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# DEVELOPMENT OF DIGITAL COMPETENCE OF VOCATIONAL THEORETICAL TRAINING LECTURERS THROUGH THE USE OF THE "SMART ECOSYSTEM FOR STUDENTS" DIGITAL PLATFORM

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## Abstract

*The relevance of the article:* is determined by: the rapid pace of digital transformation in education, which necessitates the development of digital competence among vocational theoretical training lecturers, particularly in vocational (vocational-technical) education institutions; the demands of the digital economy for improving the quality of training qualified specialists, which is impossible without the implementation of innovative digital solutions that combine educational content, interaction tools, reflection, and assessment; the capabilities of the Smart EcoSystem for Students digital platform, which can be an effective tool for integrating educational processes into a unified digital environment; the need for understanding and scientific clarification of approaches to defining the essence and structure of the concept of "professional competence," as well as substantiating it as a key condition for the effective activity of lecturers who provide training for skilled workers in the service sector in accordance with current labor market challenges and digital education development.

*Purpose of the article:* is to highlight the capabilities of the Smart EcoSystem for Students digital platform for the development of digital competence of vocational theoretical training lecturers and to substantiate the methodological principles of its use in the educational process of vocational education institutions.

*Methods:* systemic analysis, pedagogical observation, generalization of empirical data, questionnaires, and methodological modeling of digital interaction based on the platform's functionality.

*Results:* it was found that the use of the Smart EcoSystem for Students digital platform provides personalized support for lecturers in forming digital competence, contributes to the improvement of pedagogical interaction, analysis of learning activities, and the implementation of adaptive educational routes; practical cases of using the platform in the context of increasing the effectiveness of the educational process were analyzed.

*Conclusions:* the main directions of using the Smart EcoSystem for Students platform in the process of digital transformation of vocational education are defined; its potential for the development of digital competence of vocational theoretical training lecturers is substantiated; the role of an integrated digital environment in improving the quality of the educational process, taking into account the individual educational needs of students and the current challenges of the modern labor market, is highlighted.

**Keywords:** *digital competence, vocational theoretical training, Smart EcoSystem for Students, simulation technologies, professional development.*

**Introduction.** In the context of transformational changes encompassing vocational education, the digital competence of lecturers emerges as one of the leading components of professional readiness for effective teaching in a digital environment. According to the updated European Digital Competence Framework for Citizens DigComp 2.1 (European Commission, 2017), digital competence encompasses not only basic technical skills but also the ability to use digital resources for communication, content creation, security, and problem-solving in the digital space. The Ukrainian adapted version of DigComp, available on the "Diia.Osvita" platform, defines digital competence as the ability of a lecturer to work with digital educational technologies with an orientation towards the needs of students (Ministry of Digital Transformation of Ukraine, 2023).

At the same time, analytical reviews show a significant gap between the existing level of digital training of lecturers and the requirements for digital support of vocational theoretical training in the context of Industry 4.0 (Chanysheva & Nanyeva, 2021; Bilyk, 2023). This refers, in particular, to the need not only for the instrumental use of digital platforms, but for the formation of a reflective, methodological approach to organizing blended learning using industry-specific software, simulation technologies, and analytical dashboards.

In this context, the Smart EcoSystem for Students digital platform serves as a comprehensive educational environment that provides personalized learning, management of educational routes, automated monitoring of results, integration of mentoring tools, feedback, certification, and more. Its development is based on the principles of methodological integrity, interdisciplinarity, and analytical adaptability, which corresponds to the provisions of The Digital Competence Wheel (The Digital Competence Wheel, 2024).

Thus, a scientific and practical problem arises: how to organize the use of Smart EcoSystem for Students (Hrechanyk, 2025) in the educational process of vocational (vocational-technical) education institutions with the aim of developing the digital competence of vocational theoretical training lecturers. This issue is closely related to the modernization of vocational education, digital self-

management of educators, and the construction of an internal institutional strategy for digital transformation.

**Sources.** The issue of forming digital competence among pedagogical workers is actively being developed in the European educational space within the framework of the Digital Competence Framework for Citizens (DigComp 2.1), which defines five key areas of competence: information literacy, communication, digital content creation, safety, and technical problem-solving (Van den Brande, 2016). This framework serves as a conceptual basis for the Ukrainian adaptation of the digital framework – Diia.Digital Literacy, introduced by the Ministry of Digital Transformation of Ukraine (Diia.Osvita, 2024). We share the systematic nature of this classification, however, we note that it does not cover the specifics of pedagogical activity in the field of vocational (vocational-technical) education, which creates a demand for a more adapted platform for the development of digital competence specifically for vocational theoretical training lecturers.

A study by the European Training Foundation (2023) determined that the effectiveness of digital platforms in vocational education depends not only on technological design but also on the level of readiness of educators for digital transformation. The authors insist on the need for platforms that provide personalized learning, adaptability, and built-in assessment mechanisms. These very features are embedded in the Smart EcoSystem for Students platform, which is the object of our research. We agree with the thesis about the need for comprehensive training of pedagogical workers and propose our own model for implementing these approaches based on the platform.

A number of studies emphasize the importance of using simulation technologies in vocational education (Lisovyi et al., 2016; Shaforost, Lut, & Shpak, 2024). However, in our opinion, most of them are primarily focused on the technical aspect of using digital tools, without proper methodological justification of the impact of such tools on the development of the lecturer's digital competence. In our study, these simulation components are integrated into the digital platform

as tools for pedagogical diagnostics and project-based learning, not just as an imitation environment.

Publications dedicated to the implementation of digital educational environments (Lemay, Bazalais, & Doleck, 2021; Cui, Zhao, & Zhang, 2022) emphasize the need to consider cultural, industry, and institutional contexts. This approach is methodologically justified in our development as well – Smart EcoSystem for Students is adapted to the needs of the vocational and technical industry, taking into account specific educational and industrial conditions and the role of pedagogical workers as facilitators of the digital environment.

Despite the existence of relevant research in the field of digital transformation of education, we have identified the following gaps: insufficient development of platforms that would integrate both pedagogical and simulation functions for vocational and technical education; lack of consistency between digital tools and educational competence frameworks for lecturers. These very aspects became the object of our theoretical analysis and practical experiment.

**Aim.** The purpose of the article is to explore the capabilities of the Smart EcoSystem for Students digital platform for the development of digital competence of vocational theoretical training lecturers and to substantiate the methodological principles of its use in the educational process of vocational (vocational-technical) education institutions. Within the stated purpose, the following tasks have been defined:

- to analyze the current state of scientific approaches to the development of digital competence in vocational education;

- to reveal the structural and functional features of the Smart EcoSystem for Students platform as a digital educational environment;

- to characterize the mechanisms that ensure personalization of learning, professional reflection, and the formation of intellectual capital of pedagogical workers;

- to determine the effectiveness of the proposed digital ecosystem in the context of the digital transformation of vocational and technical education.

**Methods.** In the research process, a complex of interconnected methods of theoretical and

empirical analysis was applied, which ensured the reliability and scientific validity of the obtained results:

- theoretical analysis and generalization of scientific literature – for studying modern approaches to the digitalization of education, digital competence frameworks (including DigComp 2.1), and for identifying scientific gaps;

- systemic and structural analysis – with the aim of singling out the functional components of the digital ecosystem and determining its pedagogical value;

- pedagogical modeling – for constructing the architecture of the Smart EcoSystem for Students digital platform and determining its educational potential in the context of professional training;

- surveying vocational theoretical training lecturers – as a tool for collecting empirical data on the level of digital competence formation and evaluating the effectiveness of using the developed platform;

- expert evaluation – for verifying the methodological relevance of the proposed model, its consistency with the demands of vocational education institutions.

**Results and Discussion.** The conducted research was aimed at a systematic study of the functional components of the Smart EcoSystem for Students digital platform, as well as at determining its significance in the formation and development of digital competence of vocational and technical education lecturers. Given the need for the transformation of vocational education in accordance with the requirements of digitalization, the key task was to identify those tools of the educational environment that contribute to the formation of the lecturer's ability to effectively use digital resources in professional activities.

The Smart EcoSystem for Students digital platform is implemented as a complex of interconnected environments that functionally interact within a single educational and methodological infrastructure. As a result of systemic and structural analysis, five leading functional components of this ecosystem were identified:

Smart Learning Environment – a module that provides an adaptive, personalized learning environment for students and lecturers. It contains a database of digital courses, interactive simulators, video instructions, and simulation scenarios aimed at forming professional skills. This environment meets the DigCompEdu requirements for creating learning situations based on ICT competence.

Smart Collaboration Zone – a functional block that enables lecturers and students to interact in real-time. This includes joint development of educational projects, exchange of digital resources, online consultations, and feedback. Its integration contributes to the development of the lecturer's digital communication competence.

Smart Monitoring Dashboard – an analytical tool that allows for assessing the digital progress of students, including their activity, the quality of task completion, and the level of formation of digital and professional skills. For the lecturer, this is a tool for formative assessment and making pedagogical decisions.

Smart Parent Dashboard – a platform for interaction with the social environment, particularly parents of students, which allows them to be involved in the educational process. From a pedagogical value perspective, this function enhances the transparency and openness of the digital educational environment.

AI Assistant and Scenario Builder – an artificial intelligence-based module for creating pedagogical scenarios adapted to the level of student training, as well as for supporting the learning process. This particular tool allows lecturers to create their own digital educational products based on a competence-based approach.

The Smart EcoSystem for Students digital ecosystem was piloted among vocational and technical education (VTE) lecturers in Kryvyi Rih, Kharkiv, Khmelnytskyi, and Kropyvnytskyi. The study participants noted that the platform's functional components allowed them to transition from fragmented application of digital technologies to comprehensive digital support of the educational process. Furthermore, the platform became a catalyst for the professional growth of educators in the field of digital competence, providing them with

tools not only for teaching but also for self-education and interaction in the digital environment.

The pedagogical value of Smart EcoSystem for Students is manifested in the platform's ability to provide not only functional support for the learning process but also to transform the lecturer's educational culture, oriented towards self-reflection, the development of digital autonomy, and the implementation of pedagogical innovations.

In the process of systemic analysis and approbation of the functional capabilities of the Smart EcoSystem for Students digital platform in vocational (vocational-technical) education institutions, we identified a complex of interdependent components that ensure the formation of digital competence of vocational theoretical training lecturers. This specifically refers to the integration of tools for personalized learning, digital collaboration, monitoring of educational outcomes, and progress analytics. All of these not only create a unified digital environment but also transform the methods of professional interaction between subjects of the educational process. The results of the systemic analysis and experimental application of the platform confirm the expediency of its implementation in the educational process of vocational education institutions as a tool for increasing the level of digital competence of vocational theoretical training lecturers.

Let's characterize the mechanisms of the Smart EcoSystem for Students digital platform that ensure personalized learning, support the lecturer's professional reflection, and contribute to the formation of their intellectual capital in the vocational education system:

Personalization of learning. One of the central mechanisms of the platform is the individual educational route, which is automatically formed based on diagnostic input testing and analysis of the lecturer's educational needs. This route includes:

- adaptive modules for professional development in digital tools, simulation-based learning, and cybersecurity;
- dynamic changes in the trajectory according to success in interactive cases and completion of reflective tasks;

– recommendations based on AI algorithms that consider the pace, depth, and style of material assimilation of a specific educator.

Example: a lecturer from Kropyvnytskyi, who had a basic level of digital competence, gained access to a series of training blocks on Google Workspace and Canva for Education simulation trainers adapted to the needs of a vocational and technical institution after completing the platform. After a month of training, the platform automatically changed the complexity of the cases and offered work in the Smart Collaboration Zone environment.

**Professional Reflection.** The platform includes a digital reflective diary that allows the lecturer to record difficulties, educational ideas, and impressions from using digital tools. Its mechanisms:

– automated analysis of entries through semantic interpretation tools, which allows the platform to provide advice for further professional growth;

– weekly reflective prompts that focus on assessing one's own progress, interacting with students, and implementing new technologies. These are special stimulating questions or tasks that the digital platform (in our case, Smart EcoSystem for Students) automatically generates weekly for the lecturer to: help them rethink their own work experience; encourage self-analysis of professional activity; contribute to the formation of skills for conscious improvement of pedagogical practice ("What digital tools were most effective for your group this week and why?" "What difficulties did you encounter during the implementation of the simulation module and how did you overcome them?" "What would you change in your educational approach next week based on the experience gained?"). Such prompts appear in a special reflective diary on the platform and motivate the lecturer to regularly record their thoughts, which becomes part of their digital portfolio.

Example: In Khmelnytskyi, one of the vocational theoretical training lecturers noted a low

level of digital engagement in the group through the diary. After analyzing the entries, the platform provided recommendations for implementing a collaborative Padlet environment with thematic surveys, which increased student motivation.

**Formation of Intellectual Capital.** Intellectual capital is formed through the creation, accumulation, and exchange of pedagogical developments within the Smart Knowledge Hub – an integrated environment of a digital library, a community of practices, and a platform for micropublications.

Mechanisms include:

– automatic saving of the lecturer's educational solutions (lesson examples, digital scenarios, recommendations), which can be published in open access at the educator's discretion;

– gamified assessment of intellectual contributions within the community – other participants can evaluate the value of published cases;

– a system for tracking content impact – number of views, downloads, comments.

Example: In Kharkiv, a lecturer created a simulation module on workplace safety, which the platform, after expert moderation, added to the open collection. The module was used by 19 educators from other cities, which was recorded in the author's profile as an indicator of their intellectual contribution.

Thus, Smart EcoSystem for Students not only provides a space for preserving and disseminating educators' intellectual products but also forms new mechanisms for recognizing the individual contribution of the lecturer to the educational digital community. All this is supplemented by a deep individualization of the educational process, which is manifested in a holistic system of personalization, professional reflection, and monitoring of pedagogical progress. Table 1 summarizes the mechanisms that ensure the implementation of these functions on the Smart EcoSystem for Students platform.

Table 1

**Mechanisms of Personalization and Reflection in Smart EcoSystem for Students**

Mechanism	Functional Purpose	Application Examples
Individual Learning Paths	Adjusting the pace, forms, and content of learning to meet the teacher's needs	Creation of a personalized module with simulation exercises for engineering discipline teachers.
Reflective Prompts	Stimulating regular professional reflection	Weekly open questions in the format: "What have you managed to change in your teaching approaches?"
Teacher Digital Portfolio	Recording results, achievements, and development dynamics	Uploading certificates, video lessons, and developed materials to a unified platform.
Micro-publications within the Internal Environment	Enhancing professional confidence through experience sharing	Publishing teaching cases that are commented on by other platform participants.
Educational Interaction Analytics	Automated data collection on activity, ensuring informed management decisions	Monitoring activity in educational rooms with visualization of results.

After a systematic analysis of the functional mechanisms of the Smart EcoSystem for Students digital ecosystem, presented in Table 1, the empirical generalization of the platform's impact on

the formation of digital competence among vocational theoretical training teachers became a logical next step. An illustrative visualization of the obtained results is presented in Figure 1.

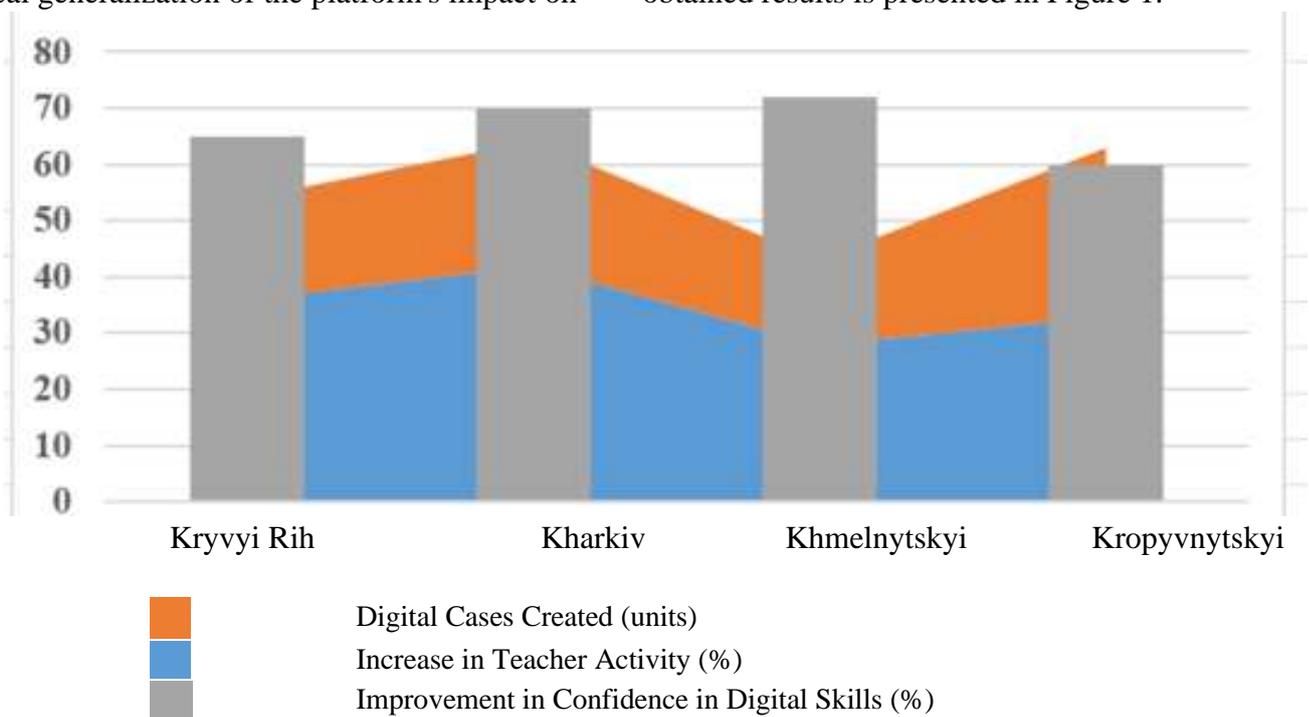


Fig. 1. Comparative indicators of the effectiveness of using the Smart EcoSystem for Students digital platform for developing the digital competence of vocational theoretical training teachers.

The diagram above clearly shows a direct correlation between the active use of the Smart EcoSystem for Students digital platform and an increase in the level of digital competence among educators. Specifically, the highest indicators of confidence in digital skills were recorded in Khmelnytskyi (72%), which was accompanied by a

stable dynamic in the creation of digital cases. In contrast, in Kropyvnytskyi, despite the highest number of digital cases created (30 units), the growth rate of confidence remained lower (60%), indicating a need for accompanying support measures (mentoring, coaching, etc.).

In Kharkiv and Kryvyi Rih, a synchronous increase in digital activity (42% and 36%) and confidence in digital skills (70% and 65%) is observed, demonstrating the effective integration of the platform into internal educational processes. At the same time, the results indicate the high potential of Smart EcoSystem for Students as a means of not only formal but also informal development of digital competence among teachers, which opens up new prospects for its implementation across the entire vocational education system.

**Conclusions.** The conducted analysis of scientific approaches to defining the concept of "digital competence" of vocational theoretical training teachers showed that there is still a lack of coherent approaches to its structural, content, and developmental methods in the field of vocational (vocational-technical) education. It has been proven that the actualization of the problem of developing digital competence among vocational theoretical training teachers in the context of the digital transformation of vocational education necessitates the use of integrated digital solutions. The expediency of implementing the Smart EcoSystem for Students platform has been determined as an innovative tool that combines pedagogical,

simulation, and communication functions within a single digital educational environment. This approach ensures the implementation of a competency-based, person-centered, and adaptive model of specialist training. It has been substantiated that the use of the Smart EcoSystem for Students digital platform aligns with the methodological principles of vocational education (subjectivity, flexibility, integration, development of self-learning, and reflection). It has been shown that the platform can contribute to the development of teachers' digital competence through the organization of digital content, a personalized environment for interaction with students, and assessment and feedback systems, which correspond to the principles of DigCompEdu and the adapted Ukrainian digital competence framework. The use of the platform can be effective not only as a learning tool but also as an innovative environment for the professional development of teachers. Prospects for further scientific research lie in developing indicators for assessing the digital competence of teachers, as well as in analyzing the dynamics of improving the quality of professional training of students as a result of implementing this educational ecosystem.

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## РОЗВИТОК ЦИФРОВОЇ КОМПЕТЕНТНОСТІ ВИКЛАДАЧІВ ПРОФЕСІЙНО-ТЕОРЕТИЧНОЇ ПІДГОТОВКИ В ПРОЦЕСІ ВИКОРИСТАННЯ ЦИФРОВОЇ ПЛАТФОРМИ «SMART ECOSYSTEM FOR STUDENTS»

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### Реферат:

*Актуальність* статті зумовлена: швидкими темпами цифрової трансформації освіти, що зумовлює необхідність розвитку цифрової компетентності викладачів професійно-теоретичної підготовки, зокрема у закладах професійної (професійно-технічної) освіти; запитами цифрової економіки на підвищення якості підготовки кваліфікованих фахівців, що неможливо без впровадження інноваційних цифрових рішень, які поєднують навчальний контент, засоби взаємодії, рефлексії та оцінювання; можливостями цифрової платформи *Smart EcoSystem for Students*, що може бути ефективним інструментом інтеграції освітніх процесів у єдиному цифровому середовищі; потребою осмислення і наукового уточнення підходів до визначення сутності й структури поняття «професійна компетентність», а також обґрунтування її як ключової умови ефективної діяльності викладачів, які забезпечують підготовку кваліфікованих робітників у сфері послуг відповідно до актуальних викликів ринку праці та цифрового розвитку освіти.

*Метою статті* є висвітлення можливостей цифрової платформи *Smart EcoSystem for Students* для розвитку цифрової компетентності викладачів професійно-теоретичної підготовки та обґрунтувати методологічні засади її використання в освітньому процесі закладів професійної освіти.

*Методи:* системного аналізу, педагогічного спостереження, узагальнення емпіричних даних, анкетування, а також методичне моделювання цифрової взаємодії на основі функціоналу платформи.

*Результати:* виявлено, що використання цифрової платформи *Smart EcoSystem for Students* забезпечує персоналізовану підтримку викладачів у формуванні цифрової компетентності, сприяє удосконаленню педагогічної взаємодії, аналітики навчальної діяльності та впровадженню адаптивних освітніх маршрутів;

проаналізовано практичні кейси використання платформи у контексті підвищення ефективності освітнього процесу.

*Висновки:* визначено основні напрями використання платформи *Smart EcoSystem for Students* у процесі цифрової трансформації професійної освіти; обґрунтовано її потенціал для розвитку цифрової компетентності викладачів професійно-теоретичної підготовки; висвітлено роль інтегрованого цифрового середовища у підвищенні якості освітнього процесу з урахуванням індивідуальних освітніх потреб здобувачів освіти та актуальних викликів сучасного ринку праці.

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**Ключові слова:** *цифрова компетентність, професійно-теоретична підготовка, Smart EcoSystem for Students, симуляційні технології, підвищення кваліфікації.*

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