# Features of the use of Smart technology in the training of master's students in universities of foreign countries

**Olha Akimova, Vasyl Kaplinskyi, Mykyta Sapohov**

Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University

## Abstract

The article delineates the distinctive characteristics of integrating Smart technologies into the education of master's students at foreign universities. It delineates the fundamental principles of scientific collaboration among European nations in the educational domain, as outlined in the Declaration on the European Higher Education Region within the overarching framework of the Bologna process. Emphasis is placed on key requirements of the Bologna Convention concerning professional training within Master's degree programmes, including the implementation of dual training cycles, fostering European cooperation at the Master's level to ensure educational quality, establishing criteria and methodologies for evaluating higher education quality, and facilitating student mobility opportunities. The Smart Education Concept is expounded upon, grounded on principles such as mobile access for digital services, fostering new knowledge creation for societal modernization, Smart guidance, and the establishment of an intelligent information environment. Specific principles of Smart education are elucidated, encompassing the utilisation of pertinent information to achieve educational outcomes, the organisation of creative, independent cognitive, research, project, and scientific activities, conducting training within an educational environment, and collaboration with employers and other stakeholders. The key features of Smart technologies in education pertinent to cultivating professional and pedagogical competence among master's students are identified, including seamlessness, accessibility, mobility, and continuous access to educational information; autonomy of educational stakeholders; utilisation of diverse motivational models for didactic interaction; assessing educational process effectiveness through competency indicators; and employing flexible approaches in organising educational activities for master's students. The structure of the educational process within the Smart environment is outlined, encompassing informational interaction among education seekers in an open model of asynchronous individual training, repositories, electronic and Smart textbooks, educational complexes, and methodological materials.

**Keywords:** concept of Smart education, Smart environment of a higher education institution, Smart technologies in education, training of master's students in foreign countries, Smart-accompanying education seekers

# Особливості використання Smart-технології у підготовці магістрантів в університетах зарубіжних країн

## Ольга Акімова, Василь Каплінський, Микита Сапогов

Вінницький державний педагогічний університет імені Михайла Коцюбинського

## Анотація

У статті схарактеризовано особливості використання Smart-технологій у підготовці магістрантів в університетах зарубіжних країн. Визначено основні засади наукового співробітництва європейських країн у галузі освіти закладені у Декларації про європейський регіон вищої освіти, що включена у загальну концепцію Болонського процесу. Виокремлено основні вимоги Болонської конвенції щодо професійної підготовки СВО «магістр»: запровадження двох циклів навчання; сприяння європейському співробітництву на рівні магістратури щодо забезпечення якості вищої освіти; виокремлення критеріїв і методів оцінки якості вищої освіти; надання можливостей для мобільності студентів. Схарактеризована Концепція Smart-освіти, що побудована на таких ідеях: мобільний доступ як можливість отримання цифрових послуг; створення нових знань як засобу модернізації суспільства; Smart-супроводження; створення інтелектуального інформаційного середовища. Розкрито специфічні принципи Smart-освіти: використання актуальної інформації для досягнення освітніх результатів; організація творчої самостійної пізнавальної, дослідницької, проєктної, наукової діяльності; реалізація навчання в освітньому середовищі; співпраця з роботодавцями та іншими стейкхолдерами. Визначено основні характеристики Smart-технологій в освіти, що є важливими для формування професійно-педагогічної компетентності магістрантів такі: безшовність, доступність, мобільність й безперервність доступу навчальної інформації; автономність суб'єктів освітнього процесу; застосування різних мотиваційних моделей дидактичної взаємодії; вимірювання результативності освітнього процесу показниками компетенцій; використання гнучких підходів до організації освітньої діяльності магістрантів. Визначено структуру освітнього процесу у Smart-середовищі, що об'єднує: інформаційну взаємодію здобувачів освіти у відкритій моделі асинхронного індивідуального навчання; репозитарії, електронні та Smart-підручники, навчальні комплекси, методичні матеріали.

**Ключові слова:** концепція Smart-освіти, Smart-середовище закладу вищої освіти, Smart-технології в освіти, підготовка магістрантів в зарубіжних країнах, Smart-супроводження здобувачів освіти

**Statement of the problem.** Examination of scholarly literature has led to the observation that international studies and projects concerning the identification and evaluation of competencies in education and the professional training of master's students have delineated a set of specialised competencies for masters. These include the cultivation of knowledge and comprehension within their chosen field of professional specialisation, proficiency in employing research pertinent to their teaching subject, and the ability to uphold values congruent with educational endeavors. Additionally, overarching key competencies at the master's level encompass research acumen, leadership attributes, and the fostering of reflective and cognitive skills. Within the European framework, fundamental theoretical tenets regarding the development of professional competence in contemporary educators stipulate European benchmarks, including identity, professional knowledge, multiculturalism, language proficiency, and European standards for quality, thereby advocating for comparability in qualifications and diplomas.

The evolving landscape of professional teaching in higher education institutions amidst the information society introduces novel dimensions to educators' roles, emphasizing a shift towards functions

such as mentoring, research, and communication. This entails promoting a model of collaborative cognitive engagement, integrating virtual modalities into the educational process through the utilisation of Smart technologies, and ensuring the professional identity, international mobility, and ongoing professional growth of educators.

**The Analysis of Sources and Recent Research.** The problem of using Smart technologies in the training of master's students in universities of foreign countries was studied by domestic and foreign scientists: O. Akimova, M. Sapohov, Y. Hapchuk (environmental approach in modern interdisciplinary studies on digitalization of education); Ya. Belmaz (professional training of teachers of higher education in Great Britain and the USA); T. Danylyshena (training of masters of pedagogical education in the universities of the USA (end of the 20th - beginning of the 21st century); N. Machynska (pedagogical education of master's students of non-pedagogical institutions of higher education); N. Makhynia (pedagogical education in Germany: history and modernity); S. Podliesnyi, O. Kostikov, B. Borovinskyi (prospects of using innovative Smart education in higher education institutions), M. Sapohov (formation of professional competence of master's students by means of Smart technologies), R. Sharan (professional training of masters of information technology in the US distance education system).

**The Purpose of the article** is the theoretical analysis and generalisation of various approaches to the problem of using Smart technology in the training of master's students in universities in foreign countries.

**The Results of the Research.** This study investigates the formation of professional and pedagogical competence among master's students in educational sciences through the lens of Smart technologies within the context of European integration. To achieve this, it examines key trends in higher education development, both domestically and internationally.

The analysis draws upon the Declaration on the European Region of Higher Education (1999), a cornerstone of the Bologna process, highlighting the core principles of scientific cooperation in education across European countries. Additionally, the role of UNESCO in regulating global educational reform and fostering integration processes is emphasized (Machynska, 2014).

In the Communiqué from the conference of European ministers in the realm of education titled "Towards the European Higher Education Area: Responses to Globalization Challenges" (2009), em-phasis is placed on advocating for the adaptation of national educational systems to the evolving landscape of European integration. Priority directions for higher education development are underscored, encompassing endeavours such as ensuring equitable access to higher education, fostering the establishment of national qualification frameworks, enhancing the flexibility of higher education structures, promoting international transparency, and advancing personalised learning approaches (Communiqué of the Conference of Ministers of European Countries Responsible for Higher Education "The Pan-European Area of Higher Education - Achieving the Goals," n.d.).

Central to our investigation are the stipulations outlined in the Bologna Convention pertaining to the professional preparation within Master's degree programmes: the implementation of dual study cycles (bachelor's, master's); fostering European collaboration at the master's level to uphold higher education standards; delineation of criteria and methodologies for evaluating higher education quality; and facilitating student mobility opportunities. European-wide pedagogical education is distinguished by several key features: the enhancement of pedagogical education's methodological foundation; the systematic progression through stages of professional pedagogical training; alignment with contemporary societal needs; and consideration of labour market demands (Machynska, 2014).

Various international organizations, such as the Distance Professional Training Council (DETC), the International Organization for Standardization (ISO), the International Council for Open and Distance Learning (ICDE), the European Association of Distance Learning Universities (EADTU), the European Distance Education Network (EDEN), the Association for Professional Use of Telecommunications Technologies in Higher Education (ACUTA), the US Distance Education Association (USDLA), and the World Organization for Distance Education (WAOE), play significant roles. Attention is also directed towards the advancement of higher education standards and educational programs tailored for master's students, as well as the methodological and technological support required for open education. The advancement and effective implementation of Smart technologies in Ukraine necessitate active participation in international forums. For instance, ongoing participation in the International Conference "Smart Education and E-Learning

(SEEL) facilitates discussions on research projects concerning Smart education, strategies and principles of Smart teaching, the integration of E-learning, the adoption of Smart technologies and systems in master's degree preparation, the establishment of Smart classrooms and universities, and the training of specialists for engagement in a Smart society based on acquired knowledge (KES-SEEL-20 | KES International Conference on Smart Education and E-Learning, n.d.).

The quality standards of pedagogical education, formulated by a committee of European experts, hold significance for our exploration concerning the cultivation of professional and pedagogical competence among master's students in educational sciences. N. Makhinya conducted an overview of these standards, encompassing the following aspects: the qualifications and expertise of faculty members; the content and components of the master's curriculum; the integration of research with pedagogical practice and the application of research outcomes in educational settings; collaboration with educational institutions and employers; the internationalization of university education, particularly at the master's level, and the cooperation between educational and scientific establishments. Scholars identify the primary features of pan-European pedagogical education as aligning with societal needs amid European integration processes, granting autonomy to higher education institutions, adhering to a structured progression for institutions preparing prospective educators, and considering the demands of the labor market (Makhynia, 2008).

Let us examine the distinctive features of master's-level pedagogical education in prominent nations worldwide. Researchers pinpoint the prominent trends shaping the development of professional and pedagogical competence among master's students in the United States. These include adherence to the directives of the Bologna process, adoption of the credit-module system of education, integration of advanced information and communication technologies as well as Smart technologies, utilisation of interactive teaching methodologies, augmentation of dedicated time for independent study among master's students, and the utilisation of modern information platforms and programmes for monitoring educational quality (Danylyshena, 2011).

Among the distinctive features of master's education in the USA, scholars highlight several aspects. These encompass the primary reliance on funding sci-

entific endeavors as the principal avenue for fundamental research, the predominant organizational structures of scientific activity identified as research and project-based initiatives, and the presence of commercial ventures within university settings. N. Machynska conducted an analysis of the idiosyncrasies in master's student training, exemplified through a case study of the School of Informatics at the University of Berkeley (iSchool, California, USA), drawing from primary source materials (Academic Programs | Office of Planning and Analysis, n.d.).

The author observes that in Berkeley, the academic training complex is designed to equip individuals with the requisite expertise to attain either a master's or doctoral degree, contingent upon the selection of coursework. For instance, the "Master" program is tailored to equip prospective professionals with a Master of Information Systems and Management in Informatics degree. Enrolling in this specific program offers two pathways for preparation: a master's degree track without the requirement of completing a thesis, which is geared towards immediate immersion into practical endeavors within the chosen field of specialization (Machynska, 2013).

In American higher education institutions preparing master's students, the utilization of electronic education and Smart technologies is nearly ubiquitous, facilitated primarily through online portals. These platforms offer a wealth of educational resources, including internet-based courses developed by leading educators and scholars, such as Coursera and Muks. To enhance proficiency in chosen fields, various resources are accessible, such as the Open University (open.ac.uk), where the OpenLearn platform grants access to course materials. Similarly, the Massachusetts Institute of Technology (mit.edu) administers the OpenCourseWare University project, providing educational courses. Tufts University (tufts.edu) offers publicly available OpenCourseWare university curriculum, while Carnegie Mellon University (cmu.edu) provides online courses and educational materials through the Open Learning Initiative program. Stanford University (stanford.edu) is affiliated with iTunes U, enabling access to its full array of courses (Podliesnyi et al., 2019; Akimova et al., 2023).

T. Danylyshena conducted an investigation into the pedagogical education of master's students in US universities, focusing on contemporary educational and civilizational shifts prompted by processes of in-

ternationalization, globalization, and advancements in information and Smart technologies. Of particular significance is the integration of information technology-based professional competence formation within the US higher education landscape, intersecting with domains such as educational philosophy, the cultivation of value-oriented priorities among master's students, and the modernization of educational standards, programs, and quality control and monitoring mechanisms. The author advocates leveraging these transformations within the US educational policy to inform the educational content for master's preparation in educational pedagogical sciences in Ukraine, aiming to enhance and implement cutting-edge forms and technologies for professional training in educational sciences. The study highlights the US experience in training Masters in Pedagogical Education, showcasing a diverse array of master's programs and courses, as well as the adaptation of traditional teaching methods through the incorporation of Smart technologies. Additionally, it underscores improvements in master's class settings through personalized education approaches utilizing contemporary technological resources and leveraging non-formal and informal educational opportunities (Danylyshena, 2011).

In contemporary US master's degree programs, the methodology for fostering professional and pedagogical competence through Smart technologies emphasizes problem-based, research-oriented, and project-driven learning approaches. Key strategies identified for effective master's training include cultivating managerial competence to equip future education specialists with leadership and mentoring skills in educational management, knowledge acquisition facilitation for master's students, and adept practical application. Research and scientific activities are regarded as integral components of master's education in the USA. The establishment of robust research infrastructure within universities enables the selective admission of highly motivated and talented students into master's programs through competitive processes (Danylyshena, 2011; O. Akimova et al., 2022a).

In his investigation into the professional preparation of master's students within the distance education framework of the USA, R. Sharan underscores the active integration of information technologies in education. This integration is driven by significant shifts in the labor market dynamics, emphasizing the imperative for educators to cultivate in-

formation literacy. Furthermore, the increasing prominence of master's training is recognized for its role in shaping the societal elite. These factors highlight the necessity for a revamped IT education paradigm grounded in Smart technologies and novel approaches to master's level professional development. This paradigm shift seeks to revolutionize educational content, leveraging cutting-edge information and Smart technologies within the instructional process, establishing methodological frameworks to support education, and adapting to the evolving roles of educators and students within the educational milieu, including the emergence of tutor functions (Sharan, 2010; O. Akimova et al., 2022b).

The experience of master's education in the United States holds significance for our research into the development of professional and pedagogical competence among master's students in educational sciences through the utilization of Smart technologies. Acquiring a master's degree in the USA entails a careful consideration of the professional aspect within university curricula. This encompasses an appropriate allocation of credit hours to specialization subjects, both core and elective, as well as a defined number of credit hours devoted to supplementary disciplines. Specialization subjects or those directly related to the chosen field of study are designed to equip students with professional expertise under the guidance of designated consultants. Elective courses complement specialization subjects and align with the individual interests and abilities of master's students (Akimova et al., 2022b).

Researchers delineate the guiding principles underpinning the formulation of training courses. These include continuity, which mandates the sequential progression from foundational to more specialized courses; integrability, which reinforces theoretical knowledge through pedagogical practice integrated throughout the program; conceptuality, emphasizing the alignment of educational and societal objectives in teaching practices; fundamentals, necessitating comprehensive psychological, pedagogical, humanitarian, and general cultural training; systematicity, which combines theoretical and practical elements within the program; and cooperativeness, fostering collaboration between the university and other social institutions (Danylyshena, 2011).

The analysis of pedagogical education at the master's level in Germany is also relevant for our research. The generalization of the views of scientists (N. Abashkina, T. Vakulenko, N. Zhmurko, N.

Kozak, L. Pukhovska) regarding the peculiarities of pedagogical education in Germany was carried out by N. Machynska. Based on the analysis of scientific works, the author claims that the process of training specialists in pedagogy in Germany is based on the following principles: education as one of the priorities of the state policy of the European Union countries; development of pedagogical education taking into account new social realities related to globalization, internationalization and computerization of society; the need to strengthen cooperation between pedagogical education institutions and scientific institutions. N. Makhinya, based on the analysis of the scientific works of members of the German Pedagogical Society (G. Mehnert, U. Vyshkon), singled out innovative solutions for reforming university pedagogical education, namely: the unity of the content of the professional and pedagogical training of master's students and the structural similarity of pedagogical education; strengthening the relationship between theory and practice in pedagogical education through participation in projects, scientific schools, creative laboratories (among the forms of educational activity, the following are highlighted: student scientific work, research projects, pedagogical design, etc.); development of pedagogical sensitization (intuition) and social activity; pedagogical reflection and theoretical justification of decisions made; democratization of the educational process based on mutual responsibility for the learning process, the availability of optional disciplines; development of creativity as an ability for pedagogical creativity through the use of various trainings; internationalization of pedagogical education through academic exchanges, mutual recognition of master's training systems, coherence of international programs (Makhynia, 2008; O. V. Akimova et al., 2020).

To exemplify the cultivation of professional and pedagogical competence among master's students through the utilization of Smart technologies in Germany, we will draw upon an illustration from the official website of the Justus Liebig University of Hesse (Germany, 2020). The university offers a virtual environment for students, providing them and their instructors with opportunities not only to fulfill academic tasks and access information but also to engage in remote learning utilizing virtual applications and platforms. One such platform is ILIAS, an educational platform equipped with advanced e-learning features (including web-based training, e-lectures, quizzes, e-portfolios, and group

wikis) that can be seamlessly integrated into teaching practices if the functionalities of Stud.IP are deemed insufficient. The ILIAS functionality can also be directly activated through the Stud.IP-ILIAS interface. Graduate students encountering inquiries about ILIAS or requiring assistance are encouraged to reach out to the Office of Multimedia Coordination (KOMM). The ILIAS central installation is accessible to all members of JLU Giessen. Furthermore, examples of its utilization are evident within the university didactic network Mittelhessen (HDM) and in the field of sports science (sports-edu). Additionally, educational platforms based on ILIAS are utilized by the pedagogical departments of both JLU Giessen and the Philippian University of Marburg (ILIAS, n.d.).

The virtual university website features media updates and resources on e-learning. Graduate students can access the latest developments in e-learning and new media through this platform. Screen recordings are produced using OBS Studio, an open-source software allowing video recording and live broadcasting. Tutorials are available to demonstrate the straightforward creation of screen recordings using free software, a basic webcam, and PowerPoint, along with open consultation sessions on e-learning.

In the process of designing digital teaching and learning scenarios or incorporating digital media and methods into education, various queries often arise regarding individual tools or the pedagogical benefits of specific projects. The website offers explanatory videos utilizing the "glass board" technique, facilitating the effective communication of educational content. Numerous methods for producing such "video sequences" and glass board videos are presented (Slushnyi et al., 2020).

Furthermore, the new ILIAS training module on "Scientific Thinking for the Profession" has been launched, supplementing the existing teaching modules on Master's Research by providing philosophical and practical insights into scientific thinking for professional contexts. Additionally, a training module on "Pedagogy in Smart Learning" has been released as part of the Teaching 4.0 initiative, covering current legal issues in e-learning.

The Justus Liebig University of Hesse (Germany, 2020) offers guidance on e-learning for master's students, providing assistance for planning e-learning projects and utilizing new media in education. Pedagogical support is available throughout students' studies, assisting with information tech-

nology utilization while considering resource allocation, time management, and didactic proposal distribution. Consultations and training sessions are tailored to address individual project needs, ensuring effective integration into the curriculum. E-learning resources complement face-to-face teaching in an engaging and pedagogically sound manner (Beratung Zu E-Learning, n.d.).

As an illustration, we reference the content of the Master's level E-learning Basics Workshop titled "First Steps to Your Own Concept" available on the Justus Liebig University of Hesse website. The workshop description reads: "If you are already utilizing educational platforms such as Stud.IP, ILIAS, or Moodle in your course to disseminate files, send announcements, or manage participant information, would you be interested in exploring additional learning platform tools such as wikis, blogs, or e-portfolios and integrating them effectively into your teaching? This workshop aims to acquaint you with fundamental e-learning tools, allowing you to define pedagogical design flexibility and gain an overview of the potential applications of e-learning in your course. During the initial segment of the seminar, various e-learning tools will be introduced using the ILIAS learning platform as a model. Participants will assume the role of students and engage in hands-on exploration, either in small groups or individually, to familiarize themselves with the functionality and potential applications of discussion forums, blogs, wikis, web-based training (WBT), and e-lectures. Ahead of the in-person session, participants will develop initial concepts for their own small-scale e-learning project, which they will then implement on their university's personal learning platform. Online support will be available during this practical phase. In the final segment of the workshop, participants will present their e-learning concepts during a plenary session and gain insights into other e-learning scenarios drawn from practical experiences." (TH Mittelhessen, 2024).

**Conclusions.** We conceive of professional and pedagogical competence among master's students in educational sciences as a comprehensive aptitude grounded in foundational subject knowledge and pedagogical principles, as well as contextual and innovative professional skills. This competence encompasses the potential for ongoing professional growth, epistemological awareness, worldview, and cultural perspectives. Additionally, it involves proficiency in utilising cutting-edge educational and Smart technologies, problem-solving abilities related to inclusion and diversity, including addressing giftedness, adherence to pedagogical, professional, and universal values, cultivation of transnational consciousness alongside national identity, and openness to multiculturalism. Language proficiency, encompassing both native and foreign languages, is integral, alongside an emphasis on European quality standards and pedagogical professionalism.

The concept of Smart education is founded on several key principles: the facilitation of mobile access to digital services, the generation of new knowledge to modernise society, Smart support predicated on an IT environment mimicking natural intelligence, and the establishment of an intelligent information environment to enhance efficacy in a digital society. The aim of Smart technologies is to establish an educational and informational milieu conducive to fostering the requisite level of competitiveness among future specialists. This entails fostering collaboration, communication, and teamwork skills, nurturing social responsibility, cultivating critical and creative thinking abilities, and promoting effective problem-solving skills. The educational framework within the Smart environment integrates informational exchange among learners in an asynchronous individual learning model, supported by repositories, electronic and Smart textbooks, educational modules, and methodological resources.

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## Про авторів

**Ольга Акімова**, доктор педагогічних наук, професор, e-mail: sopogov@ukr.net, https://orcid.org/0000-0001-6988-6258

**Василь Каплінський,** доктор педагогічних наук, професор, e-mail: vasuliukaplinskiy@gmail.com, https://orcid.org/0000-0003-0829-1079

**Микита Сапогов,** доктор філософії, e-mail: sopogov@ukr.net, https://orcid.org/0000-0002-0046-7650

## About the Authors

**Olha Akimova,** Doctor of Pedagogical Sciences, Professor, e-mail: sopogov@ukr.net, https://orcid.org/0000-0001-6988-6258

**Vasiliy Kaplinskiy,** Doctor of Pedagogical Sciences, Professor, e-mail: vasuliukaplinskiy@gmail.com, https://orcid.org/0000-0003-0829-1079

**Mykyta Sapohov,** PhD in Education, https://orcid.org/0000-0002-0046-7650