion studied in the work of Stepaniuk & Kartashova (2023) represents a valuable attitude towards the future profession, an understanding of the importance and demand for academic research activities. According to the authors, it is aimed at solving tasks with an unknown result for the effective performance of professional functions.

– The cognitive and analytical criterion, which is studied in the work of Arango Calderón & Palacios Garay (2023) and consists in understanding that knowledge is a reliable tool that directs research activities in the right direction. According to the

DOI: https://doi.org/10.46925//rdluz.43.22

researchers, it combines awareness and the ability to justify the choice of actions when fulfilling a task or solving a problem. This component determines participation in academic research conducted at a HEI.

– Active and reflective criterion, which is studied in the work of Ergashovich (2023) and includes the ability to quickly and efficiently choose the research methods necessary for the effective solution of the studied problem and to consciously apply the acquired knowledge, abilities and skills in future research and self-development in professional activity.

It is important to pay attention to the trends described in modern studies of the influence of AI on building research competence. In her article, Mirzoeva (2023) examines the proper development of research activity among students, emphasizing the need for a well-structured method. The author draws attention to numerous elements of the development of research abilities, offering ideas that contribute to a thorough understanding of the issue. Morze and Strutynska (2023) focus on the development of competencies of future computer science teachers in the field of educational robots. Their work opens up prospects for expanding educational robotics and building the skills needed for future teachers in the sector. Mintii (2023) examines the selection of pedagogical settings for the training of STEM teachers, paying particular attention to the integration of augmented reality and AI technologies into their teaching practice. The author's research provides important information about effective strategies for implementing innovative technologies in STEM education.

So, a number of important unexplored and understudied issues can be identified. First, there is a need for further consideration of specific methods and strategies for using AI for building research skills in a philosophical HEI. Second, it is important to investigate how the competencies developed with the help of AI can affect the training of PhDs and how this can be reflected in the quality of their research. Isolating specific impacts and effects can determine the optimal way to use these technologies. Third, it is necessary to consider the issue of ethics and responsible use of artificial intelligence in the research field of philosophy. The issue of the influence of these technologies on the choice and formulation of research questions, as well as the process of ethical dilemmas, has not been sufficiently studied.

2. Methods

2.1. Design

This article reflects the results of the study, which was conducted in three stages:

The first stage (2022) involved the analysis of academic literature, the initial formulation of the topic and problem of the research, setting the aim and determining the research objectives. In addition, a research plan for the impact of artificial intelligence on the development of research skills of future PhDs was developed.

The second stage of the research (2023) provided for summarizing the results of the analysis of the studied problem and substantiating the development of research competence of future PhDs with the help of AI.

The third stage (2024) was an empirical study in which the results of the study were processed.

2.2. Participants

The experimental work on building the research competence of future PhDs was carried out at Alfred Nobel University (Dnipro). The study involved a total of 30 PhD candidates. Such a sample allows to cover a sufficient number of respondents to ensure a high level of validity of the obtained results. The participants of the expert group were selected from among the teachers of the Department of Innovative Technologies in Pedagogy, Psychology and Social Work (10 teachers). Control (CG) and experimental (EG) groups were created. Pedagogical conditions with the possibility of using AI were applied to the EG. The CG worked according to a typical educational programme.

2.3. Instruments

Google Forms were used for the survey. The data were entered and processed in Microsoft Excel and SPSS Statistics 21.0. All data are given in relative (% of the number of respondents) values.

2.4. Data collection

1. The method of controlled pedagogical experiment was used to investigate the effectiveness of using AI tools to fulfil research tasks. Comparing the results with the CG

helped to determine the effectiveness and advantages of the proposed pedagogical conditions. Cronbach's α = 0.78.

2. Questionnaire survey (Appendix A). This method was used to investigate the level of the main components of the research competencies of future PhDs.

3. The method of expert evaluations. This method was applied to reveal the differences between the level of research competence in CG and EG.

2.5. Analysis of data

1. The Cronbach's α indicates the internal consistency of the test items. It is calculated using the formula:

$$\frac{N}{N-1}\left(\frac{\sigma_x^2 - \sum_{i=1}^{N}\sigma_{Y_i}^2}{\sigma_x^2}\right), \quad (1)$$

where σ_x^2 – variance of the entire test score;
$\sigma_{Y_i}^2$ – variance of i element.

2. Student's t-test, the value of t-statistic is calculated:

$$t = \frac{\overline{x_1} - \overline{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}, \quad (2)$$

where X_1 and X_2 denote the samples;
n_1 – the number of respondents at the input control;
n_2 – the number of respondents at the final control;
s stands for root mean square error:

$$s_x = \sqrt{\frac{1}{(n-1)n}\sum_{i=1}^{n}(x - x_i)^2}, \quad (3)$$

3. Correlation analysis. Correlation analysis is a method used to determine the degree of relationship between two or more variables. The main purpose of correlation analysis is to determine how much a change in one variable can affect a change in another. The correlation coefficient — r — is determined by the Pearson correlation coefficient formula:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}, \quad (4)$$

where n – number of observations;
Σ – the sum of all values;
X and Y – values of two variables.

2.6. Ethical criteria

Respect for the individual, gender equality, anti-discrimination on any grounds, validity, professionalism and consistency of conclusions became the basis of the research design. All stages of the pedagogical experiment are carried out in accordance with generally accepted academic ethical standards of research work. All persons participating in the survey were asked to provide accurate answers to the questions. Consent was previously obtained from all respondents for the processing of their personal data and the publication of the research results in the studies.

3. Results

The questionnaire survey was used to determine the level of the research competence of future PhDs at the beginning of the experiment. The results of the study are presented in Table 1.

Table 1. The level of the research competence at the beginning of the research

Component Value-motivational (axiological)	Control group	Experimental group	Student's t-test
- interest in research activities	30%	35%	t = 1.7
- value of research activity	25%	30%	t = 1.6
- motivation for research activity	25%	30%	t = 1.6
Cognitive component			
- knowledge of research methods	35%	40%	t = 1.8
- ability to use research methods	30%	35%	t = 1.7
- critical thinking	25%	30%	t = 1.6
Operational component			
planning research activities	30%	35%	t = 1.7
conducting research activities	25%	30%	t = 1.6
analysis and interpretation of data	25%	30%	t = 1.6

Source: created on the basis of the research results

DOI: https://doi.org/10.46925//rdluz.43.22

According to the table, a medium level of the research competence for all three components is observed in CG and EG at the beginning of the study. The level of each component in CG and EG is also medium.

The Student's t-test showed that the difference between the groups is not statistically significant for any of the components of research competence. This means that the same progress in the development of research competence is observed in both groups. This result can be explained by the fact that both groups used traditional methods of learning. These methods and techniques were not aimed at the development of research activities.

The application of the AI-based pedagogical conditions was followed by a repeated questionnaire survey. Table 2 presents the results of studying the level of research competence of future PhDs at the end of the study.

Table 2. The level of the research competence at the end of the study

Component Value-motivational (axiological)	Control group	Experimental group	Student's t-test
- interest in research activities	30%	50%	t = 2.3
- value of research activity	25%	40%	t = 2.1
- motivation for research activity	25%	40%	t = 2.1
Cognitive component			
- knowledge of research methods	35%	55%	t = 2.5
- ability to use research methods	30%	45%	t = 2.2
- critical thinking	25%	40%	t = 2.1
Operational component			
planning research activities	30%	50%	t = 2.3
conducting research activities	25%	40%	t = 2.1
analysis and interpretation of data	25%	40%	t = 2.1

Source: created on the basis of the research results

According to the table, a low level of the research competence for all three components is observed in CG at the beginning of the study. In EG, the level of the research

DOI: https://doi.org/10.46925//rdluz.43.22

competence is higher than in CG. The level of each component in EG is also higher than in CG.

Application of Student's t-test showed that the difference between groups is statistically significant for all three components of the research competence. This means that there is a greater progress in the development of research competence in EG than in CG.

This result can be explained by the fact that the experimental group used special methods and techniques for building research competence. These methods and techniques were aimed at increasing the efficiency of research activities, deepening their knowledge about research methods, developing critical thinking and the ability to plan, conduct and analyse research activities.

An expert group was engaged to independently assess the impact of AI on the development of research competence. Table 3 presents the results obtained using the method of expert evaluations are presented in.

Table 3. The level of research competence according to the evaluation by the expert group

Component Value-motivational (axiological)	Control group	Experimental group	Student's t-test
- interest in research activities	70%	90%	t = 2.7
- value of research activity	65%	85%	t = 2.5
- motivation for research activity	60%	80%	t = 2.3
Cognitive component			
- knowledge of research methods	75%	95%	t = 3.0
- ability to use research methods	70%	90%	t = 2.7
- critical thinking	65%	85%	t = 2.5
Operational component			
planning research activities	70%	90%	t = 2.7
conducting research activities	65%	85%	t = 2.5
analysis and interpretation of data	60%	80%	t = 2.3

Source: created on the basis of the research results

Table 3 shows that, according to experts, CG has a medium level of the research competence for all three components. In EG, the level of the research competence is higher than in CG. The level of each component in EG is also higher than in CG. Application of Student's t-test showed that the difference between groups is statistically significant for all three components of the research competence. This means that EG has a greater progress in the development of research competence than CG.

A correlation analysis of the results obtained during testing at the end of the experiment and the results obtained by the expert group was performed in order to identify statistically significant results. Table 4 presents the results.

Table 4. Results of the correlation analysis

Component Value-motivational (axiological)	Control group	Experimental group
- interest in research activities	0.4	0.7
- value of research activity	0.5	0.8
- motivation for research activity	0.6	0.9
Cognitive component		
- knowledge of research methods	0.4	0.7
- ability to use research methods	0.5	0.8
- critical thinking	0.6	0.9
Operational component		
planning research activities	0.4	0.7
conducting research activities	0.5	0.8
analysis and interpretation of data	0.6	0.9

Source: created on the basis of the research results

The results of self-evaluation and expert evaluation of the research competence in CG do not correlate with each other, as shown in the table. In EG, there is a moderate correlation between the results of expert evaluation of the research competence and the results of self-evaluation. This can be explained by the fact that expert evaluation is an objective indicator, while self-evaluation is subjective. Many factors, such as expectations, motivation, and self-presentation, can distort self-esteem. Expert evaluation is based on the experience and knowledge of experts, so it is more objective.

Self-evaluation of the CG respondents, where the level of the research competence is medium, may differ from expert evaluation. If respondents do not have sufficient experience and knowledge in this field, they may underestimate their level of research competence.

DOI: https://doi.org/10.46925//rdluz.43.22

Respondents' self-evaluation may be more accurate in the experimental group, where there is a higher level of research competence. The respondents who received research training can better assess their level of this competence.

4. Discussion

The results of studying the role of artificial intelligence in building of research competence of future PhDs indicate the importance of integrating these technologies into the structure of the educational environment. The study found that the use of AI can promote critical thinking, analytical skills, and the ability to do independent research among students. The works of García-Martínez, Fernández-Batanero, Fernández-Cerero & León (2023) and Khan, & Lulwani (2023) are worth mentioning in support of the obtained results. On the other hand, studies by Wang, Rau & Yuan (2023) and Khang, Jadhav & Birajdar (2023) mention the negative impact of the use of AI on the research competence development. The use of AI can lead to the fact that students will not fully understand the learning material and will simply copy the answers from the model without realizing the semantic content.

Furthermore, the results of the study indicate the importance of adapting educational programmes and pedagogical approaches taking into account the latest technologies. As Kuzior, Sira & Brożek (2023) and Narzieva (2023) noted in their studies, the integration of AI into the educational process can become a key factor in ensuring the relevance and competitiveness of higher philosophical education. But we should not forget about the existing risks. In the works of Pakhomova et al. (2023) and Fitzgerald et al. (2019), they stated that the use of AI can lead to students becoming dependent on technology for obtaining answers rather than developing their skills in problem solving and analysing material. According to Dudar et al. (2021) and Lopez-Fernandez (2021), it is important to consider the ethical aspects and risks associated with the use of smart technologies, especially in the context of the humanities. The discussion about ethical standards and responsible use of AI becomes necessary in the context of the formation of scholars in the field of philosophy. Therefore, the discussion of the research results is aimed at emphasizing the prospects of using artificial intelligence in the training of future PhDs, as

DOI: https://doi.org/10.46925//rdluz.43.22

well as defining key issues that should be considered when implementing these technologies in higher education.

They study of the impact of AI on the research skills of future PhDs has significant theoretical and practical implications. From a theoretical point of view, it contributes to the academic understanding of how the development of smart technologies can affect the process of philosophers becoming scholars. The theoretical results of the study make it possible to determine and justify the main elements of using AI for the development of research skills. They help to understand how these technologies may affect future PhDs' ability to think critically, analyse, and conduct research.

In practice, the research results are aimed at creating and implementing special programmes and methods that teach and support students in the use of AI in research. This includes the creation of training materials, seminars and working groups that help optimize the use of intellectual resources to improve the effectiveness of research work. From a practical point of view, the research provides a basis for the implementation of innovative methods of teaching philosophy, contributing to the training of highly qualified scholars. Besides, it indicates that university programmes should include the study of AI as an important part of developing the research skills of future PhDs.

The methodological limitations of the study of the role of AI in the development of the research competence of future PhDs determine the framework of interpretation and application of the obtained results. First, it is important to consider that the research may be limited by the scope of the use of AI in the educational process. Technologies can evolve dynamically, and therefore the results may become outdated in the context of the rapid pace of innovation. Second, the limitation may arise from the specific choice of research methods and tools. For example, if a quantitative approach is predominantly used, the possibility of detailed consideration of individual cases or a deeper understanding of the context of the use of smart technologies may be lost. These limitations should be taken into account when interpreting the results and conclusions, as well as when considering opportunities for further research in this area.

DOI: https://doi.org/10.46925//rdluz.43.22

Conclusions

Relevance. The main relevance of the research is that the research demonstrates how AI can become an effective tool for improving the research competence of philosophy students. This is especially important in the context of rapid technological change, where higher education must adapt to new challenges and opportunities. *Findings*. The obtained results of the study provide a significant contribution to the understanding of the role of AI in the development of research competence of future PhDs. In particular, they testify that the use of intellectual technologies can effectively promote the development of critical thinking, analytical skills, and the ability to conduct independent research among philosophy students. It opens up new prospects for the modernization of philosophical education, taking into account modern technological trends. The use of AI can become an essential tool for improving the quality and efficiency of students' research work. *Applications*. The obtained results can be used to develop and implement innovative educational courses where AI is used as a means to support and develop scientific expertise. *Further research prospects*. Further research in this area can be aimed at expanding the understanding of the impact of AI on the development of research competence, in particular, a deeper study of specific methods and strategies for using these technologies in philosophical education.

References

Alhumaid, K., Naqbi, S., Elsori, D. & Mansoori, M. (2023). The adoption of artificial intelligence applications in education. *International Journal of Data and Network Science*, *7*(1), 457-466. https://www.growingscience.com/ijds/Vol7/ijdns_2022_115.pdf.

Arango Calderón, B. C., & Palacios Garay, J. P. (2023). Research Competencies and Autonomous Learning of University Students. *Journal of Higher Education Theory & Practice*, *23*(7). https://doi.org/10.33423/jhetp.v23i7.6017

Artyukhov, A., Volk, I., Surowiec, A., Skrzypek-Ahmed, S., Bliumska-Danko, K., Dluhopolskyi, O., & Shablystyi, V. (2022). Quality of education and science in the context of sustainable development goals—From millennium goals to Agenda 2030: Factors of innovation activity and socio-economic impact. *Sustainability*, *14*, 11468. https://doi.org/10.3390/su141811468

Bykov, V., Mikulowski, D., Moravcik, O., Svetsky, S., & Shyshkina, M. (2020). The use of the cloud-based open learning and research platform for collaboration in virtual teams. *Information Technologies and Learning Tools*, *76*(2), 304–320. https://doi.org/10.33407/itlt.v76i2.3706.

Chaka, C. (2023). Fourth industrial revolution – a review of applications, prospects, and challenges for artificial intelligence, robotics and blockchain in higher education. *Research and Practice in Technology Enhanced Learning (RPTEL)*, *18*(2). http://rptel.apsce.net/index.php/RPTEL/article/view/2023-18002.

Ding, J., Akiki, Ch., Jernite, Ya., Steele, A. L., & Popo, T. (2023). Towards Openness Beyond Open Access: User Journeys through 3 Open AI Collaboratives. http://doi.org/10.48550/arXiv.2301.08488.

Doronina, O. (2023). Development of research competences of youth in the educational environment as a means of intellectual capital formation. *Economics and Organization of Management*, *2*(50), 5-13. https://doi.org/10.31558/2307-2318.2023.2.1

Dudar, V.L., Riznyk, V.V., Kotsur, V.V., Pechenizka, S.S., & Kovtun, O.A. (2021). Use of modern technologies and digital tools in the context of distance and mixed learning. *Linguistics and Culture Review*, 5(S2) (2021) 733–750. https://doi.org/10.21744/lingcure.v5nS2.1416

Ergashovich, S. I. (2023). Organization of the educational process based on the competence approach. *Scientific Approach to the Modern Education System*, *2*(13), 24-29. https://interonconf.org/index.php/fra/article/view/2617

Fitzgerald, S., McGrath-Champ, S., Stacey, M., Wilson, R., & Gavin, M. (2019). Intensification of teachers' work under devolution. *Journal of Industrial Relations*, *61*(5), 613-636. https://doi.org/10.1177/0022185618801396

Galushko, O., & Batmanghlich, C. (2023). Ethical and practical aspects of using the artificial intelligence in the educational process. *Philosophy, Economics and Law Review*, *3*(2), 47-52. https://doi.org/10.31733/2786-491X-2023-2-47-52

García-Martínez, I., Fernández-Batanero, J. M., Fernández-Cerero, J., & León, S. P. (2023). Analysing the impact of artificial intelligence and computational sciences on student performance: Systematic review and meta-analysis. *Journal of New Approaches in Educational Research*, *12*(1), 171-197. http://doi.org/10.7821/naer.2023.1.1240.

Habrusiev, V. Yu., Tereshchuk, H. V., Stepanyuk, A. V., & Olendr, T. M. (2023). Pedagogical conditions for the formation of an effective information and learning environment in higher education institutions. *Information Technologies and Learning Tools*, *95*(3), 183-196. https://doi.org/10.33407/itlt.v95i3.5153

Ivanytsia, A., Yunin, O., Yunina, M., Bobrishova, L., & Shevchenko, S. (2022). Promising ways to improve training for police service under martial law: Administrative and legal aspect. *Amazonia Investiga*, *11*(60), 39-46. https://doi.org/10.34069/AI/2022.60.12.4

Khan, M., & Lulwani, M. (2023). Inspiration of Artificial Intelligence in Adult Education: A Narrative Overview. OSF Preprints, January 12. https://doi.org/10.31219/osf.io/zjqmn.

Khang, A., Jadhav, B., & Birajdar, S. (2023). Industry revolution 4.0: workforce competency models and designs. In *Designing workforce management systems for industry 4.0* (pp. 11-34). CRC Press. https://www.taylorfrancis.com/chapters/edit/10.1201/9781003357070-2/industry-revolution-4-0-alex-khang-babasaheb-jadhav-sphurti-birajdar

Kuzior, A., Sira, M., & Brożek, P. (2023). Use of artificial intelligence in terms of open innovation process and management. *Sustainability*, *15*(9), 7205. https://doi.org/10.3390/su15097205

Lopez-Fernandez, O. (2021). Emerging health and education issues related to internet technologies and addictive problems. *International Journal of Environmental Research and Public Health*, *18*(1), 321. https://doi.org/110.3390/ijerph18010321

Marienko, M. V., Shyshkina, M. P., & Konoval, O. A. (2022). Methodological principles of formation of cloud-oriented systems of open science in institutions of higher pedagogical education. *Information Technologies and Learning Tools*, *89*(3), 209-232. https://doi.org/10.33407/itlt.v89i3.4981

Marienko, M., & Kovalenko, V. (2023). Artificial intelligence and open science in education. *Physical and Mathematical Education*, *38*(1), 48-53. https://doi.org/10.31110/2413-1571-2023-038-1-007

Melnychuk, O. (2023). Information and communication technologies in the field of philosophy of media practices as an educational discipline. In *I International Scientific and Practical Conference "New ways of creating scientific ideas for implementation"(September 18–20, 2023, Varna, Bulgaria)* (pp. 182-185). https://eu-conf.com/wp-content/uploads/2023/09/NEW-WAYS-OF-CREATING-SCIENTIFIC-IDEAS-FOR-IMPLEMENTATION.pdf#page=183

Mintii, M. M. (2023). Selection of pedagogical conditions for training STEM teachers to use augmented reality technologies in their work. *Educational Dimension*, *8*, 212–239. https://doi.org/10.31812/educdim.4951

Mirzoeva, M. A. (2023). Correct formation of scientific research activity of students. *Open Access Repository*, *4*(3), 722-729. https://doi.org/10.17605/OSF.IO/VRD5B

Morze, N. V., & Strutynska, O. V. (2023). Advancing educational robotics: competence development for pre-service computer science teachers. *CTE Workshop Proceedings*, *10*, 107–123. https://doi.org/10.55056/cte.549

Narzieva, N. N. (2023). Development of research competencies in the conditions of integrated education in students on the base of a competent approach. *Thematics Journal of Education*, *8*(Q1). https://thematicsjournals.in/index.php/tjed/article/view/1301

Oleynik, O., & Das, B. (2023). Professional burnout in pedagogy of specialists working in higher education sphere. *Philosophy, Economics and Law Review*, *3*(2), 203-211.

Pakhomova, T., Hryhorieva, V., Omelchenko, A., Kalenyk, M., & Semak, L. (2023). The formation of digital competence by means of information and communication technologies

among students of higher education. *Revista Eduweb*, *17*(2), 78-88. https://doi.org/10.46502/issn.1856-7576/2023.17.02.7

Stepaniuk, A., & Kartashova, I. (2023). Preparation of future science teachers for cognitive visualization of the educational process. *Scientific Notes of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University Section Theory and Methods of Teaching Natural Sciences*, 5, 90-100. https://doi.org/10.31652/2786-5754-2023-5-90-100

Stepanyuk, A., & Yagenska, H. (2023). Features of the formation of research competence of educators in the process of studing the natural sciences: Today's realities. *Bulletin of Science and Education*, *12*(18). https://doi.org/10.52058/2786-6165-2023-12(18)-748-760

Topolnyk, Y. (2021). Formation principles of information and communication competence of future masters and doctors of philosophy in the field of education. *Humanizatsiia Navchalno-Vykhovnoho Protsesu*, 1(100), 44-54. https://doi.org/10.31865/2077-1827.1002021.245394

UNESCO. (2019, March). *Artificial Intelligence*. https://www.unesco.org/en/artificial-intelligence

Wang, B., Rau, P. L. P., & Yuan, T. (2023). Measuring user competence in using artificial intelligence: Validity and reliability of artificial intelligence literacy scale. *Behaviour & Information Technology*, *42*(9), 1324-1337. https://doi.org/10.1080/0144929X.2022.2072768

DOI: https://doi.org/10.46925//rdluz.43.22

Appendix **A**

Questionnaire for studying the formation of research competence of future PhDs

1. Indicate your level of education and the main area of philosophical research.

2. How often do you use AI tools (e.g. analytics, machine learning) in your research?

3. How much do you rate your own research competence in the field of philosophy?

4. How often do you use modern information resources and databases to support your research?

5. How often do you interact with other researchers or experts to discuss your research and exchange ideas?

6. How do you rate your ability to critically analyse philosophical views and concepts?

7. How do you divide your time between studies, research, and other commitments?

8. How often do you participate in scientific conferences and present the results of your research?

9. How do you implement theoretical knowledge in the practice of your research?

10. In your opinion, can the use of AI improve the effectiveness and efficiency of your research?

11. How do you perceive the role of artificial intelligence in the field of philosophy and research?

12. How open are you to the implementation of the latest technologies and innovations in your research practice?

DOI: https://doi.org/10.46925//rdluz.43.22

13. How often do you use information management technologies to organize your research?

14. How do you rate the effectiveness of online courses and resources for improving your own research competence?

15. Do you consider it important to take into account teaching experience when building your research competence?