Incorporating innovative technologies into higher education teaching: Mastery and implementation perspectives for educators

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1. Introduction

Among the globalization challenges of our time in education is the integration of innovative technologies both as technical tools and as essential professional skills and qualities for high school teachers. In 2002, the National Doctrine of Education Development stated that Ukraine should ensure accelerated, forward-looking, and innovative education development. The country should also create conditions for the development, self-affirmation, and self-realization of people throughout life (National Doctrine of Education Development, 2002). The priority areas for the development of education in the country include the following:

- The introduction of educational innovations.
- The integration of national education into the European and world educational spaces" (National Doctrine of Education Development, 2002).
- The COVID-19 pandemic and Russia's full-scale invasion of Ukraine on February 24, 2022, once again, clearly demonstrated the vital need to implement and integrate innovative technologies into the educational process at all levels, including higher education institutions (HEIs).

The scientific papers that were useful for preparing this article cover a wide range of issues related to innovations and innovative technologies. These studies also cover the implementation of innovations in various spheres of society and specific examples of implementing innovations in the educational process in different educational institutions in Ukraine. Such a comprehensive approach toward familiarization with the scientific achievements on this issue allows for a more holistic
perspective on the integration of innovative technologies into the professional activities of university professors. It also allows for an understanding of the main trends, issues, and prospects of the given research area.

We should first pay attention to an umbrella-type scientific monograph, "Innovation Studies. Evolution and Future Challenges". The authors of this monograph opened a wide field of study of innovations in the history of mankind after the Second World War. They state that the current era is the new time when the modern multilevel management system requires innovative solutions. Otherwise, various crises may drag on and lead to nationalistic regression and protectionism.

In this context, technical innovations can become more destructive than creative. They tend to be deployed primarily to fight or compete with "others" and knowledge sharing. This is crucial for overcoming global challenges, which will no longer be an option (Innovation Studies. Evolution and Future Challenges, 2013). In other words, we should use innovations carefully, recognizing their undoubted advantages and possible negative consequences. Thus far, humanity is not ready to talk about them.

The monograph "Innovations in Higher Education: Problems, Experience, Prospects" is devoted to the following theoretical and practical aspects of implementing innovations in the educational practice of higher education institutions:

- The place of higher education in Ukraine in pan-European discourses.
- Innovative conceptual frameworks for reforming higher education both in Ukraine and in the EU.
- The introduction of educational innovations in the higher education system.
- Special scientific attention is focused on the practical experience of Ivan Franko Zhytomyr State University (Innovations in Higher Education, 2011).

Studies by Shapovalova (2011) and Strizhkova (2019) are devoted to the problems of legislative support for the innovative development of education in Ukraine, the formation of a national innovative system, and the digitalization of public administration. Vasylchenko et al. (2021) considered the specifics of the psychological readiness of high school teachers for innovations in higher education. Bazylevych et al. (2019) focused on the analysis of scientific approaches related to the impact of digital technologies on students' behavior and their demands for education. Cherdemik and Dansheva (2018) studied pedagogical technologies in the higher education system. Kucher and Rozhnova systematized the key aspects of the innovative approach and methods of using modern technologies in teaching graduates (2023). Boichuk and Boiarska-Khomenko analyzed the role of innovations in the training of future teachers. In particular, they analyzed the role of innovations in the training of future teachers, using the example of H. S. Skovoroda Kharkiv National Pedagogical University (2022).

In general, despite an impressive volume of scientific literature on the study of innovative technologies and their implementation in the educational process at various levels, the topic is actually inexhaustible. After all, innovations in all spheres of life are accumulating like a snowball. Their mastery, practical application, filtering, and improvement are integral parts of modern life. E. Schmidt and J. Cohen rightly pointed out that these tools will only exist with a reliable education system. The authors have raised the following questions:

- How can we strike a balance between mechanical memorization and the development of critical thinking?
- How long should lectures last, and how much time should be devoted to discussions?
- What should students learn together in the classroom, and what should they work independently at home using a laptop or tablet?

The internet and information will allow us to confirm or deny conventional educational theories regarding general education and improve teaching methods that have not changed over a decade (Schmidt & Cohen, 2015).

2. Materials and Methods

When compiling this article, the following general scientific methods were used: analysis, synthesis, and concretization. These methods allowed the authors to cover multiple approaches to the issue of integrating innovative technologies into the professional activities of high school teachers. The literature review method allowed the study of documents and materials related to the generalization of the experience of innovative development globally and in Ukraine. The method of generalization was applied to formulate the results and conclusions of the study.

This research also employed content analysis and comparative analysis of scientific, didactic, educational, reference, terminological, and encyclopedic printed and electronic information sources. This was especially useful for understanding the specifics of introducing innovations into the professional activities of educators of different educational institutions and specialties. The method of studying best pedagogical practices made it possible to trace the dynamics of teachers' implementation of innovations in their professional activities. The methods of comparison and contradiction allowed the authors to analyze the specifics of introducing innovations by teachers in their professional activities both in Ukraine and abroad.
3. Results

The introduction of innovations in education is a necessary step toward the development of the entire society. Innovations impact the level of a teacher's professional activity, expanding educational opportunities and the quality of educational services. It is essential to understand that innovation is not just any novelty but something that enhances the efficiency of the system. In our case, we are talking about the professional activities of high school teachers. Recognizing the role of the teacher as the "most valuable commodity owned by the educational institution" (Blouin et al., 2009) is another step toward quality changes in higher education.

The teacher's task is to teach students how and why certain processes occur, how to obtain information and transform it into knowledge, and how to stimulate critical thinking. We are already dealing with people from the "digital natives" generation. In particular, computers were introduced for computer-assisted learning in the 1960s (Gudkova, 2020). Current students tend to obtain information from the internet, prefer visuals, pay attention to environmental issues and their own health, are emotionally sensitive, are socially and virtually active, and seek practical knowledge and skills. All these aspects need to be taken into account by teachers in the development of educational programs, teaching materials, and communication with the student audience.

The concept of the "teacher's brand" and its practical implementation have become important. In particular, it is worth actively introducing e-portfolios into professional activities as a modern tool for shaping professional qualities and competencies, a "portfolio of achievements" for teachers, and a technology for personal monitoring and self-control. For example, Cherevychnyi described the methodology of introducing e-portfolios to history students. The author noted that an e-portfolio is not only a personal-activating construct for filling the treasury of one's achievements and outlining perspectives. It can also be considered a diagnostic and controlling tool for assessing the accomplishments of future history teachers (a qualitative form of self-assessment of results, the lever to enhance students' motivation for self-education, the formation of a reflexive culture, and the direction of critical thinking development) (Cherevychnyi, 2022; Byrkovich et al., 2023). Thus, we can consider the E-portfolio to be an effective methodology in the educational process and in the professional development of teachers.

Teachers' task is to provide high-quality modern higher education through personal background, continuous professional development, experience, current technologies, interdisciplinary approaches, professional and auxiliary knowledge, skills, and abilities. They should develop students' creativity and critical thinking skills and teach them to learn and analyze information, turning it into knowledge, which is a valued asset. When mastering innovations for professional activities, teachers need to consider the specificity of the "digital natives" generation, who are usually more creative in technical and technological terms than the older generation. However, "shallow thinking" hinders the in-depth and systematic mastering of educational material (Kuznetsova et al., 2023). Therefore, it is crucial to select tools to combine technology and experience carefully. A comprehensive approach to integrating innovative technologies into the professional activities of university teachers is one of the keys to the high quality of modern higher education. The effective implementation of innovations in higher education institutions also requires official support, including legislative, financial, logistical, and technical support (Kuznetsova et al., 2023).

We can state that, in Ukraine, the process of forming a national innovation system is ongoing. It has both achievements and problems, which are determined by internal and external factors. The possibility of creating a complete innovation cycle (personnel issues, infrastructure, funding, and material-technical support) becomes particularly acute in the conditions of war. The issue of "brain drain" cannot be ignored, along with the necessity of commercializing domestic innovative achievements.

The perception of higher education in society as an opportunity to obtain a diploma rather than acquiring knowledge for its subsequent practical application, dissemination, and multiplication and the formation of a fully developed personality remains relevant. An important component of implementing innovations in the professional activities of teachers is the information pedagogical management of higher education (Karpliuk, 2019; Zondo, 2022). The praxeological effectiveness of higher education (functionality, efficiency, productivity) significantly improves due to the proper mastery of innovative technologies. However, excessive enthusiasm for the "showization" of the educational process can negatively affect the perception of education as a multidimensional and complex development process.

Therefore, it is essential in the process of innovatively improving professional skills to harmoniously combine both traditional methods of teaching and communication and modern methods. In particular, in "University World News," discussing the future of universities in the near perspective, it is noted that "Universities of the future will be open, transformative, and transnational, building partnerships with a wide range of actors at local and international levels. Their nature and structure will be hybrid, combining physical and virtual spaces in an integrated learning and research environment that takes into account the needs of a diverse university community" (Jorgensen & Claes-Kulik, 2021; Kussainov et al., 2023). In their professional activities, teachers have successfully mastered Google Classroom, Zoom, Kahoot!, Google Meet, etc. Various messengers and e-mails are also involved. Virtual laboratories and computer modeling are actively being introduced into the educational process.
Among the problems of implementing innovations in the educational process and the professional development of teachers, we can name the following:

- lack of technical and technological readiness to use the latest teaching tools;
- perception of innovations as a technical function, not as a creativity of ideas;
- understanding of the strategic goals of educational innovations (a change not only in the methods of the educational process and professional development but also in the consciousness of all participants in the educational process);
- psychological (un)readiness for innovative changes (Petrunko, 2014).

4. Discussion

The term "knowledge society" has already been well established in academic circles. It was introduced into scientific and journalistic discourse in the 1990s. In particular, the American scholar and writer Peter Ferdinand Drucker emphasized in 1993 that capital, natural resources, or labor are no longer primary economic resources or the means of production. All of them were replaced by knowledge. Now, value is created by “productivity” and “innovation,” which means applying knowledge to work. The leading social group in the emerging society will be knowledge workers who know how to use knowledge for productive purposes” (Drucker, 1993).

In 2005, UNESCO published a report dedicated to the knowledge society, identifying 10 fundamental vectors for building such a society on a global scale. The report particularly emphasized what can be considered a knowledge society. It is a society with diversity and possibilities (Toward Knowledge Societies, 2005). While the concept of the information society is based on technological achievements, ethical, social, and political parameters are fundamental for the knowledge society. Therefore, various tools are equally crucial for the construction and development of such a society: school textbooks, media, radio, television, and, later, the internet with free access to it. On the other hand, key resources include the creative potential of both society and individuals, as well as social integration and solidarity.

Regarding solidarity, it is worth mentioning the solidarity of our Ukrainian society in the face of a full-scale invasion, especially in its first hours and days. For the formation and effective development of a knowledge society, youth is crucial as the vanguard of the practical application of the latest technological developments. In addition, with its experience, the older generation helps compensate for the “shortsightedness of thinking” of young people (Toward knowledge societies: UNESCO world report, 2005). However, let us return to the 10 aforementioned vectors of building a knowledge society. We will dwell in detail on those related to the development of education and higher education:

The transition from an information society to a knowledge society is accompanied, among other things, by significant technological differences in the development of various societies. Overcoming such gaps is currently a serious challenge. Ultimately, overcoming the digital divide should lead to the effective use of technologies for the development of a knowledge society and digital solidarity.

The development of a network society, a network economy. We are already witnessing and participating in the "virtual migration" process. The transition from an agricultural economy to an industrial economy occurred in the XIX century. It was accompanied by significant migration flows from rural areas to cities and factories. Similar processes are taking place in the 21st century. However, they are associated with migration from the physical to the virtual world. Regarding education, including higher education, the “spread of virtual, variable, and infinitely accessible objects in our environment that promotes collective work and joint acquisition of new knowledge” has become a reality. Learning, which has long been confined to specific places such as schools, has now become a virtual space at the planetary scale with remote access, where an infinite number of situations can be simulated (Toward knowledge societies: UNESCO world report, 2005).

Learning societies (learning how to learn). In this case, we observe a tremendous increase in the amount of knowledge and the desire to assimilate this knowledge. The path from discovery or technological achievement to including this information in a textbook has never been as short as it is now. Cognitive sciences (psychology, philosophy, artificial intelligence, linguistics, biology, medicine, anthropology, sociology) play a key role. Hence, great attention is given to the cultural and social environment where knowledge is transferred (class, student group, professional environment), as well as the exchange of emotions and information. Knowledge transfer should occur primarily among researchers, scientists, and teachers and then among teachers and seekers (Toward knowledge societies: UNESCO World Report, 2005).

Moreover, it is essential to remember that in accelerated technical and technological development conditions, certain competencies are rapidly depreciated. Therefore, the learning mechanism must be flexible without imposing the idea of “the only correct knowledge.” In the learning process, it is vital to learn to doubt, reflect, adapt to changes, and use one’s own cultural heritage while maintaining an understanding of other points of view.

According to UNESCO, lifelong learning for everyone is a fundamental principle, primarily concerning primary and secondary education when discussing it on a global scale. Generally, four stages are distinguished in a person's education:

- the first (preschool education);
- the second – primary school education;

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As seen above, innovative education processes face various problems. This solution is a necessary condition for the effective implementation of innovative technologies, both as tools and at the level of psycho-emotional perception, in the educational process. The psychological readiness of teachers for innovative activities in the educational process involves several interrelated components related to both professional training and personal characteristics. This includes, first, communication skills, psycho-emotional state, intellectual level, career motivation, and professional interests. The innovative activities of a teacher will be successful if they possess intellectual activity, creativity, tolerance for uncertainty, independence, initiative, flexibility, adaptability, psychological resilience, and openness to new experiences (Vasylenko & Vasylenko, 2021; Yuldashev et al., 2022).

V. Kucher and T. Rozhnova identified the main innovation requirements for higher education teachers:

- Theoretical and practical knowledge of information technologies (computer and digital literacy of the teacher).
- Work with new forms and methods of teaching (project-based learning, online courses, podcasts, discussions, case methods, and virtual laboratories).
− Creativity, innovative thinking, a creative approach to the educational process, the ability to work in a teacher–student team, teaching others while learning oneself.
− Critical thinking and the ability to quickly navigate rapid information flow for effective scientific and teaching activities (Kucher & Rozhnova, 2023).

S. Karpliuk offers a scheme for a clear understanding of digitalization specifics within the higher education process (Figure 1).

![Figure 1 Specifics of digitalization within the higher education process. Source: Karpliuk (2019)](Image)

All these innovative requirements are successfully implemented in the educational process by teachers. They are interested in the quality of their work and the opportunity for professional development despite blackouts and rocket-drone attacks, which, unfortunately, are a part of our reality and need to be taken into account. Innovative technical innovations such as Google Classroom, Zoom, Kahoot!, and Google Meet have become quite traditional. Corporate e-mails and various messengers are actively used for communication and to address organizational issues in the educational process. Virtual laboratories and computer modeling are also being actively implemented. In particular, information and computer technologies, as well as project and modular learning, are actively used for the study of the discipline "Physics" at the Kharkiv National University of Civil Engineering and Architecture. They allow the integration of fundamental and professional training (Cherednik & Dansheva, 2018; Popovych et al., 2020).

In current conditions, another critical factor in the innovative professional activities of higher education teachers is the formation of their own brand. On the internet, there is much information about what a personal brand of a higher education teacher is, why it is needed, and what specific steps need to be taken to develop and form their own teaching brand. In particular, the HEI "Innovative University," together with the Office of Scientific Support in November 2022, conducted a professional development course, "Scientist's Brand in the Digital World." Course participants were invited to understand the following components of forming a scientist's brand in the modern information space: a successful scientist's career, communication, presentation, "I - brand," emotional management, image on social networks, use of scientometric databases, etc. ("The Brand of a Scientist in the Digital World", 2022).

Innovation is essential for positive changes. It is a global trend. American scholar P. Serdyukov, while analyzing the importance of innovation in US education and the expectations of businessmen, politicians, and Americans in general regarding educational innovation, mentioned the disappointment caused by the expectations and results of innovation in education at all levels. The most important thing here is that the need for innovation is outstripping the practical implementation and adoption of innovations. In addition, a clear understanding of what innovation is needed is needed. It is not a specific technology or toolkit. First and foremost, innovation is about creativity (inventing new stuff).
5. Conclusion

Today's agenda includes the active and practical implementation of interdisciplinary approaches, digital and media literacy, monitoring of students’ requests and expectations for educational programs, individual disciplines, seminars, and helpful and laboratory tasks. It also includes the development of emotional intelligence and an understanding of the importance of social capital.

There is currently no doubt about the need to "keep a finger on the pulse" of the development of new technologies and their possible application in the educational process as tools and as an essential link between the generations of "digital tourists" and "digital natives." Information and pedagogical management in higher education institutions should be based on complex organizational forms, technological principles, and philosophies of interaction among all participants in the educational process. The effectiveness of education quality and the learning process for teachers’ knowledge acquisition and professional development should be enhanced.

For the successful integration of innovative technologies into the professional activities of teachers from higher education institutions, it is necessary to combine several factors, namely:

- State support.
- Policies of higher education institutions.
- The motivation of teachers.
- Material and technical possibilities.

Ethical considerations

Not applicable.

Conflict of interest

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