THE IMPACT OF INDUSTRY 4.0 ON THE MODERN WORLD EDUCATIONAL PROCESS AND IN UKRAINE

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Summary

In the article, the authors analyze the basic concepts of Education 4.0 and determine that it is characterized by the digital transformation of industry and the introduction of advanced technologies. It is established that Education 4.0 is a new approach to learning based on the use of advanced technologies, interactivity and individualization of the learning process. It is noted that the Concept of Education 4.0 provides for a change in the basic principles of the educational process: the formation of a set of competencies rather than a set of knowledge; continuous improvement of teaching methods through the active introduction of modern technologies; teacher and student become partners who jointly carry out research activities The authors describe the features of the implementation of Education 4.0 in Poland, Ukraine and Romania, and provide an overview of the achievements and challenges facing Education 4.0 in the modern world.

In the article, the authors explore the challenges that accompany the implementation of this concept, such as increasing the competence of teachers, educators and research and teaching staff; creating technological infrastructure; issues of technological support, and others. In the course of the study, a survey was conducted at the All-Ukrainian Conference "Innovations, Trends" in 2023. A total of 55 respondents aged 25–68 took part in the survey. It is noted that encouraging a country to implement Education 4.0 is important for its competitiveness and development in the face of rapidly changing technologies. The authors provide recommendations that will help implement Education 4.0 and improve the educational process.

Key words: Education 4.0, digitalization, higher and pre-higer education institutions, information and communication technologies, new strategies, educational process.

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1. Introduction

The information revolution, the rapid development of technology and communications, the pandemic, and then the war launched by the Russian Federation against Ukraine in 2022 were marked by the necessary transition to "digital" and distance education. The full-scale invasion of Russian troops dealt a major blow to the Ukrainian higher education system compared

to years of quarantine restrictions. The destruction of the infrastructure of higher education institutions, the problem of human capital, as well as the resumption of the educational process under martial law have become real challenges.

Therefore, the activation of new ways of learning, the search for new strategies and the development of Education 4.0 around the world have prompted Ukrainian educational institutions to try to actively implement it in the learning process.

Industry 4.0, characterized by the digital transformation of industry and the introduction of advanced technologies, has a significant impact on the modern educational process both in Ukraine and around the world.

After analyzing the work of scholars, we can identify the following aspects of Education 4.0:

– Updating curricula: Industry 4.0 requires updating curricula to take into account current technological trends *(Salmon, 2019)*. New courses and modules should include skills in artificial intelligence, the Internet of Things, data analysis, etc. This is becoming a prerequisite for graduates to be ready for a successful career in the digital age and to actively participate in the development of industry. It is worth noting that the curriculum update has several key aspects:

1. Inclusion of modern technologies: new curricula should take into account the latest advances in information technology, artificial intelligence and other technologies that define Industry 4.0.

2. Practical orientation in teaching disciplines, as programs should provide opportunities for the practical use of new technologies through laboratory work, projects, and internships at modern enterprises.

3. Cross-disciplinarity is an important element: updated programs should promote interaction between different technical fields to prepare specialists capable of solving complex problems in global technological ecosystems.

4. Key skills and competencies that enable the development of skills in working with big data, data analysis, software development, and cybersecurity and data protection.

– Development of digital skills: students studying in the modern world need to have basic digital skills to work effectively with modern computers, software, and electronic devices *(Anand, 2021)*.

– Availability of electronic infrastructure and access to the Internet of Things in educational institutions. Industry 4.0 requires a reliable electronic infrastructure and fast Internet connection to provide access to online resources and learning platforms *(Bykov, 2017)*.

– Open learning and scalability. Thanks to technological tools, the educational process can become more open and accessible to the general public, including distance and blended learning and scaling of educational programs.

– Changes in teaching methods. The introduction of new technologies, such as cloud services, virtual reality, and augmented reality, can improve the educational process, encourage students to learn, and motivate them.

– Ensure flexibility and adaptability. Modern curricula should provide students with skills that allow them to quickly adapt to changes in the technological sphere and the economy *(Barreiro, 2022)*.

Summarizing the above, Education 4.0 transforms the educational process, making it more adapted to the requirements of the modern technological society and contributing to the training of qualified personnel for the digital age.

2. Analysis of scientific sources

The processes of digitalization in educational institutions were considered by such scholars as O. Spirin, L. Kartashova, S. Antoshchuk, O. Humennii, N. Volkova, A. Kviatkovska, O. Shelever, and others. The effectiveness of the use of educational technologies and the implementation of Education 4.0 in Ukraine was studied by T. Vakaliuk, A. Yatsyshyn, S. Nazarovets, O. Zhabin, L. Kartashova, O. Ovcharuk, L. Petukhova, I. Robert, P. Samuelson, and others.

3. Features of Education 4.0 in Ukraine

Education in Ukraine still lags far behind past Industrial Revolutions (2.0 and 3.0) and involves the use of predominantly traditional teaching methods. Computers and the Internet still have little influence on the educational process, when they should become drivers of its improvement. That is why the study of the principles of functioning of universities in the context of the deployment of Industry 4.0 for their implementation in the practice of Ukrainian higher education institutions is important *(Kasych, 2022).*

The European University Association (EUA) says Europe needs strong, autonomous and accountable universities that can act strategically and strive for continuous improvement. Their important characteristics should be consistency, interdisciplinarity, diversity and social cohesion. Higher education institutions must provide teachers with modern pedagogical tools and innovative technologies to support the educational process that meets the requirements of society 4.0.

That is, the key tasks of transforming universities towards the next level of development should be: implementation of Industry 4.0 technologies by updating the material and technical base; improvement of educational programs by modernizing them in accordance with the industry and sectoral direction and taking into account their advanced achievements; optimization of learning processes through the introduction of digital and other innovative technologies and methods; expansion of international cooperation through academic mobility, implementation of joint educational and research projects.

During the Government meeting on December 9, 2022, the major transformation program "Education 4.0: Ukrainian Dawn" was presented, which was prepared by the Ministry of Education and Science team on the basic principles and principles of the Ukraine Recovery Plan. The strategic goals of the program are the direction towards the restoration and development of Ukrainian education on the path to European integration. The priority is to restore the destroyed infrastructure. The key formula for financing education should be the principle of "money follows the person," which will allow citizens to be subjects of educational policy.

Not all universities are able to implement education 4.0 methods and technologies. Since Industry 4.0 is based on the use of automation and digitalization technologies, graduates must be ready to work in such dynamic conditions.

In general, the Concept of Education 4.0 provides for a change in the basic principles of the educational process: the formation of not a set of knowledge, but a set of competencies; continuous improvement of teaching methods through the active introduction of modern technologies; teacher and student become partners who jointly carry out research activities.

In the 21st century, there is a gradual transformation of higher education and a change in the philosophy of functioning of higher education institutions. Let us add that in Ukraine there is no higher education institution of this level yet.

4. Features of the implementation of Education 4.0 in Poland and Romania

The Polish labor market is still struggling with a shortage of competencies in Industry 4.0 and digital transformation. That's why an educational project was created, implemented by the Wroclaw University of Science and Technology in cooperation with ABB. The goal of the Education Project is to prepare future engineers to work in a digital industrial environment, equip teachers with modern tools, and convince those already working in industry to embrace digital transformation. The project includes, among other things, the creation of new curricula and courses based on innovative teaching methods. The main focus will be on expanding the educational offer of the Laboratory of Modern Electrical Devices at the Wroclaw University of Science and Technology, which is already one of the most modern facilities of its kind in Poland. The initiative will be funded by the governments of Iceland, Liechtenstein and Norway under the financial mechanism of the European Economic Area (EEA). In the DESI 2021 report, Poland ranks 24th in the European Union in terms of digitalization of the economy and society. Although, of course, many universities in Poland are trying to introduce elements of Education 4.0 into their teaching. For example, the Politechnika Gdańska is known for its expertise in technological disciplines and is actively working to adapt its education to modern technological requirements. The Politechnika Polska is known for its specialization in engineering and technology. It is actively working on the introduction of modern technologies, virtual laboratories and pedagogical approaches in the process of blended and distance learning.

The authors also analyzed the state of Education 4.0 in Romania, which is at the initial stage. Thus, in the project "Development of the Institutional Capacity of the Ministry of Economy, code SIPOCA: 7", Industry 4.0 refers specifically to Romania: "Support for digitalization in enterprises in the context of Industry 4.0, "taking into account the extreme importance of the EU in Romania's international trade" *(Turkes, 2019).* Romania, like any other country in the world, has faced some challenges to adapt to the new educational context. As Romanian scientist S. Halili, technologies such as 3D printers or multitouch LCD screens are not available in educational institutions. Therefore, additional funds will be needed to purchase new equipment. In addition, teachers in higher education institutions are a crucial factor in the successful integration of technology. But in this context, Romania has problems: the reluctance of teachers to move from a traditional teaching system to a more student-centered one *(Halili, 2019).* Most of them also lack the digital skills needed to work with the new equipment, necessitating intensive training. In response to the European Union's requirements, Romania developed in 2020 the Strategy for the Digitalization of Romanian Education for 2021–2027. It was a dense legislative proposal structured around two main areas of EU inclusion in digital education. According to this document, the digitalization of the education system has been a government priority since 2016, after the launch of the Educated Romania project.

5. Research results

In the course of the study, the authors analyzed the challenges faced by higher education institutions in implementing Education 4.0. During the All-Ukrainian Conference "Innovations, Trends" in 2023, a survey was conducted among teachers, graduate students, lecturers and research and teaching staff on the likelihood of challenges that higher and professional higher education institutions will face as a result of the implementation of Education 4.0. A total of 55 respondents aged 25–68 took part in the survey. The results of the survey are presented in Fig. 1.

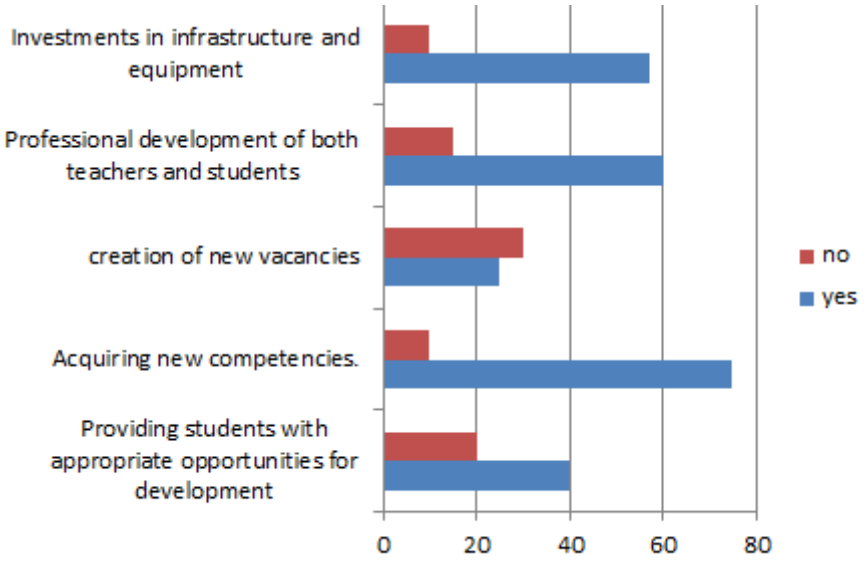

Fig. 1. Respondents' answers to the risks of Education 4.0

Having analyzed the survey results, we can say that the respondents believe that the main challenges are:

1. Providing students with appropriate opportunities to develop and acquire new competencies. Indeed, Artificial Intelligence, the Internet of Things, and advanced robotics require specialized knowledge and experience. Of course, employers provide additional training (40% said "Yes" and 20% said "No" to relevant opportunities, and 75% said "Yes" and 10% said "No" to competencies).

2. A potential challenge is the creation of new jobs, so the tasks of educational institutions at all levels include appropriate training of young people to solve problems related to Industry 4.0 technologies (25% said "Yes", 30% – "No").

3. Professional development of both teachers and students (60% said yes, 15% said no). Modern higher education institutions should also strive to improve the skills of their staff so that they can support their students on the path to success in the market defined by Industry 4.0 technologies.

4. Investments in infrastructure and equipment (57% said "Yes", 10% – "No").

Therefore, encouraging a country to implement Education 4.0 is important for its competitiveness and development in the face of rapidly changing technologies. The authors recommend the following steps that can be taken to achieve this:

1. Develop a clear strategy: Government agencies and educational institutions should jointly develop a clear strategy for implementing Education 4.0. It should include specific goals, objectives and steps to achieve success.

2. Forming partnerships. It is important to cooperate with industry, technology companies, and innovative startups. This will support training that meets the needs of the labor market.

3. Supporting infrastructure changes. Investing in modern infrastructure, including access to fast Internet and technologically equipped classrooms, is essential for the successful implementation of Education 4.0.

4. Enhancing the competencies and professional development of teachers, educators and pedagogical and research staff. They should have the opportunity to acquire skills and knowledge to use modern technologies in teaching: conducting trainings and seminars, participating in international conferences is an important component of this.

5. Financing of innovations: The state should provide financial support for the development and implementation of innovative curricula and technologies in educational institutions at all levels.

6. Conclusions

On the one hand, the results of the study confirmed the continued interest at the European level in bringing the education system in line with the new

Paradigm, on the other hand, they proved that there are significant implementation risks. Which can occur in every country. The authors note that the implementation of Education 4.0 is a complex process, but it can significantly improve the quality of education and prepare students for the requirements of the modern world. To overcome these challenges, cooperation of all stakeholders and constant adaptation to changes in the technological environment and society are necessary.

References

1. Bykov V.Y. (2017). Knowledge Society and Education 4.0. Education for the future in the light of the challenges of the XXI century. Education in the context of changes Civilization. p. 30–45. [in Polish]

2. The program of the great transformation "Education 4.0: Ukrainian Dawn" (2022). URL:https://mon.gov.ua/storage/app/media/news/2022/12/10/Osvita4.0.ukrayinskyy.svitanok.pdf. (date of application 21.09.23) [in Ukrainian]

3. Anand P. (2021). Ackley S. Assessment of 21 century skills & academic literacies: from theory to practice. Asian EFL journal research articles. Vol. 3, no. 28. P. 119–142. [in English]

4. Tserklevych V. S., Kyrylyuk Y. M. (2015). Na dopomohu kuratoru akademichnoi hrupy: informatsiino-metodychnyi posibnyk [To the help of the curator of an academic group: an informative and methodical manual]. Khmelnytskyi, Ukraine: KhKTEI. [in Ukrainian]

5. Barreiro A. (2022). Education 4.0 and its impact on the educational system during the pandemic and post pandemic Covid 19 in Ecuador. Sinergias educativas. Vol. 7, no. 1. URL: http://portal.amelica.org/ameli/jatsRepo/382/3822817007/index.html. (date of application 23.09.23). [in English]

6. Salmon G. (2019). May the fourth be with you: creating Education 4.0. Journal of learning for development. Vol. 6, no. 1. P. 96–115. [in English]

7. Kasych, A. O. (2022). Vprovadzhennia kontseptsii Universytetu 4.0 yak stratehichne zavdannia reformy vyshchoi osvity [Implementation of the University 4.0 concept as a strategic task of higher education reform]. Problemy intehratsii osvity, nauky ta biznesu v umovakh hlobalizatsii [Problems of integration of education, science and business in the context of globalization]. P. 212–117 [in Ukrainian]

8. Tserklevych V.S. (2017). Suchasni mozhlyvosti vykorystannia vizualnoho metodu u vykladanni istorii ekonomiky.[Modern possibilities of using the visual method in teaching history of economics]. Vyshcha osvita. Naukovo-praktychne vydannia Ministerstva osvity i nauky Ukrainy.

[Higher education. Scientific and practical publication of the Ministry of Education and Science of Ukraine]. p.116–129. [in Ukrainian]
9. ABB i Politechnika Wrocławska będą uczyć Przemysłu 4.0 (2022). URL:https://new.abb.com/news/pl/detail/90334/abb-i-politechnika-wroclawska-beda-uczyc-przemyslu-40 (date of application 23.09.23)
10. Mnistry of Education and National Research, "Strategia pentru digitalizarea educației din România – 2021–2027. (2021). SMART-Edu e: URL: https://www.smart.edu.ro/home/strategi-econsultare-public%C4%83. [in Romanian]
11. Halili S. (2019). Technological Advancements in Education 4.0. The Online Journal of Distance Education and e-Learning. vol. 7, no. 1, pp. 63–69, 2019. [in Romanian]
12. Turkes M., Oncioiu I., Aslam H. (2019). Enablers and barriers to the use of industry 4.0: the perspective of SMEs in Romania. Processes. 7 (3), 153. [in Romanian]