

Evaluation of pedagogical approaches, instructional techniques, and their influence on student progress and growth



Nataliia Tymoshenko^a   | Alina Velyka^b  | Oksana Yatsiv^c  | Viktor Rovnyi^d  | Yana Tovtyn^e 

^aDepartment of Philosophy, Faculty of Sociology and Law, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine.

^bDepartment of the Slavic and the Germanic Philology and Translation, Educational and Research Institute of Philology and Journalism, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine.

^cDepartment of General Pedagogy and Preschool Education, Faculty of History, Pedagogy and Psychology, Drohobych Ivan Franko State Pedagogical University, Drohobych, Ukraine.

^dDepartment of National Security, Interregional Academy of Personnel Management, Kyiv, Ukraine.

^eDepartment of Ancient, Middle Ages and Premodern History of Ukraine, Faculty of History and International Relations, Uzhhorod National University, Uzhhorod, Ukraine.

Abstract This article is a comprehensive review of modern pedagogical strategies in Ukrainian education from 2015 to 2023. The study includes an analysis of traditional, interactive, and individualized methods, as well as active engagement in the learning process. The analysis of different pedagogical and learning approaches confirms that there is no absolute solution for learning. It is noted that effective learning requires flexibility and a balanced approach that includes elements of traditional and innovative methods. The article highlights the dynamics of changing preferences in applying the methods and reveals their impact on academic performance and the overall development of students. The results allow us to conclude that there is a need to balance traditional and innovative approaches to ensure the quality and comprehensiveness of education in Ukraine. The study includes a thorough review of traditional, interactive, individualized, and active engagement approaches to the learning process. The interest in interactive methods and individualized approaches emphasizes the need to take into account the individual characteristics of students and their ability to learn independently. The obtained results provide an understanding of the effectiveness of these methods and their impact on academic performance and the overall development of students. The article highlights the prospects for a balanced use of different approaches that contribute to the formation of flexible and competent graduates in the modern educational environment.

Keywords: teaching methods, students' academic performance, students' development, traditional methods, interactive methods, active involvement

1. Introduction

In modern education, the effectiveness of pedagogical approaches and teaching methods is central to the discussion of educational strategies. Modern education is constantly evolving and is influenced by technological and socio-cultural changes. At the same time, the way knowledge is transferred to students is becoming the most crucial issue. In this article, we will analyze various pedagogical approaches and teaching methods. In addition, we will consider their impact on students' academic performance and, more broadly, on their intellectual and personal development. Modern requirements for education make it necessary to find a balance between traditional methods and innovative approaches to ensure maximum adaptability and readiness of students for the world's challenges today. In the modern educational paradigm, the emphasis is shifting from the mere transfer of knowledge to the development of critical thinking skills, creativity, and the ability to learn independently. Pedagogical approaches and teaching methods are becoming key tools to facilitate this process. In a shift from traditional lectures and textbooks to more interactive and individualized methods, education is becoming a place where students have to absorb information and actively interact with the material.

Dubasenyuk and Antonova (2012) describe practical advice for teachers, including specific techniques to support beginning and experienced educators in their pedagogical endeavors. Batsurovska et al. (2021) explores the integration of MOOCs into an e-learning system. The study provides insight into the use of online platforms in specialized education. Also, the research by Batsurovska et al. (2020) is devoted to the implementation of learning technology in the information and educational environment and the features of designing this environment for learning. It offers information for teachers involved in the development of curricula in technical disciplines.



The study by Balukh (2022) examines psychological and pedagogical approaches to the formation of future teachers' competencies. It emphasizes the importance of addressing the skills of educators related to well-being and health. These results open up valuable perspectives for teacher education and emphasize the importance of a holistic approach to teacher education. Batsurovska et al. (2021) consider the organizational and pedagogical conditions necessary for the education of higher education students using competency-based teaching aids. The study focuses on the integration of innovative teaching methods and tools. Kalaian (2017) discusses pedagogical approaches to student-driven learning, emphasizing modern teaching methods.

Pavelkiv and Petrenko (2021) provide a theoretical analysis of pedagogical approaches to the formation of educational spaces. They offer a theoretical framework for understanding how pedagogical approaches affect the creation of educational spaces. The authors emphasize the importance of educational environment design. Osadcha (2022) examines the pedagogical aspects of teaching, focusing on the specifics, goals, and methodology of teaching. Padalko (2023) explores new approaches to teaching elective courses. It contributes to the discussion of innovative teaching methodologies, offering potential strategies to improve the effectiveness of elective courses.

Shi and Blau (2020) discuss contemporary learning theories and pedagogical approaches to ensure success for all participants in the educational process. The authors provide a comprehensive overview of theories and approaches, offering a valuable resource for educators interested in inclusive pedagogy and student success. Sørensen et al. (2023) explore the experiences of student teachers with learning and pedagogical participation within a student-centered learning approach. The authors offer insight into the student's perspective. They improve our understanding of the effectiveness and impact of student-centered learning approaches.

Tkachenko and Yuan (2023) consider the pedagogical conditions for the development of transversal competencies during professional training. Their study provides insights into the pedagogical strategies necessary to cultivate transversal competencies in the specific context of philosophy and education. Truskavetska (2023) explores methodological approaches to preparing future science teachers for professional activities. The author offers valuable information about the methodological foundations necessary to prepare future science teachers for their future roles effectively.

The article by Bezliudna (2019) explores the historical development and current practice of teaching. The author offers views on the evolution of language education and discusses current challenges and approaches. Drach (2013) considers the management model in forming the professional competence of Master's students in pedagogy. This model is devoted to the organization and methodology of experimental testing. The study provides a theoretical background and practical methods for testing management models. It contributes to the development of educational management.

Harkusha and Ekonomova (2023) focus on the professional development of higher education students. They provide insights into the challenges and opportunities of music education. The study contributes to the understanding of the unique aspects of professional development. By exploring the influence of psychological culture on students' creative abilities, Gulbs et al. (2022) focus on the intersection of psychology and creativity in educational settings. The obtained results emphasize the importance of fostering a positive psychological culture to enhance the creative potential of students. The research by Babenko (2021) explores the use of podcasting as a tool for improving students' cognitive and intellectual abilities. The author emphasizes the potential of podcasting in educational institutions, shedding light on innovative approaches to facilitating learning. The paper contains practical advice and recommendations for teachers interested in implementing podcasting in their teaching methods.

The research by Hural and Smolovyk (2023) examines the correlation between students' preferences in choosing learning formats and their academic performance. The study provides insight into the factors that influence students' choices and their subsequent impact on learning outcomes. The paper by Kozmenko (2019) is devoted to the application of assessment tools to evaluate the effectiveness of teaching and student performance in higher education. It provides insights into the practical application of assessment tools. The paper emphasizes their role in improving the quality of learning and assessing student outcomes.

Martyniv et al. (2023) consider the development of health-protective skills in students on the principles of interdisciplinary integration. It helps to understand how interdisciplinary approaches can be used to develop health skills among students, emphasizing a holistic perspective of education. Marushko (2023) explores the methodological approaches and principles of preparing future science teachers for their careers. The study offers an understanding of the pedagogical strategies and approaches necessary to prepare future teachers in the context of combining theory and practice.

Nazarenko (2023) explores students' perceptions of professional success, emphasizing the role of emotions and values. Thakuri (2023) conducts a literature review on promoting engaged pedagogical innovations for meaningful learning. The study provides a synthesis of the existing literature and offers a framework for understanding pedagogical innovations and their role in promoting meaningful learning experiences. Doronina (2018) consolidates various perspectives on the theory and practice of higher education in the Ukrainian context.

Nevertheless, the problems of analyzing pedagogical approaches and teaching methods and their impact on student performance and development in the context of modern literature need to be given more attention.

This article aims to conduct an extensive analysis of pedagogical approaches and teaching methods in order to identify their impact on students' achievement and their comprehensive development in modern education.

The research goals include:

- an analysis of traditional teaching methods;
- an assessment of the impact of interactive methods;
- an investigation of individualized approaches;
- an analysis of active engagement in the learning process;
- a comparison of the evolution of using teaching methods from 2015 to 2023.

2. Materials and Methods

This article employs numerous methodologies and approaches to analyze the impact of pedagogical strategies on students' performance and development. Literature review (Assessment of current research, articles, and publications about the chosen topic to identify key trends and results of previous research in the field of pedagogy and teaching methodology).

Analysis of statistical data (The use of statistical methods to analyze data on the use of pedagogical approaches in educational institutions in Ukraine for the period from 2015 to 2023. This includes calculating average values, percentages, and temporal trends). Comparative analysis (Comparison of different pedagogical approaches and teaching methods based on their effectiveness, impact on academic performance, skill development, and personal growth of students).

Analysis of temporary trends (The study of the dynamics of changes in preferences in the use of methods from 2015 to 2023 and the identification of possible factors influencing these changes). Content analysis (The study of curricula and materials used in educational institutions to identify the preferred approaches to teaching and their compliance with modern requirements). A combination of these methods allowed us to get a broad and in-depth look at current trends in education, the effectiveness of the methods used, and their impact on students' development.

3. Results

Education is a fundamental element in the development of individuals and society. However, it is necessary to focus not only on the content of education but also on teaching methods and pedagogical approaches to achieve the best results in the learning process. The Table 1 summarizes pedagogical approaches, teaching methods, and their impact on students' performance and development.

Table 1 Pedagogical approaches, teaching methods, and their impact on students' performance and development.

Pedagogical approaches	Teaching methods	Impact on students' academic performance and development
Traditional methods	Lectures and textbooks	Limited development of critical thinking, reduced ability to search for information independently.
Interactive methods	Discussions, team projects, practical classes	Active involvement of students, development of communication and teamwork skills, and deeper understanding of the material.
Individualized approaches	Differentiated learning and the use of technologies	Adaptation of the educational process to the personal needs of students and more effective learning.
Active involvement in the learning process	Problem-based learning, project assignments, research activities	Independent thinking, development of problem-solving skills, and creativity.

- *Traditional teaching methods.* Traditional methods, such as lectures and textbooks, are the standard approach in education. However, despite their widespread use, they can limit the development of critical thinking and creativity. Students who are taught by traditional methods may have limited opportunities to search for information on their own and to apply knowledge in practice.
- *Interactive methods.* Interactive methods, such as discussions, group projects, and practical exercises, promote more active involvement of students in the learning process. These methods not only promote an in-depth understanding of the material but also develop communication and teamwork skills. Students who study through interactive methods are often more successful in solving complex problems and applying knowledge in practice.
- *Individualized approaches.* Such approaches as differentiated instruction and the use of technology allow teachers to adapt the learning process to students' individual needs. This approach is especially important in a society where students have different learning styles and learning rates. Individualized approaches contribute to deeper and more effective learning, taking into account the characteristics of each student.
- *Active involvement in the learning process.* Student success often depends on their active involvement in the learning process. The use of methods such as problem-based learning, project assignments, and research activities stimulates



students to think independently, solve problems, and be creative. These methods help to develop the skills necessary for a successful career in the global market.

Let us analyze the use of pedagogical approaches, such as traditional methods, interactive methods, individualized approaches, and active involvement in the educational process since 2015. The results will be presented in a bar chart in Figure 1.

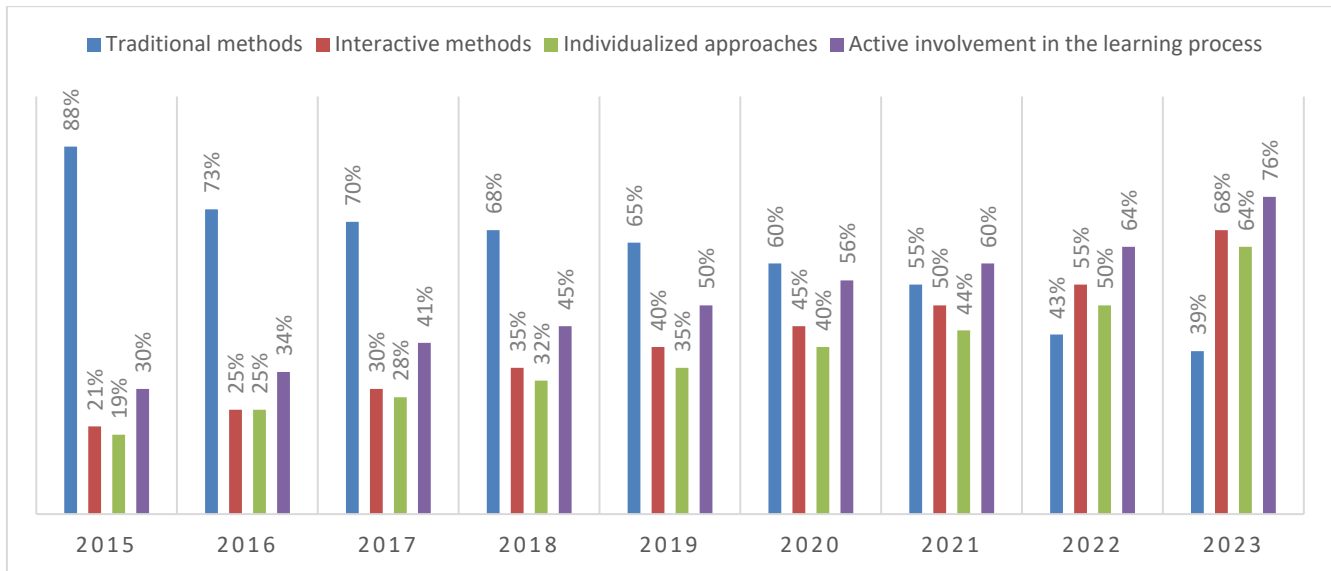


Figure 1 The use of pedagogical approaches to the educational process from 2015 to 2023.

The data analysis reveals some interesting trends in using different pedagogical approaches in Ukraine from 2015 to 2023. The percentage of traditional methods is gradually decreasing from 88% in 2015 to 39% in 2023. There is a steady downward trend in the share of traditional methods. This may reflect a desire for greater variability and interactivity in the educational process. The percentage of interactive methods is gradually increasing, starting from 21% in 2015 and reaching 68% in 2023. This growth may indicate a desire for more active involvement of students in the learning process and a shift away from traditional, often passive methods. The percentage of individualized approaches is also increasing from 19% in 2015 to 64% in 2023. It may indicate a desire for more flexible educational programs and a desire to take into account the individual needs of students. The percentage of active engagement in the learning process also shows a steady increase, starting at 30% in 2015 and reaching 76% in 2023.

This reflects the desire to create a more dynamic and engaging learning experience where students are actively involved in the learning process. The general trend in the bar chart data indicates a shift in pedagogical practices towards more modern and interactive teaching methods. The latter can contribute to more effective learning and student development (Iatsyshyn et al., 2020; Shcherbak et al., 2023).

The analysis of different pedagogical approaches and teaching methods confirms that there is no such thing as a single solution for learning. Instead, effective teaching requires flexibility and a balanced approach that includes elements of traditional and innovative methods. Teachers who use various methods contribute not only to the success of their students but also to their all-round development. This is the key to preparing qualified and competent specialists needed in the future.

4. Discussion

Based on the above analysis, it becomes clear that the change in emphasis on pedagogical approaches indicates the desire to create an educational environment that stimulates active interaction of students with the learning material. The interest in interactive methods and individualized approaches emphasizes the need to consider the students' characteristics and ability to learn independently. The growing use of active engagement in the learning process demonstrates the importance of developing both theoretical knowledge and practical skills needed in society (Popov et al., 2022; Semenets-Orlova et al., 2022). Despite the progress in utilizing modern methods, the issues of effectiveness and adaptation to changing circumstances still need to be addressed. The prospects for developing education in Ukraine can be enriched by the exchange of experience and the introduction of innovations. In this way, it will ensure more effective and comprehensive progress for future generations (Antoshkina et al., 2023).

Some learning challenges related to explaining complex terms and concepts can be overcome by using interactive elements: to attract students' attention, keep their interest, and involve them in cognitive activities. There are some features of creating educational tools for studying technical disciplines, the use of interactive posters can help overcome difficulties in

learning certain engineering concepts, calculations and working with drawings and diagrams, visualization of processes (Dotsenko, 2023). Interactive posters can be customized to meet the individual needs and learning styles of students. For example, they can offer the ability to choose the level of difficulty, personalized guidance, and feedback, and adapt to different learners.

Knowledge tracking is the task of tracking the development of students' knowledge during training, which increases the effectiveness of training. Most of the existing methods strive for high accuracy in predicting students' success but neglect the consistency between the dynamic state of students' knowledge and their learning process. Moreover, they focus on learning outcomes during a single learning interaction, whereas student progress in a continuous learning interaction is more instructive (Shen et al., 2023). Monitoring knowledge and learning progress plays an important role in education systems, as it allows for the assessment of student progress, the identification of areas that require additional support, and the adaptation of curricula and methods to the individual needs of participants. Regular feedback from teachers and opportunities for dialogue between students and teachers also play an important role in monitoring knowledge and progress. It helps students understand their strengths and weaknesses and get recommendations for improvement. The use of educational technologies such as online learning platforms, learning material management systems (LMS), responsive applications, etc. can also enable more effective monitoring of student progress.

Learning in an online learning environment in the context of physical, mathematical, and engineering education has some features that arise due to the large amount of data, calculations, and the use of special programs. Therefore, there is a need not only to use the digital environment of the higher education institution but also to involve the use of third-party engineering programs (Babenko et al., 2023). Engineering education often includes a multidisciplinary approach, combining knowledge from various fields of science and technology. This allows students to acquire a wide range of competencies and skills, which contributes to their readiness to work in various fields and industries. Engineering education emphasizes the importance of continuous learning and self-development in the face of rapid technological progress. Students learn to adapt to changes, master new technologies, and work methods, which allows them to successfully adapt to changing conditions and requirements of the labor market.

With the development of modern technologies, interactive learning has become more accessible and diverse. This includes the use of interactive whiteboards, online learning platforms, virtual classrooms, mobile applications, and other innovative technologies that allow for the creation of interactive learning materials and tasks (Hong et al., 2021). Game elements such as gamification and game-based learning design are used to create interactive and engaging educational experiences. This allows you to stimulate student motivation, increase the level of engagement, and improve learning outcomes. Interactive learning involves the active interaction of students with each other and with the teacher. This includes working in groups, discussing and sharing ideas, and solving tasks and projects together, which contributes to the development of communication and collective skills (Doringin & Oktriono, 2019).

Interactive learning also involves taking into account the individual needs and interests of students. Personalized curricula and materials allow students to choose content and learning methods that match their knowledge level, learning style, and learning goals (Yinghui & Lin, 2021). It also includes the use of formative assessment, which involves continuous monitoring of student performance and feedback during the learning process. This allows students to quickly identify their mistakes and gaps in knowledge, which contributes to their effective learning. The development of interactive learning is an important trend in modern education, which contributes to the improvement of the quality of learning and the educational process in general.

5. Conclusions

The analysis of pedagogical approaches and teaching methods shows a dynamic change in the educational paradigm in Ukraine from 2015 to 2023. An increase in using interactive methods and individualized approaches underscores the educational system's desire to create flexible and adaptive learning that meets the needs of various students' groups. A significant increase in active involvement in the learning process demonstrates the willingness to develop theoretical knowledge and practical skills necessary for successful societal adaptation. It is essential that despite these positive trends, the effectiveness and optimal combination of different methods require further research and discussion. The trend toward increased use of interactive and individualized methods demonstrates the desire of modern educational institutions to create a stimulating and diverse learning environment.

Active involvement in the learning process develops students' independence and builds their skills in solving complex problems and applying knowledge in practice. Research findings emphasize that the success of the educational process depends on a balanced approach that takes into account both traditional and innovative methods. Based on the observed trends, we can conclude that the dynamism of the educational environment requires constant updating and improvement of pedagogical methods to maintain a high level of educational effectiveness in Ukraine.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research did not receive any financial support.

References

- Antoshkina, V. K., Shevchenko, A. Y., Skryl, S. A., Sadovyi, S. M., & Kuznichenko, O. V. (2023). Problems of legal education development in Ukraine. *International Journal of the Legal Profession*. <https://doi.org/10.1080/09695958.2023.2279758>
- Babenko, O. (2021). Development of students' cognitive and intellectual abilities by means of podcasting. *Bulletin of Zaporizhzhia National University. Pedagogical Sciences*, 2, 150-155. <https://doi.org/10.26661/2522-4360-2020-3-2-22>
- Balukh, M. (2022). Psychological and pedagogical approaches to the formation of healthcare competences of future primary teachers. *Educational Horizons*, 53, 78-81. <https://doi.org/10.15330/obrii.53.2.67-70>
- Babenko, D., Dotsenko, N., & Gorbenko, O. (2023). Technology of creation term papers in electrical engineering disciplines in the online learning environment. *2023 IEEE 5th International Conference on Modern Electrical and Energy System (MEES)* (pp. 1-5). Kremenchuk, Ukraine. <https://doi.org/10.1109/MEES61502.2023.10402391>
- Batsurovska, I. (2021). MOOCs in the System of E-learning for master's in electrical engineering. *IEEE International Conference on Modern Electrical and Energy Systems (MEES)* (pp. 1-4). <https://doi.org/10.1109/MEES52427.2021.9598641>
- Batsurovska, I. V., Uchitel, A. D., Dotsenko, N. A., Gorbenko, O. A. & Kim, N. I. (2021). Implementation of future agricultural engineers' training technology in the informational and educational environment. *CTE Workshop Proceedings*, 8, 233-246. <https://doi.org/10.55056/cte.235>. Accessed on April 16, 2024.
- Batsurovska, I. V., Oliynyk, V. V., Samoilenko, O. M., & Dotsenko, N. A. (2021). Information and educational environment for teaching general technical disciplines to bachelor's in electrical engineering. *Information Technologies and Learning Tools*, 83(3), 259-273. <https://doi.org/10.33407/itl.v83i3.4373>
- Batsurovska, I., Dotsenko, N., Gorbenko, O., & Kim, N. (2021). Organizational and Pedagogical Conditions for Training Higher Education Applicants using Competence-Oriented Learning Tools. *Second International Conference on History, Theory and Methodology of Learning (ICHTML 2021), SHS Web of Conferences*, 104, 1-8. <https://doi.org/10.1051/shsconf/202110402014>
- Bezliudna, V. (2019). Methodology of teaching foreign languages in higher educational institutions: history and modernization. *Youth & Market*, 2(169), 46-50. <https://doi.org/10.24919/2308-4634.2019.162718>
- Doronina, T. O. (2018). *Theory and Practice of Higher Professional Education in Ukraine: Teaching Methodological Complex*. Kryvyi Rih State Pedagogical University.
- Dotsenko, N. (2023). Interactive posters as a learning tool for practical tasks in the context of electrical engineering education. *2023 IEEE 5th International Conference on Modern Electrical and Energy System (MEES)* (pp. 1-5). Kremenchuk, Ukraine. <https://doi.org/10.1109/MEES61502.2023.10402463>
- Doringin, F. & Oktriono, K. (2019). The challenges of implementing online learning in secondary education. *2019 IEEE International Conference on Engineering, Technology and Education (TALE)* (pp. 1-4). Yogyakarta, Indonesia. <https://doi.org/10.1109/TALE48000.2019.9226036>
- Drach, I. I. (2013). Organization and methods of experimental testing the model of management of forming a professional competence of the masters of pedagogic of high school. *Theory and methods of educational management*, 11, 12-28. https://umo.edu.ua/images/content/nashi_vydanya/metod_upr_osvit/v_11/3.pdf. Accessed on April 16, 2024.
- Dubasenyuk, O. A., & Antonova, O. Ye. (2012). *Methods of teaching pedagogy: A study guide*. 2nd ed. Zhytomyr Ivan Franko State University Publishing House.
- Gulbs, O., Lantukh, I., & Zhuk, O. (2022). The influence of psychological culture on the development of students' creative abilities. *Bulletin of National Defense University of Ukraine*, 64(6), 49-57. <https://doi.org/10.33099/2617-6858-2021-64-6-49-57>
- Harkusha, L., & Ekonomova, O. (2023). Professional development of university students in a special instrument class (piano). *Humanities Science Current Issues*, 66(1), 220-226.
- Hural, I., & Smolovyk, L. (2023). Relationship between students' priorities when choosing the education format and their success. *Human Studies, Series: Pedagogy*, 16(48), 64-71. <https://doi.org/10.24919/2413-2039.16/48.9>
- Hong, Y., Yang, J., Chen, Y. & Dong, H. (2021). Research on the development of online education in the age of AI and 5G. *2021 2nd International Conference on Education, Knowledge and Information Management (ICEKIM)* (pp. 233-237). Xiamen, China. <https://doi.org/10.1109/ICEKIM52309.2021.00058>
- Iatsyshyn, A., Iatsyshyn, A., Kovach, V., Radchenko, O., & Turevych, A. (2020). Application of open and specialized geoinformation systems for computer modelling studying by students and PhD students. *CEUR Workshop Proceedings*, 2732, 893-908. https://www.researchgate.net/publication/345626675_Application_of_Open_and_Specialized_Geoinformation_Systems_for_Computer_Modelling_Studyin_g_by_Students_and_PhD_Students. Accessed on April 16, 2024.
- Kalaian, S. A. (2017). Pedagogical Approaches for the 21st Century Student-Driven Learning in STEM Classrooms. In N. Alias & J. Luanan (Eds.), *Student-Driven Learning Strategies for the 21st Century Classroom* (pp. 72-86). IGI Global. <https://doi.org/10.4018/978-1-5225-1689-7.ch006>
- Kozmenko, O. (2019). Using the tool for assessing the effectiveness of teaching and students' performance in higher education institutions. *Scientific Papers of Berdiansk State Pedagogical University Series Pedagogical Sciences*, 2, 216-224. <https://doi.org/10.31494/2412-9208-2019-1-2-216-224>
- Martyniv, O., Shukatka, O., Borisevych, L., & Kushnir, R. (2023). Development abilities and skills a culture of health care a students on the basis of interdisciplinary integration. *Education. Innovation. Practice*, 11, 18-23. <https://doi.org/10.31110/2616-650X-vol11i3-003>
- Marushko, L. (2023). Methodological approaches and principles of preparation for professional activity of future teachers of natural sciences. *Problems of Chemistry and Sustainable Development*, 2, 71-78. <https://doi.org/10.32782/pcsd-2023-2-10>



- Nazarenko, N. (2023). Investigation of students' perceptions of professional success: emotions and values. *The Psychological Dimensions of Society*, 10, 232-249. <https://doi.org/10.32999/2663-970X/2023-10-12>
- Osadcha, L. (2022). Pedagogical aspects of the weighing department of the special psychology in the medical college: specificity, purposes and that methodology of the weighing. *Bulletin of National Defense University of Ukraine*, 1(65), 86-92. <https://doi.org/10.33099/2617-6858-2022-65-1-86-92>
- Padalko, N. (2023). New approaches in the method of teaching elective mathematics courses at school. *Modern Information Technologies and Innovation Methodologies of Education in Professional Training Methodology Theory Experience Problems*, 66, 62-71. <https://doi.org/10.31652/2412-1142-2022-66-62-71>
- Pavelkiv, R., & Petrenko, I. (2021). Pedagogical approaches to the formation of educational space: theoretical analysis of the problem. *Innovations in Education*, 1, 39-49. <https://doi.org/10.35619/iiu.v1i13.371>
- Popov, O. O., Kyrylenko, Y. O., Kameneva, I. P., Iatsyshyn, A. V., Iatsyshyn, A. V., Kovach, V. O., Artemchuk, V. O., Bliznyuk, V. N., & Kiv, A. E. (2022). The use of specialized software for liquid radioactive material spills simulation to teach students and postgraduate students. *CTE Workshop Proceedings*, 9, 306-322. <https://doi.org/10.55056/cte.122>
- Semenets-Orlova, I., Shevchuk, R., Plish, B., Moshnin, A., Chmyr Y., & Poliuliakh R. (2022). Human-centered approach in new development tendencies of value-oriented public administration: Potential of education. *Economic Affairs (New Delhi)*, 67(5), 899-906. <https://doi.org/10.46852/0424-2513.5.2022.25>
- Shen S., Chen E., Liu Q., Huang Z., Huang W., Yin Y., Su Y., & Wang S. (2023). Monitoring student progress for learning process-consistent knowledge tracing. *IEEE Transactions on Knowledge and Data Engineering*, 35(8), 8213-8227. <https://doi.org/10.1109/TKDE.2022.3221985>
- Shcherbak, O., Truba, H., Filippova, N., Romanets V., Bordeniuk S., & Shchokin R. (2023). Sociological research on the impact of the covid-19 pandemic on student preparation and the development of film discourse. *Journal of Research and Social Intervention*, 81, 148-164. <https://doi.org/10.33788/rcis.81.9>
- Shi, T. & Blau, E. (2020). Contemporary Theories of Learning and Pedagogical Approaches for All Students to Achieve Success. In Y. Inoue-Smith & T. McVey (Eds.), *Optimizing Higher Education Learning Through Activities and Assessments* (pp. 20-37). IGI Global. <https://doi.org/10.4018/978-1-7998-4036-7.ch002>
- Sørensen, A., Lagestad, P., & Mikalsen, H. (2023). Student Teacher Experiences of Learning and Pedagogical Involvement Using a Student-Centered Learning Approach. *Education Sciences*, 13, 965. <https://doi.org/10.3390/educsci13090965>
- Thakuri, R. R. (2023). Fostering Engaged Pedagogical Innovation for Meaningful Learning: A Literature Review. *Pragyatna*, 5(1), 63-73. <https://doi.org/10.3126/pragyatna.v5i1.59272>
- Tkachenko, I. & Yuan, W. (2023). Pedagogical conditions of forming transversal competencies of future doctors of philosophy in the field of education/pedagogy in the process of their professional training: methods of detection. *Bulletin of Oleksandr Dovzhenko Hlukhiv National Pedagogical University*, 52(2), 164-170. <https://doi.org/10.31376/2410-0897-2023-2-52-164-170>
- Truskavetska, I. (2023). Methodological approaches to preparing future teachers of the natural sciences for professional activities. *The Scientific Issues of Ternopil Volodymyr Hnatiuk National Pedagogical University. Series: Pedagogy*, 2, 14-22. <https://doi.org/10.32782/2415-3605.23.2.2>
- Yinghui, Z. & Lin, C. (2021). Current situation and reform countermeasures of accounting specialty teaching in private colleges under the background of online education. *2021 International Conference on Internet, Education and Information Technology (IEIT)* (pp. 545-548). Suzhou, China. <https://doi.org/10.1109/IEIT53597.2021.00128>