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The use of online simulations for building research skills in future doctors of Philosophy

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O uso de simulações online para desenvolver habilidades de pesquisa em futuros doutores em Filosofia

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El uso de simulaciones en línea para el desarrollo de habilidades de investigación en futuros doctores en Filosofía

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Abstract: *The use of online simulations in building research skills is determined by high potential opportunities in modelling the design of academic research and testing empirical hypotheses. The aim of the study was to develop and experimentally test a programme for using online simulations to build research skills in future Doctors of Philosophy (PhDs). The research employed the following methods: questionnaire surveys, quantitative, qualitative, comparative data analysis, simulation. Four research skills were identified to determine the features of using online simulations to build research skills in future PhDs. These are design, procedural, optional, and communication skills. A programme for using online simulations to build research skills in future PhDs was developed and tested. It involved the use of online simulations to perform tasks related to academic research. Experimental testing of the programme confirmed an increase in the number of respondents with a high level of design (by 9%), procedural (by 4.6%), optional (by 4.5%), and communication (by 6.9%) research skills. An increase in the number of respondents with an average level of development of design (by 9.1%), procedural (by 9.1%), optional (by 11.4%), communicative (by 6.8%) research skills was also found. The results of the study can be used in the educational process of higher education institutions (HEIs) to develop the content of training for future scholars. The research prospects include the use of online simulations in the work of future PhDs on their academic topics.*

Keywords: *Academic research. Doctors of Philosophy. Higher education institutions. Postgraduate studies. Research competence. Online simulations.*

Resumo: O uso de simulações on-line na construção de habilidades de pesquisa é determinado por oportunidades de alto potencial na modelagem do design de pesquisa acadêmica e no teste de hipóteses empíricas. O objetivo do estudo foi desenvolver e testar experimentalmente um programa para usar simulações on-line para desenvolver habilidades de

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pesquisa em futuros Doutores em Filosofia (PhDs). A pesquisa empregou os seguintes métodos: pesquisas por questionário, quantitativa, qualitativa, análise comparativa de dados, simulação. Quatro habilidades de pesquisa foram identificadas para determinar as características do uso de simulações on-line para desenvolver habilidades de pesquisa em futuros PhDs. Estas são habilidades de design, processuais, opcionais e de comunicação. Um programa para usar simulações on-line para desenvolver habilidades de pesquisa em futuros PhDs foi desenvolvido e testado. Envolveu o uso de simulações on-line para executar tarefas relacionadas à pesquisa acadêmica. Os testes experimentais do programa confirmaram um aumento no número de entrevistados com um alto nível de habilidades de pesquisa de design (em 9%), processuais (em 4,6%), opcionais (em 4,5%) e de comunicação (em 6,9%). Também foi encontrado um aumento no número de respondentes com um nível médio de desenvolvimento de habilidades de pesquisa de design (em 9,1%), processual (em 9,1%), opcional (em 11,4%), comunicativa (em 6,8%). Os resultados do estudo podem ser usados no processo educacional de instituições de ensino superior (IES) para desenvolver o conteúdo de treinamento para futuros acadêmicos. As perspectivas de pesquisa incluem o uso de simulações online no trabalho de futuros PhDs em seus tópicos acadêmicos.

Palavras-chave: Competência em pesquisa. Doutores em Filosofia. Estudos de Pós-Graduação. Instituições de ensino superior. Pesquisa acadêmica. Simulações online.

Resumen: *El uso de simulaciones en línea para desarrollar habilidades de investigación está determinado por las altas oportunidades potenciales en la modelización del diseño de la investigación académica y la prueba de hipótesis empíricas. El objetivo del estudio fue desarrollar y probar experimentalmente un programa para usar simulaciones en línea para desarrollar habilidades de investigación en futuros Doctores en Filosofía (PhD). La investigación empleó los siguientes métodos: encuestas de cuestionario, cuantitativos, cualitativos, análisis comparativo de datos, simulación. Se identificaron cuatro habilidades de investigación para determinar las características del uso de simulaciones en línea para desarrollar habilidades de investigación en futuros doctorados. Estas son habilidades de diseño, procedimentales, opcionales y de comunicación. Se desarrolló y probó un programa para usar simulaciones en línea para desarrollar habilidades de investigación en futuros doctorados. Implicó el uso de simulaciones en línea para realizar tareas relacionadas con la investigación académica. Las pruebas experimentales del programa confirmaron un aumento en el número de encuestados con un alto nivel de habilidades de investigación de diseño (en un 9%), procedimentales (en un 4,6%), opcionales (en un 4,5%) y de comunicación (en un 6,9%). También se observó un aumento en el número de encuestados con un nivel promedio de desarrollo de habilidades de investigación: diseño (9,1%), procedimental (9,1%), opcional (11,4%) y comunicativa (6,8%). Los resultados del estudio pueden utilizarse en el proceso educativo de las instituciones de educación superior (IES) para desarrollar el contenido de la formación de futuros académicos. Las perspectivas de investigación incluyen el uso de simulaciones en línea en el trabajo de futuros doctorandos sobre sus temas académicos.*

Palabras clave: *Competencia investigadora. Doctorados en Filosofía. Estudios de Posgrado. Instituciones de educación superior. Investigación académica. Simulaciones en Línea.*

INTRODUCTION

Future scholars, in particular PhDs, must have research skills. This is necessary for conducting in-depth academic research in their chosen field. Without a high research level, a modern scientist will not be able to achieve significant research results and make his own contribution to the development of a certain scientific field. It is appropriate to use modern software and technological achievements to build research skills, among which online simulation tools occupy a leading place. They enable reproducing real academic processes, experiment with data, conduct simulations and virtual experiments. As a result, such an approach contributes to the deepening of analytical thinking and the development of critical skills of future scholars. It is well known that future PhDs often have certain difficulties in building empirical hypotheses for their research, spend a lot of time collecting, generalizing, and systematizing studies, and are forced to work a lot on large arrays of empirical data. Online simulations can help with this, making it possible to significantly optimize the process of working with both purely academic sources and raw empirical indicators.

Despite a number of studies on the development of research skills of future scholars using innovative tools, academic research lacks real practices for solving this problem. This determines the direction of academic research. The academic novelty is the conducted comprehensive analysis of the current level of research skills of future PhDs. This allows us to obtain up-to-date data on their training, develop and empirically test a programme for developing research skills using online simulations. This programme demonstrates a modern approach to training future researchers. Research hypothesis: the use of online simulations contributes to the development of research skills in future PhDs. The aim of the research is to develop and experimentally test a programme for using online simulations to develop research skills in future PhDs. The research objectives are:

- Determine the current level of research skills of future PhDs;
- Elaborate a programme for developing research skills of future PhDs using online simulations;
- Verify the effectiveness of the programme for developing research skills of future PhDs using online simulations;
- Determine the achieved level of research skills of future PhDs.

2 LITERATURE REVIEW

Academic research emphasizes the importance of developing research skills in future scholars. Attention is focused on the importance of proper support for the process of developing research skills in student studying to become scholars (Minocha et al., 2024). Studies emphasize the importance of exploring the latest tools in the preparation of PhDs (Compagnucci, Spigarelli, 2024; Roy, Jiménez López, García Álvarez, 2025), the importance of research work in the training of future scholars (De Souza, Gillett, 2025). At the same time, problems are noted in strengthening the preparation of PhD candidates for various professional environments (Garcia-Morante et al., 2024). The issue of optimizing interaction between candidates for academic degrees and their research supervisors in the direction of developing research competence (Girard, Cardona, Fiorelli, 2024) is also relevant. The authors of the studies point to the appropriateness of using modern technological achievements in the development of students' research skills. They also empirically confirm the effectiveness of introducing technological achievements into the research component of the educational process, in particular in the context of mastering research methodology by future scholars (Valyukevych et al., 2021). The researchers note the particular relevance and feasibility of using modern technological achievements in higher education during the period of distance learning under martial law. The importance of optimizing the educational space of higher school students through the development of new virtual platforms and resources is also emphasized (Ishchenko et al., 2023; Yukhymenko et al., 2024). Increasing humanization and individualization, preventing stress resistance and overcoming student anxiety in the educational process and interpersonal interaction are no less important in the context of using modern technological advances in education (Zhylin et al., 2024).

A significant role is played by the introduction of innovations that make it possible to optimize the presentation of educational content in order to improve its perception of large volumes of material (Diachenko et al., 2022) and overcome emotional tension in this process (impact on students (Gamage et al., 2020; Slipetska et al., 2023). The importance of implementing an integrative approach to the development of students' competencies is emphasized (Frumkina et al., 2020). The researchers note the important role of using innovative tools, in particular cloud technologies, in improving the competencies of teaching staff (Ishchenko et al., 2022). Productive innovative tools that are appropriate for use in higher education include simulations (Russell et al., 2024), augmented reality (AR) and virtual reality (VR) (AL-ANSI et al., 2023), artificial intelligence (AI) (Kotsis, 2024). Examples of positive practices for implementing simulations in the process of developing research skills of future scholars include the use of virtual laboratories (Rosli, Ishak, 2022). elements of machine learning (ML) in various fields of activity (Mannino, Dejaco, Re Cecconi, 2021). Other examples are also the team learning model (Daryanes, Zubaidah, Mahanal, 2025), gamification using Labster (Mcgarr, 2021), collaborative online learning through discussions in small groups using electronic multimedia tools (PhET simulations, animations, YouTube videos) (Nungu, Mukama, Nsabayezu, 2023). The researchers assign a special role to online simulations, which allow you to actively manipulate variables and interact with them (Chen, She, Tsai, 2024), model phenomena, processes (Campos et al., 2020). A positive example of such a practice is 3D modelling, which improves the research skills of future scholars (Karaismailoglu, Yildirim, 2024). PhET simulations are effective in developing research skills in doctoral candidates. They provide an opportunity to conduct visual experiments and simulate them (Dron, 2022). A similar effect can also be achieved by new platforms and digital applications (ClinicalKey, Complete Anatomy and Osmosis, Surgery Squad, Touch Surgery), which are simulators (Kundina, Storozhchuk, Kozarenko, 2024).

In general, academic research on the problem under research emphasizes the importance of developing research skills in future scholars. Considerable attention is also paid to the use of modern virtual tools in this process, in particular online simulations. However, modern research does not cover the process of developing and implementing effective practices for using online simulations to develop research skills in future PhDs. Therefore, there is a need to develop and experimentally test effective programmes for using online simulations to develop research skills in future PhDs.

3 METHODS

3.1 RESEARCH DESIGN

The study of the problem of using online simulations to develop research skills in future PhDs involved four stages. The first stage, organizational, involved sampling, the development of a questionnaire to determine the current level of research skills of future PhDs. The second, summative stage, involved a survey of the respondents. During the third (formative) stage of the study, a programme for developing research skills of future PhDs using online simulations was developed and tested. The fourth (final) stage involved testing the effectiveness of the programme for developing research skills of future PhDs using online simulations. The interpretation and comparative analysis of the obtained data were also carried out, and conclusions were drawn.

3.2 SAMPLING

The study of the problem of using online simulations to form research skills in future PhDs was conducted at the Department of Innovative Technologies in Pedagogy, Psychology and Social Work of Alfred Nobel University. The study covered 90 future PhDs (44 people - experimental group (EG) and 46 people — control group (CG)). The level of development of research skills of future doctors of philosophy was taken into account in the research process. The following criteria were taken into account when forming the sample: level of education, major, experience in participating in academic projects, gender. The respondents were postgraduate students of the 2nd and 3rd years of study, as at this stage they are actively involved in research activities and have basic research skills. The sample included postgraduate students of pedagogical, psychological, and social majors, which is determined by their close integration with research activities and the active use of empirical methods in their research. The level of involvement of postgraduate students in academic projects, their participation in conferences, and publication activity were also taken into account. In terms of gender, 45 men and 45 women participated in the study. Informed consent was obtained from the research participants and all ethical standards were observed.

3.3 RESEARCH METHODS

To conduct an empirical study of the use of online simulations to develop research skills in future PhDs, the following methods were chosen:

- questionnaire - an author's questionnaire was developed to monitor the development of research skills in future PhDs (Appendix A). Using this method, four research skills were identified - design, procedural, optional, and communicative. Design skills included the ability to choose a scientific research methodology, develop a research program and objectives. Procedural skills included the ability to follow the stages in conducting scientific research, to use adequate methods at each stage. We consider the skills of adjusting one's own research programs taking into account intermediate results to be optional. And communicative skills included the skills of conducting a constructive dialogue with like-minded people and opponents when presenting the results of one's research. The levels of development of research skills were determined during the questionnaire process. This is low - the skill is not formed, medium - the skill is partially formed, high - the skill is fully formed.

- quantitative, qualitative and comparative analysis for processing the data obtained. A one-way analysis of variance (Anova) was conducted to check for statistically significant differences between the levels of development of research skills in the groups of respondents. The reliability of the author's questionnaire was checked by calculating the Cronbach's alpha coefficient, which is 0.81, which indicates a high level of internal consistency of the scale. The study also used modelling (to develop a program for the formation of research skills of future doctors of philosophy using online simulations). Data processing was carried out using the statistical software SPSS 26.0 and Microsoft Excel. The critical level of statistical significance was taken at the level of $p < 0.05$.

The following methods were chosen to conduct an empirical study of the use of online simulations to develop research skills in future PhDs:

- Questionnaire survey — an author's questionnaire was created to monitor the development of research skills in future PhDs (Appendix A). Four research skills were identified using this method: design, procedural, optional, and communication. Design skills included the ability to select research methods, develop a research programme and objectives. Procedural skills included the ability to follow the stages in conducting academic research, to use adequate methods at each stage. We consider the skills of adjusting one's own research programs taking into account intermediate results to be optional. And communicative skills included the skills of conducting a constructive dialogue with like-minded people and opponents when presenting the results of one's research. The levels of development of research skills were determined during the questionnaire survey. This are low — the skill is not developed, medium — the skill is partially developed, high — the skill is fully developed.

- Quantitative, qualitative and comparative analysis for processing the obtained data. A one-way analysis of variance (Anova) was conducted to check for statistically significant differences between the levels of development of research skills in the groups of respondents. The reliability of the author's questionnaire was checked by calculating the Cronbach's alpha coefficient, which is 0.81, indicating a high level of internal consistency of the scale. The study also used modelling (to develop a programme for the formation of research skills of future PhDs using online simulations). The data were processed using the statistical software SPSS 26.0 and Microsoft Excel. The critical level of statistical significance was taken at the level of $p < 0.05$.

4 RESULTS

The study examined the development of research skills of future PhDs by type of research skills. Design, procedural, optional, and communication research skills were taken into account. Table 1 presents the results of monitoring the levels of development of research skills at the summative stage of the study are presented in.

Table 1 – Development of research skills of future PhDs at the summative stage of the research, %

Types of research skills	Level of development					
	High		Medium		Low	
	КГ	ЕГ	КГ	ЕГ	КГ	ЕГ
Design	23.9	20.5	43.5	47.7	32.6	22.7
Procedural	19.6	22.7	45.7	43.2	34.8	34.1
Optional	13.0	11.4	21.7	29.5	65.2	59.1
Communication	26.1	29.5	47.8	47.7	26.1	22.7
General level	20.7	21.0	39.7	42.0	39.7	34.7

Source: Developed by the authors (2025).

Based on the data in Table 1, it can be stated that in the analysed sample, the majority of the subjects have an average and low level of development of research skills. In particular, the most developed are communication (26.1% in the CG, 29.5% in the EG) and design (23.9% in the CG, 20.5% in the EG) skills. This means that future PhDs have developed the skills of choosing a research methodology, developing a research programme and tasks. They also know how to conduct a constructive dialogue with like-minded people and opponents when presenting the results of their research. Procedural research skills are developed at a medium level (19.6% in the CG, 22.7% in the EG). This indicates the ability of future PhDs to adhere to the stages in conducting academic research, to use adequate methods at each of the stages. Optional research skills are the least developed. This indicates that future PhDs have difficulties in evaluating the results of academic research and adjusting their own research programmes.

The above provided a solid insight for elaborating a programme for developing research skills for future PhDs using online simulations. It consisted of such areas as: developing design skills, developing procedural skills, developing optional skills, and developing communication skills. Future PhDs were offered specific examples of online simulations in order to develop all skills (Table 2).

As part of the implementation of the programme, future PhDs were offered to perform practical tasks in accordance with the topic of their study using online simulations (Appendix B).

Table 2 – Programme for developing research skills for future PhDs using online simulations

Programme focus	Names of online simulations	Examples of using online simulations
Development of design skills	SimSchool, E-Teaching Simulation, TeachLivE, Virtual Psychology Lab, Social Psychology Network, Open Science Framework, SPSS, RStudio або Google Colab	Modelling situations, analysing problems, predicting results, testing different teaching methods, virtual interaction, developing and testing hypotheses for empirical research
Development of procedural skills	PsychLab 101, VR Classrooms, OpenSim	Practice of psychological diagnostic methods, modelling behaviour and processes

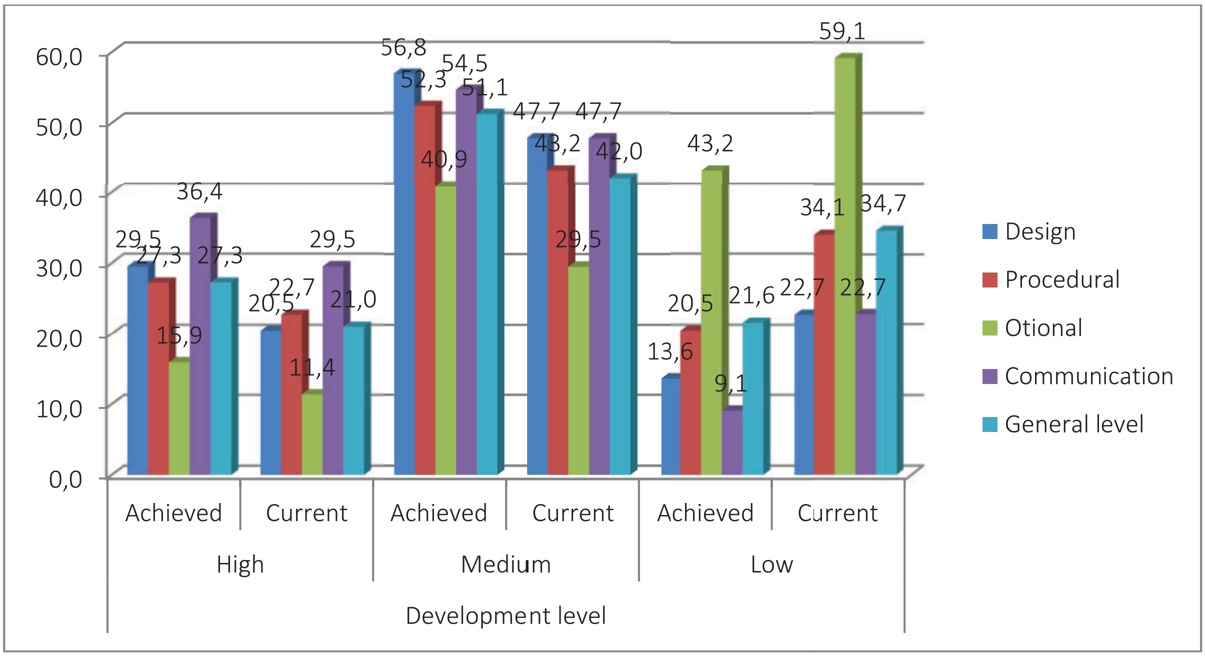
Development of optional skills	Virtual Reality Simulations for Psychology Research, XVR On Scene, Crisis Intervention Simulation, Qualtrics Research Core або OpenSim	Analysis of social interaction and correction of approaches to psychological research, practicing crisis communications, comparing predicted and actual research results
Development of communication skills	iCivics, TeachLivE, VR Classrooms, Kialo Edu, VR Engage, Psychlab, MIT Moral Machine	Conducting discussions, arguing academic positions, training communication, analysing students' reactions.

Source: Developed by the authors (2025).

When developing the programme described above, we took into account the following characteristics of online simulations: interactivity, data visualization, adaptability, safety and cost-effectiveness. The interactivity of online simulations is the ability of users to influence the course of research. Data visualization is achieved through the presentation of information in the form of graphs, diagrams, models. Adaptability lies in the ability to customize online simulations for specific research needs and the level of user training. Safety and cost-effectiveness ensure the possibility of conducting virtual experiments without risk and financial costs. We also took into account a number of advantages of online simulations. These are flexibility, accessibility, practical orientation, interdisciplinarity.

The programme proposed above was implemented in the EG for 10 months in 2024. After that, the formation of research skills of future PhDs was monitored again. For this purpose, the same questionnaire was used as in Appendix A. The repeated questionnaire survey was followed by a comparative analysis of the current and achieved levels of research skills in both groups. The data of the comparative analysis are given in Figures 1, 2.

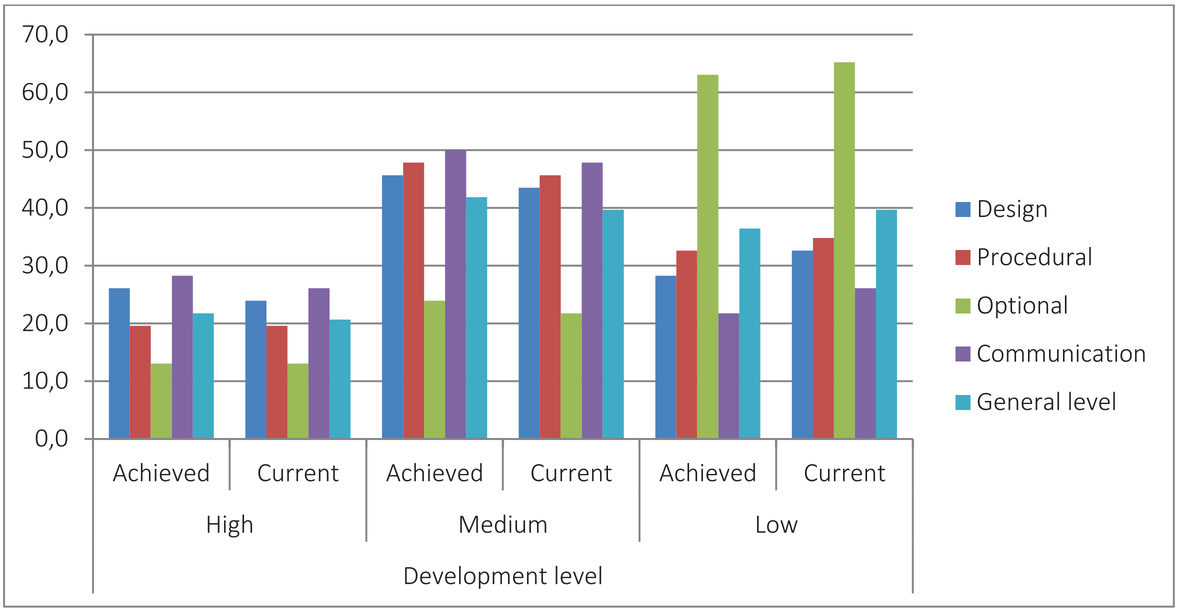
Figure 1 – Comparative analysis of the current and achieved levels of research skills in the EG, %



Source: Calculated by the author based on the questionnaire survey (2025).

Figure 1 shows that the achieved level of development of research skills after the implementation of the proposed programme in the EG is higher than the current one. In particular, an increase in the number of respondents with a high level of development of design (by 9%), procedural (by 4.6%), optional (by 4.5%), communication (by 6.9%) research skills was recorded. An increase in the number of respondents with an average level of development of design (by 9.1%), procedural (by 9.1%), optional (by 11.4%), communication (by 6.8%) research skills was also found. Furthermore, an increase in the overall level of development of research skills (by 2.7%) was recorded in the analysed sample.

Figure 2 – Comparative analysis of the current and achieved levels of research skills in the CG, %



Source: Calculated by the author based on the questionnaire survey (2025).

Figure 2 shows a slight increase in the number of respondents with a high level of design (by 2.2%), communication (by 2.2%) research skills recorded in the CG. An increase in the number of future PhDs with a medium level of each of the components of research skills by 2.2% was also found. The above indicates the effectiveness of our proposed programme for the development of research skills of future PhDs using online simulations.

The comparative analysis confirmed significantly higher growth rates in the levels of research skills of future scholars. The positive impact of our proposed programme on the development of design, procedural, optional, communication research skills is noted. The highest growth rates of indicators were recorded in the level of design and communicative skills, somewhat lower — procedural, optional skills.

5 DISCUSSION

The studies related to our study emphasize the importance of developing research skills of future scholars using modern technological developments (Valyukevych et al., 2021; Minocha et al., 2024). The authors of empirical studies state the positive impact of online simulations on the development of students' research and other types of skills (AL-ANSI et al., 2023; Russell et al., 2024). Similar studies emphasize the importance of using online simulations in various areas of students' training (Chen, She, Tsai, 2024). In the context of our study, the approach of conducting various experiments using online simulations and testing empirical hypotheses using digital platforms and interactive applications (Kundina, Storozhchuk, Kozarenko, 2024) also deserves attention.

An interesting empirically proven approach is the use of online simulations to manipulate empirical variables (Chen, She, Tsai, 2024). We also share the opinion of other researchers regarding the increased humanization and individualization of the educational process within the framework of the use of online simulations (ZHYLIN et al., 2024). Our study also provides empirical confirmation of the other researchers' opinion regarding correlations between the research skills of future scholars and the effectiveness of the implemented models of using modern online tools (Diachenko et al., 2022).

Our study is distinguished by a comprehensive approach to the assessment of research skills. We consider them not in a generalized manner, but in a comprehensive manner, distinguishing design, procedural, optional, and communication skills. For each of the types of research skills of future PhDs that we have identified, we proposed real practical tasks using online simulations. We also identified the main directions of using online simulations that are relevant to different types of academic research activity of future PhDs. The experience acquired by future scholars in the practical use of online simulations to solve the tasks set before them can be successfully continued after completing their studies and obtaining an academic degree.

Summarizing the results of our study, we can fully agree with the other researchers mentioned above, who note the leading influence of modern tools for the development of scholars' research skills. The studies different from our study consider examples of the use of online simulations in the medical field (Kundina, Storozhchuk, Kozarenko, 2024). Our study is important because of the possibility of resolving situations of uncertainty regarding the appropriateness of using online simulations in the professional training of third-level students.

The conducted research gives grounds to propose various directions for the practical use of its results. This includes the introduction of online simulations into educational programmes for postgraduate students, the organization of trainings for research supervisors on the use of online simulations in working with future scholars. It is also appropriate to create online platforms with adapted simulations for various academic majors, and the creation of educational cases for future PhDs using online simulations.

5.1 LIMITATIONS

The main limitations of the study are that it was conducted among future PhDs at Alfred Nobel University. Although the problem under study is relevant for the entire system of HEIs in Ukraine.

5.2 RECOMMENDATIONS

The main recommendations are to expand the research sample by covering future PhDs from different HEIs in Ukraine. It is also appropriate to introduce online simulations into the educational programmes of PhD students, and to develop recommendations for educational institutions regarding the use and integration of specific types of online simulations into the educational process.

6 CONCLUSIONS

The study covers the current issue of developing research skills using online simulations. These tools enable reproducing real academic research processes, experiment with data, conduct modelling and virtual experiments. The study found that the majority of future PhDs have higher levels of development of communication and design skills, medium levels of procedural skills, and low levels of optional research skills. Positive dynamics were recorded as a result of experimental testing of the programme for developing research skills for future PhDs using online simulations. In particular, an increase in high and medium levels of development of all types of research skills for future PhDs was found. The results of the study indicate that the use of online simulations is appropriate for increasing the level of development of research skills in future scholars. The study confirmed the hypothesis that the use of online simulations contributes to increasing the level of development of research skills. This is evidenced by the increase in the number of respondents with high and medium levels of development of design (9% each) and procedural skills (by 4.6 and 9% respectively). The number of respondents with the corresponding levels of optional (by 4.5 and 11.4%) and communication skills (by 6.9%) also increased.

The study monitored the development of the current and achieved levels of all types of research skills. The study proposed and tested a programme for the development of research skills of future PhDs using online simulations. The results of the study can be used in the professional training of future scholars. A promising academic interest is the use of online simulations in the work of future PhDs on their academic topics. This can be implemented through the integration of online simulations into training courses on academic research methodology, the development of specialized online modules for training in academic writing, the use of simulations in the format of virtual laboratories. It is also appropriate to study the impact of online simulations on the efficiency of postgraduate students' work on their dissertations. Furthermore, important tasks include the development of interdisciplinary online simulations for graduate students of different majors and the creation of automated systems for assessing research skills based on the results of postgraduate students' work with simulation models.

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APPENDIX A

The author's questionnaire for monitoring the development of research skills of future PhDs

Dear Respondent!

We ask you to assess the level of development of your research skills by choosing the appropriate answer option on the scale: 1 - not developed; 2 - partially developed; 3 - fully developed.

Design skills

1. Are you able to determine the methodology of scientific research in accordance with its purpose and objectives?

2. Do you have a clearly developed programme of your academic research?

3. Are you able to formulate research tasks in accordance with the chosen topic?

4. Do you have the skills to justify the relevance of your research?

5. Do you know how to determine the expected results of your academic research?

Procedural skills

6. Do you follow the sequence of stages of academic research?

7. Do you apply appropriate research methods at each stage?

8. Do you have the skills to work with primary and secondary sources of information?

9. Do you use digital tools and artificial intelligence to analyse academic literature?

10. Do you know how to systematize the results obtained and draw academic conclusions?

Optional skills

11. Are you able to make adjustments to your research programme based on intermediate results?

12. Do you analyse the possible limitations of your research and ways to overcome them?

13. Do you consider alternative approaches to solving an academic problem?

14. Do you adjust the hypotheses of your research during its implementation?

15. Do you evaluate the progress of your academic research at each stage?

Communication skills

16. Do you know how to substantiate your

research conclusions during academic discussions?

17. Are you able to constructively engage in dialogue with academic opponents?

18. Do you effectively present the results of your research during academic events?

19. Do you have the skills to work in a team on interdisciplinary academic projects?

20. Do you take into account feedback and criticism to improve your research?

Thank you for your participation!

Interpretation of the research results

Levels of development of each research skill: high – 12-15 points, medium 9-11, low – 7 and less points.

APPENDIX B

Practical tasks for postgraduate students in the programme for developing research skills of future PhDs using online simulations

1. Choose any educational situation in accordance with the topic of academic research and conduct its simulation in SimSchool. Draw conclusions about the effectiveness of the carried out work.

2. Take the diagnostic methods selected for conducting an empirical study and use E-Teaching Simulation to compare them.

3. Plan and conduct an interactive session in TeachLivE with your groupmates or students from other years of study. Make your own assessment of the participants' reactions.

4. Create a model for studying psychological / cognitive processes using PsychLab 101.

5. Organize observation of an online lesson with junior students. Analyse the behavioural characteristics of students through VR Classrooms.

6. Study the social interaction of respondents from the sample taken for conducting an empirical study using OpenSim.

7. Perform an analysis of interaction in a virtual environment using Virtual Reality Simulations for Psychology Research.

8. Conduct crisis communication in XVR On Scene and determine the best response strategies.

9. Select several examples from psychological or social work. Use Crisis Intervention Simulation to process crisis cases.

10. Analyse legal and social aspects through the iCivics game and justify their significance.

11. Develop and conduct an academic presentation of the intermediate results obtained as a result of work on an academic topic in the TeachLivE environment with groupmates. Get feedback from participants.

12. Conduct a lecture for junior students in VR Classrooms. Evaluate the audience's reactions during a simulated lecture in VR Classrooms.

13. Create a survey on your academic topic. Using Qualtrics Research Core or OpenSim, compare the predicted and actual results of an academic study, draw conclusions about the behaviour of the respondents.

14. Develop a research hypothesis and test it in the Virtual Psychology Lab, Social Psychology Network, Open Science Framework.

15. Interact with opponents in a virtual environment to practice academic argumentation skills using the Kialo Edu, VR Engage platforms.

16. Use online simulations (Psychlab, MIT Moral Machine) to model the discussion between different academic approaches.

17. Conduct empirical research using several methods according to the topic of academic research. Use SPSS, RStudio or Google Colab to compare predicted and actual results of academic research.

18. Develop a research hypothesis according to your academic topic and test it in SPSS, RStudio or Google Colab.

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