5.3. CURRENT STATE AND PROSPECTS OF INTEGRATING DIGITAL PLATFORMS INTO THE PROFESSIONAL TRAINING OF SKILLED WORKERS

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The article deals with the practical cases of using digital platforms in the educational process for the vocational training of future skilled workers. It has been established that they can be used to organize online learning, build a digital architecture for the management of vocational training (VET), overcome the gender gap, in the employment process, professional self-determination, inclusive employment, etc. It is recommended that social networks, immersive technologies (AR|VR), artificial intelligence, etc., be integrated into digital platforms to increase the efficiency and effectiveness of the educational process. The analysis of scientific sources shows that digital platforms are an indispensable tool in the training of future skilled workers, helping them to acquire knowledge faster, more efficiently, and with maximum practical results.

Keywords: *digital platforms, vocational education, skilled workers.*

5.3. СУЧАСНИЙ СТАН ТА ПЕРСПЕКТИВИ ІНТЕГРАЦІЇ ЦИФРОВИХ ПЛАТФОРМ У ПРОФЕСІЙНУ ПІДГОТОВКУ КВАЛІФІКОВАНИХ РОБІТНИКІВ

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У статті розглянуто практичні кейси використання цифрових платформ в освітньому процесі для професійної підготовки майбутніх кваліфікованих робітників. Встановлено, що вони можуть бути використані для організації онлайн-навчання, побудови цифрової архітектури управління професійним навчанням (ПОН), подолання гендерного розриву, у процесі працевлаштування, професійного самовизначення, інклюзивного працевлаштування тощо. Рекомендується інтегрувати в цифрові платформи соціальні мережі, імерсивні технології (AR|VR), штучний інтелект тощо для підвищення ефективності та результативності освітнього процесу. Аналіз наукових джерел свідчить, що цифрові платформи є незамінним інструментом у підготовці майбутніх кваліфікованих робітників, допомагаючи їм здобувати знання швидше, ефективніше та з максимальним практичним результатом.

Ключові слова: *цифрові платформи, професійна освіта, кваліфіковані працівники.*

The rapid development of industry changes priorities in the economy and updates the requirements for vocational education. The educational

process as a dynamic, holistic pedagogical system is subject to constant transformation, a change in the educational paradigm, and the introduction of new means and technologies of learning. The digitalization of vocational education responds to global information challenges and is accompanied by a "synergistic" update of educational content, its content, and the results of graduate training.

Digital educational platforms in practical application. Digital transformation has led to the restructuring of all industrial structures, which required the development of educational platforms for vocational education and careers. The model of such a resource (Lee et al., 2023) should consider the needs of the instructor, employer, and student, consist of data about the student, data about the content of training, information about work, a community of practitioners, a learning control mechanism, and a mechanism for recommendations on work.

The transfer of learning tasks and support for the educational process of VET to a shared virtual educational space has become an immediate challenge and has been accompanied by a qualitative analysis of the use of digital approaches and tools. The work (Görl-Rottstädt et al., 2022) proposes the online platform ILIAS (TM) and the web conferencing software Adobe Connect (TM) to analyze critical learning situations and develop virtual learning scenarios in terms of didactics adapted to different learning groups and needs in and outside the classroom.

The publication of digital textbooks for vocational education is challenged by digital technologies. Most educational publishers have increased their investments in the development of digital products, organically combining existing content, and human and technological resources (Shi, 2011). There is a shift in teaching and learning from traditional approaches to digital ones, by integrating digital learning materials into online platforms with content support, clear organization and structure, and effective methods for providing personalized services for mobile learning.

The development and implementation of digital systems can help students: a) become familiar with computer assembly and maintenance through virtual operations; b) reduce equipment losses caused by incorrect operation in the real course; c) demonstrate scenarios and project-based learning methods; d) increase student interest and initiative. A vivid confirmation is a course on computer assembly and maintenance using 3D

Max for modeling and building a virtual modeling system based on the Unity 3D platform in a vocational education institution (Lu et al., 2023).

The authors (Schober et al., 2014) proposed a web-based educational platform "Third Place of Learning" (TPL) – "Dritter Lernort" to support distance learning in the vocational education system in Germany. The goal of this project is to combine the vocational education system with digital media. The web-based platform allows students to be taught using interactive examples and exercises, to form the content of the training, the training material, and the technical structure following the didactic concept.

An analysis of the integration of the Blackboard digital platform as a learning resource into the educational process of the School of Accounting and Administration confirmed that the inclusion of digital technologies in professional training opens up new possibilities for the space and time of learning, creates conditions for better planning and teaching practices, and also provides students with tools for conducting learning, more autonomy and responsibility (Beatriz et al., 2013).

The digital development of innovation and entrepreneurship in colleges forms a comprehensive digital ecosystem in which digital platforms play an important role. The comprehensive educational digital platform for innovation and entrepreneurship education (Wang & He, 2024) in vocational education institutions based on large language models (LLM) allows the processing of large amounts of text data using ChatGPT 4o.

Interaction with digital technologies involves a process based on three axes: teach to use, teach to defend, and teach to create technologies (Rueda-Rueda et al., 2019). Digital platforms are not only a pedagogical tool. Modern conditions require them to become learning areas for training qualified IT workers, create spaces to inform students about the caution to be exercised on social networks and the Internet, and support strategies to encourage the study of IT, systems engineering, and related areas.

Experimental installations of a learning environment using an e-learning platform based on SCORM 2004 were carried out for students taking a computer-aided drafting course at the Faculty of Mechanical Engineering in a vocational school (Lin & Pan, 2006).

The impact of digital educational platforms on learning, development, professional growth, and satisfaction of employees in enterprises was investigated through a survey and was designed to test the aspects of interactivity, personalization, engagement, and effectiveness of learning (Nikolova, 2024). The results indicate that digital platforms improve

professional skills and productivity, but are correlated with lower satisfaction with course quality, require better adaptation of content and teaching methods to individual needs, and emphasize the importance of social learning and collaboration through interactive features, which significantly increase engagement and learning outcomes.

Social media. Mobility, multi-screening and multitasking in youth culture allow us to equate new media practices in the era of convergence of digital platforms and cross-media consumption. An empirical study of a sample of 1,814 students in basic, secondary, and vocational education in Portugal was conducted to analyze digital media consumption practices and network connections because of the use of technological resources (Amaral et al., 2017). The results showed high levels of online activity among Portuguese youth in the digital environment, especially social networks.

A survey of 209 students on the role of social media in vocational and technical education aimed to find out whether it is possible to use them as a platform for learning. The first aspect of the study was to measure the participants' social interaction through digital technologies, and the second aspect was to assess students' attitudes toward social media as a means of learning in the VET environment. Most participants agreed that social media can be chosen for professional learning and are conceptually ready to use it as a digital platform (Wahyudin et al., 2018).

Gamification. The article (Kotsifakos et al., 2018) proposed a game-based online learning platform for professional education that included polymorphic online games. The educational content of the platform covers topics related to web algorithms, techniques and data flow methods (Bellman-Ford, Dijkstra, Floyd, and Johnson algorithms). Completing each scenario introduces the student to the process of a particular algorithm and how each algorithm is implemented in a network environment.

Immersive technologies (AR|VR). The concept of a metaverse, a virtual world that offers immersive experiences, has recently gained widespread interest. Designed as a simulation of the physical world, the metaverse encompasses all areas of human activity and provides a platform for researchers from all disciplines. A study (Magetos et al., 2023) demonstrated the development of an educational virtual world for teaching the course "Art History" in the vocational education system using the spatial.io web environment, educational resources from digital repositories (Sketcfab and Photodentro), and the ADDIE educational design model. Such

online virtual world platforms are provided free of charge for educational purposes with free digital repositories of 2D and 3D educational resources.

Augmented reality and virtual reality, which have been developed over many years, have become the main environment for providing educational services due to digital transformation and the transition to remote content delivery. Positive dynamics are demonstrated by research (Shim & Lee, 2022) on the development of a vocational education learning model using AR/VR and realistic XR content Metaverse.

The potential of using mobile augmented reality (AR) and virtual reality (VR) technologies to support experiential learning in vocational education is to overcome the scarcity of resources in learning environments by allowing students to access many resources on digital platforms. AR and VR can play an important role in enhancing experiential learning and providing students with hands-on simulation experiences in various fields of knowledge (Jantjies et al., 2018).

Virtual simulation technology has changed the educational process in vocational education institutions. Thanks to it, it is possible to reduce the level of investment, losses, risks and difficulties in the implementation, monitoring and reproduction of training projects of the vocational course of vocational education based on virtual simulation technology. The authors (Liu et al., 2024) created the VR Smart Education training platform, which allowed to combine of high-quality training resources, practical training, individual intelligent training equipment equipped with a virtual operating platform and comprehensive innovative improvement of teaching methods.

Conducting experimental training using the virtual simulation platform of computer assembly is a new direction, as it contributes to a revolution in the forms, methods, and concepts of training, improving its quality (Liu, 2028).

Virtual internship allows students, especially engineering majors, to gain real experience and skills remotely online. The authors (Stefanovic et al., 2021) proposed a life cycle model and methodology for virtual internships on a digital platform. This complex connects students, vocational education institutions, company profiles, internship databases, lectures, assignments, and assessments, in a secure and shared digital environment. It allows the development of adapted and flexible internship programs, configuring them for specific scenarios or integrating them with other specialized e-learning platforms. This complements the user experience and provides practical workflows and recommendations. The complex contains

effective, personalized, inexpensive, and adaptive solutions, digital resources, and recommendations that ensure a higher level of collaboration, and better communication, increasing the level of professional knowledge and acquired skills.

A positive effect was shown by testing a digital educational application based on augmented reality for people with cognitive disabilities during vocational training in the field of housekeeping (Wuttke et al., 2022). For this purpose, an online learning platform with built-in AR learning stations was developed and evaluated by the target group.

Artificial Intelligence. Lifelong learning and continuous education have become the main pillars for enhancing personal growth in the professional world. Artificial Intelligence (AI) has transformed traditional educational models to provide personalized learning experiences. The revolutionary impact of artificial intelligence (AI) on professional education, learning processes, and preparing students for the changing demands of the labor market requires consideration of its diverse applications, including virtual reality (VR), augmented reality (AR), machine learning (ML), and the Internet of Things (IoT), as well as their role in enhancing personalized learning, skill development, and job readiness (Çela et al., 2024). Among the challenges of integrating AI into vocational education, such as algorithmic bias, digital divide, and data privacy issues, are also proposed mitigation strategies to ensure fair and effective implementation, ethical considerations, emphasizing the balance between using AI innovations and preserving essential human interaction and ethical integrity.

In vocational education, AI plays an important role in improving the efficiency and effectiveness of learning. Applications include a) developing adaptive curricula that can adjust the curriculum according to the abilities and needs of students, b) assessing student performance and providing automatic feedback, c) assessing and monitoring student performance (Suparyati et al., 2024).

For example, with funding from the German Federal Ministry of Education and Research, the cross-platform AI-based companion program cOmpanion (platform-independent) for optimizing lifelong learning (acronym: APOLLO) has been developed (Boesl et al., 2023).

Educational Institution Management. In the era of Society 5.0, characterized by the seamless integration of cyber systems and physical environments, educational institution leaders can cultivate a culture of innovation, collaboration, and excellence to meet the changing needs of VET

institutions, provide high-quality education, and prepare students for success in a rapidly changing world. Using digital platforms and resources, it is possible to develop curricula, support the process of pedagogical practice, implement diverse assessment strategies, and improve communication, collaboration, and administrative efficiency of educational institutions (Hadi et al., 2024). By focusing on a technological approach to learning management, leaders can promote effective data-based decision-making, ensure transparency, and accountability adapted to the demands of the digital era.

The development of technology provides an impetus for changing the digital architecture of L(VET)E. The development and application of education management information systems allow for more open and flexible platforms that include student management, curriculum management, course planning, exam management, assessment management, course selection management, teaching quality management, etc. (Zheng, 2010).

Gender equality. Online learning has become a transformative force that has contributed to the advancement of gender equality and the empowerment of women. Online vocational education and training for women can contribute to their inclusion in the labor market, expand economic opportunities, and improve financial independence (Lashgari, 2024). Digital platforms help to form the knowledge and skills necessary for success in the digital age, create unprecedented opportunities for women's personal and professional development, and bridge the gender gap.

Employment. Mobile applications designed on the principles of gamification provide the opportunity to use game techniques in professional self-determination based on personal preferences and choices with feedback. Such a diagnostic program allows students to form an idea of the predisposition to one of the types of professions (human-human, human-nature, human-technology, human-symbolic system, or human-artistic image). The application can be a tool for the work of a teacher-psychologist, career counselor, or parents. On the other hand, children can use this program themselves when choosing their learning trajectory.

Information technologies have proven themselves positive in the process of inclusive employment of people with neurological and intellectual disabilities, including Down syndrome, Asperger syndrome, autism spectrum disorder and mental retardation. The digital job search platform "Workability": a) organizes cooperation with such individuals, corporate

employers and vocational training centers; b) provides a digital interface with accessible customizable functions, such as speech-to-text conversion and image recognition capabilities (Madan et al., 2024). Such a digital product creates an inclusive environment, contributes to improving employment according to abilities and preferences, changes the scope of employment, social activity and involvement of this demographic group.

On the other hand, a randomized control trial conducted to assess whether digital platforms improve employment outcomes and job search among vocational education graduates found evidence of voluntary unemployment: graduates responded to access to the platform by increasing their expected wages and showing less interest in working. On the other hand, some graduates did lower their expectations (Kelley et al., 2024).

Survey on attitudes and use of digital platforms. A study of pedagogical and digital practices in vocational education in the Spanish region of Catalonia involved a survey of 158 teachers and 309 students in secondary and higher vocational education programs. The results of the quantitative analysis show that while most vocational education teachers use a combination of active and lecture methods, less than a third use online tools, giving priority to institutional platforms (Noguera et al., 2024). The results highlight the need for vocational education programs to improve the integration of digital tools and address various issues with learning effectiveness to better meet the expectations and needs of students.

In a thematic interview of Finnish vocational education institutions on the well-being of students in online learning environments, 20 teachers answered questions on positive emotions, engagement, relationships, the meaning of achievement and students' enjoyment of learning. The results showed that good digital skills helped students navigate the online collaborative learning platform they used. Students experienced the joy of learning when online tasks included variety, activity, work-life orientation, and when they received individual control and when the teacher also guided group activities (Kiikeri et al., 2024).

The prospects for integrating digital platforms into the vocational training of skilled workers can be seen in the context of patent proposals in the Derwent Innovations Index. Among the latest developments in vocational education:

1. A digital learning content creation system that supports the learning process and creates a training course on a digital virtual reality platform (Yu et al., 2022). It effectively reduces repeated investment in training and

development, as well as shortens the period of production of educational content and provides convenient and flexible applications for teachers and students. The system reduces the degree of dependence on the teacher and continuously optimizes and reproduces qualified learning content with different requirements and specifications.

2. An intelligent experimental platform with numerical control for use in secondary vocational education (Su & Guan, 2024). The platform has a mechanical robot arm, which is connected to the router through a network camera, a server, a remote network controller, a body measurement device, an experimental box, and a simulation board. Various actions required for the experiment are accurately performed through the final performer. The platform improves flexibility, and conveniently performs customized services according to professional characteristics and experimental requirements. The student's experimental enthusiasm and interest are improved.

3. Cloud service platform provision system in vehicle virtual simulation training based on the combination of virtual and real modes (Wu, 2021). The virtual disassembly and maintenance training sub-module uses a three-dimensional (3D) digital model, virtual display technology, and is equipped with a vehicle fault collection box and a data collection terminal. This module is connected with the traditional learning sub-module through the cloud to send and receive data. The described intelligent learning cloud platform realizes networked practical training for automotive vocational education.

4. A method for building a digital platform for intelligent vocational education in enterprise development, which involves building subject libraries of resources to support corporate learning (Qi, 2023). The method allows for the implementation of accurate training for enterprise personnel and improves training efficiency.

5. An artificial intelligence-based training method for professional skills development involves the collection and analysis of training data and student feedback information, as well as providing training quality assessment and improvement suggestions for teachers (Duan et al., 2023). The method includes the integration of natural language processing technology, online collaborative learning technology, web page rendering technology, search, functional modules of recommendation technology, and data management and analysis technology into the AI training system. The course content, training resources, and other necessary training resources are

viewed by the student. Multi-person video conferencing, file sharing, instant messaging, and other functions are performed to support online learning and communication. The learning data and student feedback information are collected and analyzed by the AI learning system based on search and recommendation technology. The teaching quality evaluation and improvement suggestions are provided for the teacher, and personalized support and suggestions are provided for the student. The described method improves the efficiency and quality of learning, promotes online collaborative learning and communication, reduces the cost of learning, improves efficiency, and provides a more scientific, efficient, and more humanized digital learning and educational solution for students and teachers.

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