TRANSFORMATION OF EDUCATOR PROFESSIONAL COMPETENCIES IN THE LIFELONG LEARNING ECOSYSTEM

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Abstract. The transformation of educators' professional competencies amidst contemporary sociocultural, security, and technological challenges is a key factor in ensuring the quality and sustainable development of the national education system. The study aims to theoretically substantiate and systematize the transformation trajectories of key components of teacher professionalism – specifically subject-methodological, emotional-ethical, information-digital, and evaluative-analytical competencies – within the context of the New Ukrainian School reform, the requirements of the Professional Standard for Teachers, and the systemic digitalization of the educational environment. Addressing these research objectives determines the logic of the material's presentation: an analysis of the philosophical and pedagogical dimensions of the lifelong, staged development of a professional's identity; the conceptualization of subject-specific and methodological competence amidst educational transformations; the substantiation of emotional-ethical competence as a resource for resilience and a foundation for implementing social-emotional and ethical learning; an overview of development pathways for information-digital and artificial intelligence competencies; and an exploration of the deontological and activity-based principles underlying an educator's evaluative-analytical competence. *The research methodology* is based on general scientific methods of analysis, synthesis, deduction, induction, comparison, and generalization. To characterize the theoretical, methodological, and regulatory dimensions of competency transformation, the study employs conceptual analysis, systematization, modeling, and comparative analysis of regulatory sources (specifically, the Professional Standard

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for Teachers, the DigCompEdu framework, and PISA-2022 materials). The assessment of practical innovations involves analyzing empirical data from educator surveys and the results of piloting specialized professional development programs. *The study results* demonstrate that an educator's professional development is a continuous, staged process (comprising pre-professional, professional, and postgraduate stages), with each stage requiring specific psychological, pedagogical, and methodological support. It was established that subject-methodological competence evolves from a narrow focus on subject-specific readiness into a complex, integrated construct aimed at realizing the UN Sustainable Development Goals and the New Ukrainian School (NUS) reforms. The study also confirms the role of emotional-ethical competence as a resource for teacher adaptation during crises and demonstrates its direct correlation with the development of students' creative thinking. The conceptual foundations of an educator's artificial intelligence (AI) competence have been substantiated, and the functional areas of AI tool application in the educational process have been systematized. The essence of evaluative-analytical competence has been substantiated as an integral construct that combines the measurement of students' academic achievement with a reflective analysis of the educational process. The transformation of the teacher's work function and associated capabilities within the Professional Standard for Teachers is examined, with an emphasis on the expanded descriptors of "Communication" and "Responsibility and Autonomy." The practical need among educators to develop this competence is highlighted, as is its synergy with digital analytics and formative assessment within the New Ukrainian School framework. *Practical implications.* An algorithm for designing an integrated educational product has been substantiated; it ensures the implementation of a practice-oriented approach, the development of transversal skills in learners, and the achievement of the UN Sustainable Development Goals (specifically Goal 4: Quality Education). The functioning and interaction mechanisms of regional educational network communities have been systematized (using the Odesa Academy of Continuing Education as a case study), including the use of informal digital channels – such as Viber communities, Padlet boards, and virtual methodological resource centers – as tools for rapid methodological support, continuous networking, and emotional support for educators under martial law. Recommendations have been developed to

implement the "Zerna" SEN micro-practices, which focus on self-regulation, anxiety reduction, and fostering resilience among teachers and students during crisis situations. Algorithms have been proposed for constructing personalized professional development pathways for educators; these utilize tools from the "Vector" digital platform and implement the "money follows the teacher" institutional mechanism, thereby promoting teacher agency in professional development and the freedom to choose educational providers. A systematized overview of AI services used in educational practice – covering content generation, adaptive assessment, task differentiation, and the creation of visualizations and interactive materials – has been compiled to automate routine pedagogical tasks and enhance the educational process through intelligent technologies. *Value/originality.* A holistic model for the development of educators' professional competencies amidst the challenges of martial law and digital modernization has been conceptualized; it synthesizes regulatory innovations (the 2020–2024 Professional Standard for Teachers and the New Ukrainian School concept), European standards (DigCompEdu), and data from the PISA-2022 international study. The dimensions of modern teacher competencies – specifically AI-related (AI competence) and emotional-ethical competence as an adaptive resource – are substantiated, as are the deontological foundations of evaluative-analytical activity viewed as a humanistic, reflective practice.

INTRODUCTION

The dynamic development of modern society, Ukraine's aspirations for European integration, the systemic reform of general secondary education (the "New Ukrainian School"), and the unprecedented challenges caused by martial law, blackouts, and the loss of infrastructure imperatively demand a radical modernization of the content, formats, and technologies of continuous teacher education. In this turbulent context, a key factor in ensuring the quality and resilience of the national education system is the teacher's ability to respond flexibly and adaptively to sociocultural, geopolitical, and technological shifts. The modern educator is transforming from a traditional conveyor of educational information into a facilitator, mentor, navigator of information flows, and designer of the learners' educational experience.

The theoretical and practical significance of the study stems from the need to resolve several objective contradictions:

– between the high societal demand for an adaptive, digitally literate, and emotionally resilient teacher capable of working amidst uncertainty, and the prevalence of traditional, reproductive models within the professional development system;

– between the implementation of updated state standards (specifically the 2020/2024 Professional Standard for General Secondary Education Teachers) and the lack of comprehensive methodological frameworks for their application in actual educational practices during a time of crisis;

– between the widespread adoption of artificial intelligence technologies in education and the lack of preparedness among educators to integrate these tools into teaching in a safe, ethical, and methodologically sound manner.

The study aims to theoretically substantiate, conceptualize, and structure the key vectors of the transformation of educators' professional competencies (subject-methodological, emotional-ethical, information-digital, AI-related, and evaluative-analytical) within the ecosystem of lifelong learning.

Achieving this aim involves addressing the following tasks:

– to analyze the philosophical and pedagogical dimensions of a teacher's personal and professional development across three interconnected stages (pre-professional, professional, and postgraduate/lifelong);

– to examine the specific transformation of subject-methodological competence (A2) in alignment with the requirements of the New Ukrainian School and UN Sustainable Development Goal 4 ("Quality Education");

– to substantiate the role of emotional-ethical competence (B2) as a resource for teacher well-being and a prerequisite for implementing Social, Emotional, and Ethical Learning (SEE Learning / SEL Kernels), as well as to assess its impact on the development of students' creative thinking based on PISA-2022 data;

– to conceptualize the educator's information-digital competence (A3) and AI competence through the lens of European standards (DigCompEdu) and modern Ukrainian digital platforms ("Mriya," "Diia. Osvita," "Vector");

– to investigate the deontological, communicative, and activity-based foundations of the teacher's evaluative-analytical competence (G3) within the context of formative assessment and academic integrity.

The methodological basis of the study consists of a set of mutually complementary and holistically integrated scientific methods. General scientific methods – analysis, synthesis, deduction, induction, comparison, and systematization – served as the foundation for understanding global educational trends, global challenges, and their impact on the evolution of pedagogical science.

To gain an in-depth understanding of the theoretical, methodological, technological, and regulatory dimensions of the transformation of teachers' professional competencies, the study employed methods of conceptual analysis, modeling, and critical interpretation of international and national regulatory documents (specifically the Professional Standard for Teachers, the DigCompEdu framework, and PISA-2022 findings). The practical effectiveness of educational innovations was assessed by analyzing and synthesizing empirical data from educator surveys and the results of pilot studies of specialized professional development programs.

1. Philosophical and Pedagogical Dimensions of the Educator's Personal Development within the Ecosystem of Lifelong Learning

Examining the transformation of an educator's professional competencies within the ecosystem of lifelong learning requires alignment with the fundamental principles governing the staged development of a well-rounded individual. As noted by V. Ishchenko, Ya. Blokha and O. Skubii, lifelong learning serves as a fundamental philosophical-pedagogical and anthropological condition within which the sequential, staged development of the individual unfolds throughout their life. In this context, the development of the educator-professional takes place within the framework of continuous personal and professional transformation, driven by internal agency and the aspiration to transcend established standards and to gain a profound understanding of the purpose, values, and meaning of one’s own professional activity. Within the framework of the philosophy of lifelong learning, three key, interconnected stages in the development of a well-rounded professional personality are distinguished: pre-professional, professional, and postgraduate. Each of these periods involves specific psychological-pedagogical tasks and developmental determinants [1].

The first stage – pre-professional preparation for high school students – is a multifaceted process that lays the psychological and moral foundation

for future professionalization. The pre-professional stage during high school focuses on:

– formation of an initial value-based attitude toward work and future professional activity;

– intensive development of professionally significant qualities, such as responsibility, a high level of self-organization, and communication skills;

– proactive development of soft skills as a foundation for resilience;

– fostering cognitive engagement and the flexible adjustment of an individual's social and professional self-determination [2].

The content of the pre-professional stage entails implementing modern, learner-centered developmental approaches – specifically, project-based learning, the case method, and business simulations – alongside providing systematic psychological and pedagogical support. Special importance at this level is attached to career specialization and the role of career counselors, who assist high school students in identifying their interests, aptitudes, and goals. As I. Bekh emphasizes, fundamental value orientations are established during the school years; therefore, educational efforts should focus primarily on fostering the student's agency rather than on the rote assimilation of prescribed requirements.

The successful organization of the pre-professional stage is a necessary psychological prerequisite for the continuous professional development of a specialist within the tiered education system [3].

The second stage – professional training in higher education institutions – logically continues personal development, acting as a sensitive period for the intensive formation of professional identity and worldview convictions among young people.

During their university years (ages 18–23), young people not only master a body of specialized scientific knowledge but also begin to envision their future career horizons, redefine their social roles, and transition from youthful, romantic idealism to a realistic, pragmatic, yet value-oriented perception of reality [2; 3].

In line with the philosophy of lifelong learning, professional training in higher education should not be limited to the mere transmission of academic knowledge. Its primary objective is to create a developmental educational environment that fosters critical thinking, scientific creativity, civic responsibility, intercultural competence, and the spiritual enrichment

of the future professional. Achieving these goals requires integrating instruction, development, and upbringing. In this process, instruction primarily shapes the operational aspects of activity (building knowledge, skills, and abilities). In contrast, upbringing integrates the spheres of values and meaning, shaping the individual's attitude toward their future profession and society.

The key functions of educational work within a higher education institution at this stage are:

– goal setting and the facilitation of personal and professional self-design among students;

– integrating educational and moral-ethical components into academic disciplines through the analysis of ethical dilemmas and the simulation of real-world professional situations;

– fostering an active civic stance, leadership qualities, and social responsibility through student self-governance;

– organization of extracurricular activities (scientific clubs, creative studios, sports, and cultural events), which positively impacts academic performance and supports the overall well-being of students.

Higher education institutions should aim to shape not merely a highly qualified professional but a well-rounded "person of culture" – an individual possessing spiritual and emotional maturity and capable of engaging in dialogue, empathy, solidarity, and constructive self-realization. At this stage, self-improvement is a key factor in an individual's successful professional development [5].

The third stage – postgraduate education and professional practice – encompasses the period of maturity and the direct performance of professional duties. In today's high-tech, dynamic world, postgraduate education is no longer merely an occasional or supplementary activity but an urgent necessity. This is driven by the fact that the "competence half-life" (the rate at which knowledge becomes obsolete) in most modern fields is a mere two to three years. Consequently, an individual must view themselves as an open system capable of continuous self-development and the lifelong renewal and expansion of their intellectual, physical, and moral capabilities. This trend is facilitated by the emergence of innovative digital formats for postgraduate learning, such as massive open online courses (MOOCs), micro-credentials, digital badges, and electronic educational portals.

Depending on sociocultural, psychological, and organizational conditions, a specialist faces one of three potential life outcomes in the postgraduate period:

– acme-development (acmeological outcome): the individual is fully satisfied with their work, demonstrates sustained motivation for self-actualization, and experiences continuous spiritual, intellectual, and professional growth. This path is the most desirable for society; however, it requires the creation of a flexible and motivating educational environment: the introduction of financial incentives (educational vouchers), flexible learning schedules, and a transparent system for recognizing the outcomes of non-formal and informal education in the workplace;

– a constructive change scenario: this arises when an educator is dissatisfied with current working conditions or professional outcomes, prompting them to actively seek a new trajectory, retrain, and reorient their life path;

– maladaptive variant: characterized by a mismatch between performance outcomes and the individual's expectations; in the absence of appropriate methodological and psychological support, this leads to professional and spiritual regression, chronic burnout, a mid-career crisis, and destructive personality deformations [6, p. 200].

Avoiding the maladaptive path and fostering "acme-development" requires a profound reform of the postgraduate pedagogical education system, in which the educator's role undergoes a radical transformation – shifting from a mere transmitter of ready-made knowledge to a facilitator, tutor, and navigator amid information flows. Scientific and methodological support during the post-graduate period should focus on developing reflective practices and mentoring, as well as fostering professional networks and peer-to-peer learning.

Thus, the professional development of an educator is a continuous, staged process encompassing pre-professional, professional, and post-graduate stages, each characterized by specific psychological-pedagogical conditions and driving forces. The pre-professional stage establishes value orientations and the foundations of agency through interactive learning methods – such as projects and case studies – within the educational process. Professional training in higher education institutions fosters the development of professional identity and social responsibility during the

formative student years (ages 18–23). The postgraduate stage, coinciding with a period of active professional practice, necessitates continuous competence enhancement due to the rapid pace of information turnover; without appropriate methodological and psychosocial support, this process can lead either to the individual's "acme" development or to professional burnout and maladaptation.

2. Transformation of Subject-Specific and Methodological Competence Amidst Change

The dynamic development of modern society – driven by Ukraine's European integration aspirations, the systemic reform of general secondary education, and the unprecedented challenges of martial law – highlights the need for a fundamental modernization of the content and technologies of continuous teacher education. In the context of transformational change, the development of teacher professionalism takes on particular significance; a teacher's ability to respond flexibly and adaptively to sociocultural and geopolitical shifts is a key factor in ensuring the quality of the domestic education system. Methodological competence naturally emerges as the primary foundation for the sustainable development of the education sector, evolving from a traditional, narrow, subject-specific technical readiness into a complex, multifaceted personal and professional construct.

A theoretical analysis of the essence of methodological competence within the modern scientific paradigm reveals a wide range of interpretations among domestic researchers. In particular, scholars associate this phenomenon with the use of discipline-specific teaching methods and the effective organization of the educational process in a given discipline (I. Akulenko, O. Matiash, V. Sitarov, T. Syasina, N. Tsiuliupa). In the works of N. Tsiuliupa, methodological competence is understood as a system of knowledge, skills, practical experience, and pedagogical abilities that is directly aimed at professional practice and continuous self-improvement.

O. Tsilmak defines the competence under study as a personal capacity to organize professional activity in a structured and highly effective manner, based on acquired knowledge and skills. In this context, O. Protsyshyna interprets it as the ability to organize and conduct classes using teaching methodologies across various disciplines to achieve specific educational objectives.

In our study, we view an educator's methodological competence as a complex, integrated personal attribute comprising a set of capabilities and a readiness for methodological activity, general pedagogical and specialized knowledge and skills, pedagogical values, methodological experience, and personal qualities – all of which, through their interconnection and interaction, ensure the effective implementation of the educational process. This interpretation is the most comprehensive, as it goes beyond the purely reproductive mastery of didactic tools and shifts methodological activity toward person-centered and praxeological approaches [7].

A significant impetus for transforming the conceptual and categorical framework of pedagogical science was the approval in 2020 of the professional standard covering the professions of "Primary School Teacher (General Secondary Education Institution)," "Teacher (General Secondary Education Institution)," and "Primary Education Teacher (Junior Specialist Diploma Holder)" (Ministry of Economy Order No. 2736), as well as the adoption of its updated version – the professional standard "Teacher (General Secondary Education Institution)" – in 2024 (Order of the Ministry of Education and Science of Ukraine No. 1225 dated August 29, 2024). In these foundational regulatory documents, classical methodological competence is interpreted as subject-specific methodological competence (A2), which forms part of the structure of a teacher's professional competencies. The standard delineates specific capabilities within the knowledge and value-action domains (A2.1 through A2.7) to guide the continuous professional development of educators. This standard necessitates a shift from traditional instruction to a competence-based model, in which the teacher acts not as a transmitter of knowledge, but as a facilitator of the educational process [8; 9].

It is noteworthy that the development of a teacher's subject-specific and methodological competence is a fundamental factor in achieving the UN Sustainable Development Goals for 2030, specifically Goal 4: "Quality Education." In accordance with the Decree of the President of Ukraine "On the Sustainable Development Goals of Ukraine for the Period up to 2030," ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all are national priorities [10]. Developing teachers' subject-specific and methodological competence is a key instrument for achieving this goal, as the quality of teacher training

and the ability to design a modern, developmental educational environment directly determine the quality and accessibility of educational services for students in basic and specialized secondary education amid martial law and global changes.

To illustrate the differences between the traditional understanding of methodological competence and its modern interpretation as subject-specific methodological competence – aligned with the requirements of the 2024 Professional Standard for Teachers and the UN General Assembly resolution defining the Sustainable Development Goals [8; 9; 11] – we compare their key parameters (Table 1).

Table 1

Comparative analysis of a teacher's methodological and subject-specific methodological competencies

Comparison criteria	Methodological competence	Subject-specific methodological competence (A2) according to the 2020/2024 Professional Standard for Teachers.
Primary focus	Focus on teaching a specific academic subject and imparting subject-specific knowledge, skills, and abilities	Focus on developing students' key and subject-specific competencies, as well as cross-cutting life skills, within the context of the New Ukrainian School (NUS) and the UN Sustainable Development Goals
Regulatory and methodological framework	Implementation of standard curricula; use of a standard set of traditional didactic teaching methods	Ability to design innovative learning content aligned with the mandatory outcomes of the State Standard; creation of original curricula based on a competency-based approach
Level of content integration	Separate subject teaching, limited use of interdisciplinary connections, and isolated methodological tools	Ability to implement deep integrated learning, synchronization of content across educational domains, and implementation of STEM/STEAM technologies
Digital and security dimension	Sporadic use of ICT as a supplementary visual aid, without systemic digitalization or security support	Integration of AI tools, work in digital educational spaces, cybersecurity, and the creation of a safe environment during martial law

Source: Compiled by the author based on a synthesis of academic and regulatory sources

The comparative data presented in Table 1 demonstrate that, within the framework of the New Ukrainian School (NUS) reforms, subject-specific and methodological competence requires basic-school educators to rethink established practices and systematically transform traditional tools. The modern educator emerges not merely as a transmitter of scientific facts, but as an active agent in designing students' individual educational trajectories.

Implementing the goals of reforming the national education system requires significantly broadening the scope of professional competence development for teachers in basic and specialized (upper) secondary schools. However, the formidable challenges of the present – martial law, air raid alerts, the imperative of strictly adhering to safety protocols, the psychological trauma experienced by participants in the educational process, and the shift to blended and remote learning formats –necessitate a systemic transformation of the regional scientific and methodological support provided to educators. Under these conditions, the primary task of a postgraduate pedagogical education institution is to provide teachers with prompt, effective, and individualized methodological support tailored to their actual needs and requests.

At the Odessa Regional Academy of In-Service Education (OANO), the modernization of scientific and methodological support is being carried out on a solid theoretical and experimental foundation. The development of algorithms to enhance educators' subject-specific and methodological competence in the Odesa region was primarily guided by research findings from the Academy's Department of Teaching Methodology and Educational Content. For several years, this department has been working on the project "Professional Development of Educators in Basic and Specialized Upper Secondary Schools Amidst Educational Reform." A key component of this work involved the interim results of a comprehensive research study titled "Transformation of Personal and Professional Competencies of Educational Process Participants in the Current Context." The study identified the factors driving the transformation of teachers' personal and professional spheres during crises. It developed innovative pedagogical tools that were piloted in professional development courses for educators in the Odesa region [12].

Specifically, the diagnostic phase of the study – during which teachers from the Odesa region assessed themselves against criteria for key subject-specific and methodological competencies defined by the Professional Standard – revealed a relatively uniform distribution of responses, ranging from the initial level to readiness to teach others. This enabled the differentiation of the educational process within professional development courses and the development of variable algorithms to support methodology. Based on a synthesis of the theoretical foundations and practical experience of the OANO, three key vectors for the development of subject-specific methodological competence among teachers of basic and upper secondary schools have been identified:

– The integrative learning vector: implementation of an integrative strategy.

The ability to deliver integrated instruction to students – a component of subject-specific methodological competence designated A2.3 in the Professional Standard for Teachers – is a crucial characteristic of the modern basic-school teacher. This approach is fostered by familiarizing subject teachers with various types of integration (thematic and activity-based) and developing their skills in applying cross-curricular connections when designing integrated lessons. Staff members of the OANO have developed and successfully implemented professional development courses centered on the theme "Implementation of an Integrative Teaching Strategy." A key reference point in this process is the educational and methodological manual "The New Ukrainian School Based on the Unity of Values, Content, and Forms" (2023, edited by O. Levchyshena), which provides a roadmap for lower secondary school teachers regarding the organization of an eco-friendly digital environment, the use of formative assessment, and the integration of various educational domains [12; 13].

– The vector of pedagogical partnership, mentoring, and guidance: peer mentoring and partnership (index A2.7 of subject-methodological competence). Enhancing subject-specific and methodological competence is impossible without active teacher interaction based on partnership and mutual support. Mentoring is viewed as a distinct form of pedagogical partnership that brings together an experienced professional (mentor) and a young colleague or learner (mentee) seeking to gain practical experience. Within this framework, teachers employ tools such as SWOT analysis of

methodological gaps, the development of individual professional growth pathways, and peer-to-peer learning, all of which enable the effective design of lessons grounded in a competency-based approach.

– Digitalization and information security vector: Modern blended and remote learning requires educators to integrate digital and methodological tools. This vector entails engaging basic education teachers in the "School in the Digital World" digital educational space (hosted by the OANO), utilizing artificial intelligence tools (such as ChatGPT, Gemini, and MagicSchool) to prepare instructional materials, automate assessment, and create presentations using services like Slidesgo or ClassDojo, as well as fostering media literacy and ensuring information security for all participants in the educational process amidst the realities of martial law.

The algorithm developed by the staff of the Department of Teaching Methodology and Educational Content for designing an integrated product (as a key indicator of subject-specific methodological competence) encompasses the following mandatory steps:

– defining the general lesson objective and the goals for integrating educational areas or topics;

– selecting related subjects or topics for integration and identifying interdisciplinary connections;

– selecting appropriate digital technologies, AI tools, and innovative resources;

– creating a comprehensive learning case for students (e.g., using Padlet or Nearpod);

– assessing the relevance of integrated content to students' real-life needs and incorporating environmental themes;

– fostering collaborative communication with students and colleagues during integrated learning;

– providing constructive feedback and utilizing formative assessment tools;

– tracking students' learning progress and engaging in pedagogical reflection.

Incorporating this algorithm into the professional development curriculum for basic-school teachers in the Odesa region has demonstrated a marked increase in their readiness to design modern lessons within the New

Ukrainian School (NUS) framework, grounded in a holistic understanding of the world.

Amidst socio-political transformations and wartime crises, traditional forms of methodological work are losing their agility, giving way to flexible, informal, and interactive models of professional interaction. Ongoing regional educational networks of subject-specific teachers have emerged as a crucial innovative space for the continuous professional development of educators in the Odesa region. In contemporary scholarship, a professional network community is defined as a formal or informal group of individuals united by shared interests who interact within a specific subject area or professional domain via local and global computer networks [14].

The need to develop and provide scientific and methodological support for the strategy of expanding educational networks in the Odesa region is directly driven by the requirements of the 2024 Professional Standard for Teachers. In particular, the content of the professional competence "capacity for lifelong learning" – within the scope of work function D, "continuous professional development" – requires teachers to identify the conditions and resources for their own professional growth and to interact with other educators based on principles of partnership, mentoring, and supervision. This entails a deep understanding of the activities of professional communities and teacher associations, as well as the ability to actively engage in collaborative action, provide supervision, and share effective pedagogical experience [9].

Networking among educator communities in the Odesa region aims to address key professional challenges. It enables every teacher to meet individual professional needs promptly, receive ad hoc methodological support during crises, collaboratively design innovative lessons, exchange digital resources, pilot modern formative assessment methods, and collectively overcome professional burnout while maintaining emotional resilience.

A network of such regional communities has been established and is successfully operating within the virtual environment of the Odessa Regional Academy of In-Service Education (ORAISE). These communities bring together subject-specific teachers from various educational fields, educators from pilot schools that are the first to implement the State Standard for Basic Secondary Education, certified "New Ukrainian School" (NUS)

trainers from the Odesa region, and school administrators from the area. Furthermore, the Academy's NUS educational field coordinators actively participate in networks at both the national and international levels.

Practical, innovative formats for collaborative interaction within the Odesa region's digital network include:

– Thematic Viber communities and chats: these serve as platforms for rapid written communication, the instant exchange of ideas, the dissemination of urgent regulatory updates, and the prompt resolution of pressing methodological issues arising in teachers' daily practice – particularly under conditions of blended or remote learning during air raid alerts or power outages.

– Padlet virtual interactive online boards: used as structured, interactive repositories of teaching resources, organizing links to useful instructional materials, integrated lesson plans, posters showcasing effective practices by educators from the Odesa region, AI usage guidelines, and tools for the formative assessment of student learning achievements.

– OANO's ongoing networking spaces: activity within them intensifies significantly in the lead-up to, during, and following the Academy's large-scale educational events. These spaces host discussion forums, practical intensives (such as "Digitalization of Education: A Case Study for Teachers" as part of the "Resources, Strategies, Practices" series), pedagogical workshops, personal growth training sessions, and masterclasses led by thought leaders [14].

The effectiveness of educators' participation in the Odesa region's online educational communities is significantly enhanced by integrating non-formal education with the formal training provided by the Odessa Regional Academy of In-Service Education (ORAISE). By mastering the content of courses such as "Personal Learning Network: Creating Together" and "Integrating Learning: Values, Competencies, and Practices," participants acquire practical skills in independently creating and modifying their Personal Learning Networks (PLNs), piloting various virtual interaction formats (groups, channels, blogs), and employing tools to foster peer motivation during online collaboration. Networked communities in the Odesa region serve as an effective, synergistic platform that aligns the methodological support provided to teachers with the modern, innovative requirements of lifelong learning.

Thus, amidst educational reforms and sociocultural challenges, methodological competence is transforming from a teacher's traditional, narrow, subject-specific technical skill into a holistic subject-methodological competence (A2). In accordance with the requirements of professional standards for teachers, it emerges as a complex, integrated personal-professional construct combining a system of fundamental subject knowledge, mastery of modern methodological tools, the ability to model integrated learning content, and developed pedagogical reflection. Modernizing this competence is a fundamental factor in achieving UN Sustainable Development Goal 4 ("Quality Education") by providing continuous lifelong learning.

It is worth noting that innovative formats of scientific and methodological support for teachers – specifically the operation of regional educational networks in the Odessa Regional Academy of In-Service Education (ORAISE).– serve as an effective, synergistic platform for continuous professional development. They ensure the prompt fulfillment of educators' individual educational needs through non-formal and informal education tools (Viber communities, Padlet online boards, networking spaces, and LEGO initiatives).

3. Emotional-Ethical Competence as an Adaptive and Professional Resource for Educators Amidst Modern Challenges

Ukraine's contemporary sociocultural landscape is characterized by persistent infrastructural, security-related, and socio-psychological instability resulting from the challenges of martial law, necessitating a qualitative renewal of the content and methodologies of continuous teacher education. Pedagogical practice under such extreme conditions entails an exceptionally high psycho-emotional burden, a lack of security, and risks of chronic stress and professional burnout among teachers. In this context, the shift from traditional, authoritarian, and controlling didactics to a humanistic paradigm of partnership-based interaction – one directly grounded in the development of the educator's emotional maturity – takes on particular significance.

Within the modern scientific paradigm, an educator's emotional-ethical competence is viewed as an integral personal-professional construct; it enables the individual to recognize and constructively regulate their own

emotional states, accurately perceive and interpret the emotions of others, build constructive partnerships, and make morally and ethically sound decisions in complex pedagogical situations [15, p. 158].

Within the framework of the research conducted by the Department of Teaching Methods and Educational Content Odessa Regional Academy of In-Service Education (ORAISE) – a communal institution of higher education under the Odesa Regional Council – on the topic "Professional Development of Teachers in Basic and Specialized Upper Secondary Schools Amidst Education Reform," emotional-ethical competence is viewed as the fundamental core of a teacher's innovative culture and professional resilience [16, p. 2268].

Legislative confirmation of the high socioeconomic status of this competence is found in the approval of the Professional Standard for "Teacher of a General Secondary Education Institution." The standard clearly defines emotional-ethical competence (B2) as an essential component of teacher professionalism that directly facilitates the work function of partnership-based interaction. A key aspect of this competence is awareness of one's own feelings and emotions, as well as the needs and emotional states of other participants in the educational process, alongside the ability to manage one's own emotional states (component B2.1) [9].

The structural-functional potential of emotional-ethical competence encompasses several interconnected dimensions:

– emotional self-regulation and mindfulness: the teacher's ability to identify their own emotional triggers, master grounding and self-soothing techniques, and prevent professional deformation and burnout;

– empathy and social sensitivity: the ability to interpret students' non-verbal cues, show sensitivity toward children who have experienced traumatic events, and foster a sense of psychological well-being;

– ethical responsibility and deontological culture: adherence to academic integrity, non-violent communication, respect for the child's dignity, and making managerial and pedagogical decisions based on human-centric values.

The theoretical basis of the competence under study draws upon classical and contemporary models of emotional intelligence. For instance, D. Goleman's concept (Goleman, 2020) demonstrates that success in "person-to-person" professions is largely determined by emotional

intelligence (EQ) rather than solely by academic intelligence (IQ) [17]. In his operational model of emotional-social intelligence (ESI), R. Bar-On identifies intrapersonal and interpersonal skills, adaptability, stress management, and general mood as key factors in individual adaptation [18].

In the domestic context, Zh. Stelmashuk emphasizes that emotional competence is a dynamic combination of attitudes, values, and skills for successfully organizing the educational process based on emotional engagement and empathy. An educator with developed emotional intelligence is capable of maintaining a "therapeutic presence" and emotional stability, as well as preventing professional burnout during crises [19].

The effective implementation of State Standards for general secondary education requires teachers in basic and specialized schools to purposefully foster students' transversal skills – specifically constructive emotion management, critical thinking, collaboration, and problem-solving [20]. Integrating social-emotional learning (SEL) programs into the educational process serves as a key tool for developing these transversal skills (or "soft skills"). According to the CASEL (Collaborative for Academic, Social, and Emotional Learning) framework, SEL encompasses the development of five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making [21].

A unique evolution of the SEL concept is the international Social, Emotional, and Ethical Learning (SEE Learning) program, developed by Emory University (USA) and piloted in Ukraine by the NGO EdCamp Ukraine [22]. The SEE Learning program is grounded in three dimensions of learning – awareness, compassion/ethics, and engagement – which are systematically unfolded across three interconnected levels: personal, social, and systemic (Table 2). Unlike standard SEL programs, SEE Learning emphasizes the ethical component and the cultivation of both heart and mind through the analysis of ethical dilemmas, empathy, and the recognition of our shared humanity [23].

To clearly illustrate the structure and logic of integrating SEE Learning into the educational process in accordance with the Emory University methodology, it is appropriate to present its key dimensions and levels in a Table 2.

Table 2

Interconnectedness of the levels and dimensions of Social, Emotional, and Ethical Learning (SEE Learning)

SEEL Dimensions / Levels Personal	Level (Inner Self)	Social Level (Self and Others)	Systemic Level (Self in the Community)
Awareness	Awareness, attention, and self-awareness: understanding the body's physiological signals, identifying emotions and triggers	Attention and awareness of others: recognizing the emotions of those around us, understanding social context	Understanding interdependence: realizing oneself as part of global and local social systems
Compassion	Compassion Self-care: self-compassion, healthy self-support, understanding emotional needs	Care for others: empathy, respect, gratitude, and healthy support for colleagues and students	Common humanity: recognizing the shared human desire for well-being, valuing diversity
Engagement	Self-regulation: emotional self-help skills, grounding techniques, managing stress.	Interaction skills: nonviolent communication, active listening, conflict resolution	Global engagement: responsible decision-making, initiating and implementing socially beneficial activities

Source: Developed based on the SEE Learning guide [23] and the LifeComp framework [24]

The implementation of the SEE Learning (Social, Emotional, and Ethical Learning) conceptual framework in domestic schools is carried out by designing and delivering specialized professional development programs for educators. A prime example is the standard program titled "Social-Emotional Learning as a Tool for Developing Cross-Cutting Competencies in New Ukrainian School Students." This program aims to equip educators with the skills to structure lessons so that cognitive, emotional, and behavioral components are integrated into every learning activity: first, the rational processing of information; next, its deep emotional experience and reflection; and only then, its practical application [25].

The implementation of the fundamental provisions of the Law of Ukraine "On Education" (2017) – which legislatively enshrined the concept

of academic freedom in teachers' professional development – served as the organizational and legal foundation for the broad diversification and flexible implementation of social-emotional learning in domestic practice. This has driven the emergence of a fundamentally new, decentralized model of teacher professional development, which has been actively implemented since 2020. Under this model, teachers gained the autonomy to independently select professional development providers and specific educational programs based on their own methodological requirements and self-development needs.

Providers of such services may now include not only traditional postgraduate pedagogical education institutions but also other educational institutions or their subdivisions, research organizations, and legal entities or individuals (including NGOs and private trainers) offering relevant professional development services for teachers. This academic freedom allows teachers to flexibly combine and mutually recognize learning outcomes acquired through formal and non-formal education.

A logical extension and a financial-economic instrument for securing this autonomy was the introduction – scheduled for a 2026 pilot phase – of the large-scale state initiative known as "Money Follows the Teacher." This innovative approach significantly modernizes the funding mechanism for the professional development of teaching staff. Under the initiative's regulations, a fixed amount of state funds is credited directly to the personal virtual account of each teacher, principal, or deputy principal at a general secondary education institution. Using the national digital platform "Vector" (https://vector.uied.gov.ua/uk/), educators can independently select an education provider and register for a relevant professional development program.

Within this innovative ecosystem for funding and professional development, the "Vector" platform hosts a professional development program for general secondary education teachers titled "Developing Cross-Cutting Skills in Grades 7–9 Students through Social-Emotional Learning," developed by staff at the Odesa Academy of Continuing Education (Shatailo N., 2026). This program aims to address the psycho-emotional deficits experienced by adolescents (students in basic secondary education) under martial law conditions. The core methodological component of this program is the innovative SEL Kernels program, developed by renowned

experts at the Harvard Graduate School of Education and adapted for Ukraine through its official website. The SEL Kernels concept relies on the use of concise, flexible, targeted, and easily adaptable educational micro-practices (known as "kernels") that do not require the creation of a separate subject in the school curriculum. These micro-interventions can be seamlessly integrated by a secondary school teacher directly into the structure of any lesson – whether in mathematics, physics, language, or art – or incorporated into school events and daily routines. Each "seed" targets the development of a specific socio-emotional competence in adolescents (such as self-regulation, the empathetic expression of feelings, assertiveness, constructive conflict resolution, or creativity) [26]. Thanks to this flexibility, the "Seeds" program serves as a highly effective tool for supporting student mental health and resilience, fostering essential life skills within real-world sociocultural contexts.

The transformation of an educator's emotional-ethical competence must clearly correlate with the actual academic achievements and psychological characteristics of today's students. An objective picture regarding the development of a key 21st-century transversal skill – creative thinking – was provided by the national and international reports on the PISA-2022 study, in which creative thinking was singled out for the first time as an innovative assessment domain. Within the PISA framework, creative thinking is understood as the competence to engage productively in generating, evaluating, and improving ideas, resulting in the adoption of original and effective solutions, the advancement of knowledge, and the practical application of imagination [27].

An analysis of PISA 2022 empirical data has revealed several serious deficiencies in the development of creativity among Ukrainian adolescents, posing complex didactic challenges for the lifelong learning system. Specifically, Ukraine achieved an average score of 27 points, ranking between 32nd and 42nd place among the 64 participating countries – a result 6 points lower than the OECD average (33 points). Only 59% of Ukrainian students reached the baseline proficiency level of 3 or higher (demonstrating the ability to generate appropriate ideas for moderately complex tasks). In contrast, the corresponding figure for the OECD is 79%. Of particular concern is the fact that only 13% of adolescents in Ukraine achieved the highest proficiency levels (levels 5 and 6) – compared to 25%

in the OECD – with the figure for the highest level (Level 6) standing at just 3%. Conversely, 18% of Ukrainian students performed at a low level (Level 1 or below), indicating a reliance on stereotypical thinking and pre-set templates.

The study revealed a significant correlation between creative performance and specific socio-economic and organizational factors: a 2-point gender gap favoring girls; an 11-point gap attributable to socio-economic status (the ESCS index); and students in colleges and vocational-technical institutions trailing their peers from lyceums and specialized schools by 5 points. At the same time, the PISA assessment examined indices of students' intrinsic motivation that directly influence creativity: creative self-efficacy, openness to intellect, and openness to art.

A key finding of PISA 2022 is a significant gap between teachers' and students' perceptions of the nature of creativity. For instance, almost all Ukrainian adolescents attend schools where principals hold positive beliefs – specifically, that creativity can be learned (77%) or that it can manifest in any field of activity (97%). However, only 47% of Ukrainian 15-year-olds believe in the potential to develop their own creativity (while others view it as an innate, fixed talent).

It has been statistically shown that students who possess a growth mindset regarding creativity achieve, on average, a score that is 5 points higher [28]. This implies that a teacher's communication of their own beliefs about the development of abilities to students is the first critical step in helping children overcome mental rigidity and the fear of making mistakes.

Conveying such positive beliefs is possible only if the teacher possesses well-developed emotional-ethical competence and empathy, as well as the ability to create a safe educational environment. Moreover, PISA data indicate that students in Ukraine report high levels of perceived creative pedagogical approaches (80% of students state that teachers value their ideas). A one-unit increase in the index of perceived creative approaches is associated with a 0.8-point rise in student performance in Ukraine – significantly higher than the OECD average (0.2 points). Thus, a teacher's emotional resilience, direct empathetic engagement, and support for the student during complex divergent tasks serve as key determinants in overcoming educational losses and fostering a child's creative potential [16].

Thus, an educator's emotional-ethical competence emerges as a key internal resource for professional resilience, adaptability, and successful interaction amidst modern crisis-related challenges. In accordance with the requirements of the 2024 Professional Standard for Teachers, awareness of one's own emotional states and their constructive management serve as the foundation for building partnership-based, subject-to-subject interactions with all participants in the educational process.

Implementing Social-Emotional and Ethical Learning (SEEL) at the personal, social, and systemic levels is an effective pedagogical tool for developing transversal skills in learners. Thanks to the introduction of academic freedom in professional development and the launch of the "Money Follows the Teacher" state funding program, modern educators can personally select innovative courses via the "Vector" digital platform. This enables the effective implementation of SEE (Social, Emotional, and Ethical) learning – specifically the micro-practices from the Harvard Graduate School of Education's "Zerna" SEE program – into daily work with students in grades 7–9, significantly boosting their emotional resilience without adding to the instructional workload.

It is worth noting that there is a direct interdependence between a teacher's emotional-ethical competence and the level of development of students' creative thinking. Data from the PISA-2022 international study demonstrate that students' success in generating original ideas depends critically on the teacher creating an emotionally safe environment and conveying a belief in their potential to develop their abilities (a growth mindset), thereby breaking down psychological barriers, stereotypes, and rigid patterns of thought.

4. Transformation of the Educator's Information and Digital Competence Amidst the Intellectualization and Digital Modernization of the Educational Environment

The modern era of global digital development – characterized by the rapid deployment of Industry 5.0 technologies and the integration of intelligent, adaptive systems, cloud computing, and virtual and augmented reality – imperatively demands a profound rethinking of the theoretical and methodological foundations that underpin Ukraine's entire educational system. Amidst prolonged martial law and unprecedented security, socio-

economic, and logistical challenges, the domestic education sector faces an exceptionally complex task: ensuring not merely the stable survival and functioning of educational institutions, but also a transition toward a strategy of proactive development. This strategy relies directly on the large-scale digitalization of the educational environment, which serves as a powerful tool for bridging accumulated systemic gaps in learning quality, compensating for infrastructure losses, and expanding equal access to knowledge for all categories of learners [29].

In academic discourse, the digitalization of education is viewed not merely as the mechanical, instrumental equipping of educational institutions with state-of-the-art computer hardware or digital gadgets, but as a complex, multidimensional socio-cultural and pedagogical transformation of the educational space. According to the prominent researcher A. Schleicher, the digital transformation of education entails a radical overhaul of the entire learning experience, a shift in the traditional roles of teacher and student, and a renewal of approaches to assessment and the structuring of educational content [30]. In the era of intellectualization, digital technologies emerge not merely as intermediaries or auxiliary didactic tools but as a strategic factor in creating an open, flexible, and adaptive educational environment that unlocks the unique potential of every learner.

The methodological foundation for researching digital transformation processes in domestic pedagogical science is based on the fundamental works of V. Bykov, V. Kremen, O. Spirin, M. Shyshkina, S. Lytvynova, and other representatives of this academic school. In particular, V. Bykov substantiated the conceptual foundations for the design, formation, and development of a cloud-oriented educational, research, and learning environment, and highlighted the methodological principle of the unity of humanistic, creative, and technological approaches. Within this framework, the cloud-oriented environment serves as an integrative basis for modernizing didactic systems, enabling the integration of formal, non-formal, and informal educational activities into a single, holistic ecosystem for the continuous professional development of educators and the cultivation of a digital culture within society [31].

Throughout the historical progression of the informatization of domestic education – from 1991 to the present – a distinct evolution of the conceptual and categorical framework has been observed, reflecting shifts in

technological paradigms and pedagogical approaches. In the early stages of informatization, researchers focused primarily on the concepts of "computer literacy" and "informatics competence," which entailed developing teachers' basic skills in using operating systems, word processors, and spreadsheets. With the development of the global Internet and cloud computing, the focus shifted to "information and communication competence" (ICT competence), viewed as an educator's ability to effectively utilize network resources, email, learning management systems (such as LMS Moodle), and web-based interaction tools to organize the educational process [32].

At the current stage of societal development and the emergence of the digital economy, the concept of an educator's "information and digital competence" (IDC) has acquired a fundamentally new, integrative meaning. It is interpreted as a complex personal and professional characteristic of a teacher, combining deep subject-matter knowledge, mastery of innovative digital tools, the ability to critically evaluate information sources, media literacy, cybersecurity, and ethical online interaction skills, as well as sustained motivation for continuous professional self-improvement. An important component of a modern educator's digital competence is the development of "digital pedagogy" – a new field of knowledge focused on the conscious, didactically sound, and purposeful selection of technologies tailored to specific subject matter, learners' age characteristics, and concrete pedagogical goals. This drives a qualitative shift from the mere use of gadgets in the classroom to the creation of high-tech, emotionally responsive, adaptive, and human-centric educational interactions. In this context, the educator's role undergoes a significant transformation: shifting from the traditional "transmitter of knowledge," the teacher becomes a facilitator, mentor, moderator of digital discussions, and architect of the students' individual educational experiences. At the same time, the digital interaction environment integrates security and ethical dimensions, ensuring adherence to academic integrity standards, the protection of students' personal data, and the creation of a psychologically comfortable digital space.

In the context of the New Ukrainian School (NUS) reform, information and digital competence serve as a fundamental prerequisite for the successful implementation of the State Standard for Basic Secondary Education.

The shift toward competency-based learning requires teachers to move away from outdated, authoritarian, and transmission-oriented teaching models in favor of facilitation and mentorship, in which the educator serves as an educational experience designer, guide, and navigator for the student within the vast landscape of information. Thus, transforming a teacher's information and digital competence within the ecosystem of lifelong learning is not merely a response to the emergence of new technologies; it is a fundamental process of professional renewal for the educator – one upon which the quality, competitiveness, and resilience of the national education system depend in the face of modern crises and challenges.

The systematic enhancement of educators' information and digital competence requires clear, scientifically grounded benchmarks and standards that enable objective monitoring, self-assessment, and targeted professional development. In the international educational landscape, the European Framework for the Digital Competence of Educators (DigCompEdu) serves as such a universal foundation, defining professional requirements for teachers across six interconnected areas. These areas encompass: 1) professional engagement (using digital technologies to interact with colleagues, students, and parents, and for continuous professional development); 2) digital resources (the ability to search for, create, modify, and share digital educational resources); 3) teaching and learning (the ability to design and manage the educational process using digital tools); 4) assessment (using digital technologies for ongoing, formative, and summative assessment of student achievement); 5) empowering students (ensuring inclusivity, accessibility, differentiation, and the active engagement of learners); 6) fostering students' digital competence (developing children's information literacy, communication skills, digital content creation, and problem-solving abilities) [33].

Within the domestic regulatory framework, the logic of the European DigCompEdu standard has been successfully implemented and adapted through the Concept for the Development of Digital Competence of Pedagogical Staff [34] and the Professional Standard "Teacher of a General Secondary Education Institution" [9].

Within the structure of this standard, digital information competence (A3) is defined as a key component of a teacher's professional competence; it directly enables the performance of the professional function of "creating

a safe and inclusive educational environment" and is articulated through a system of three interconnected professional capabilities:

– the ability to navigate the information landscape, search for, critically evaluate, systematize, and responsibly use information from various sources, as well as possess foundational knowledge of media literacy, digital financial literacy, and information security (A3.1);

– the ability to effectively use digital technologies in the educational process to structure learning content, organize various forms of learning activities (in-person, remote, blended), conduct formative and criterion-based assessment, and provide support to students as they acquire knowledge (A3.2);

– the ability to create, compile, modify, and use electronic educational resources; work within the educational institution’s cloud-based and virtual educational environment; and adhere to academic integrity requirements and rules regarding the use of copyrighted materials in the digital environment (A3.3) [9].

A comparative analysis of the competencies outlined in the 2024 Professional Standard and the European DigCompEdu indicators reveals a significant increase in requirements for the critical and safety-related aspects of a teacher's information and digital competence. A modern educator must not only possess skills in using specific software applications but also demonstrate a high level of digital culture, encompassing the ability to counter disinformation, recognize manipulative narratives in the media landscape (particularly amidst hybrid military aggression), protect students' personal data, and foster safe online behavior skills among them. Requirements for ensuring and upholding academic integrity standards in the digital educational space have taken on particular importance in the 2024 Professional Standard for Teachers. This shift is directly driven by the widespread adoption and accessibility of generative artificial intelligence (AI) technologies, which have fundamentally transformed the landscape of creating, processing, and presenting educational content. The rapid evolution of AI tools has significantly complicated traditional methods for verifying authorship and ensuring that students complete their work independently, thereby posing a range of new ethical, deontological, and assessment-related challenges for the teaching community.

The transformation of professional requirements regarding an educator's information and digital competence (work function A3) – and its alignment with the European DigCompEdu framework – significantly influences the updating of their role within the educational process. The teacher's traditional monopoly as the sole source of knowledge is definitely giving way to digital pedagogy, in which the educator serves as a moderator of the educational environment, transforming didactic interactions around principles of human-centricity, empathy, and agency. In line with this paradigm, the new-generation teacher fulfills their tasks through the following interconnected and dynamic professional roles:

1) digital learning facilitator – someone who organizes and supports students' independent inquiry-based activities in a digital environment, creates conditions for collaborative interaction, and provides adaptive feedback;

2) mentor and tutor for individual development – a guide who helps each student build their own educational trajectory, understand their cognitive styles, overcome learning difficulties, and make professional career choices using educational analytics tools;

3) moderator of intellectual dialogue – an organizer of safe, tolerant, and ethical communication within professional online communities and virtual classrooms, ensuring support for the psycho-emotional well-being of all participants in the educational process;

4) architect and designer of educational experiences – a specialist capable of modeling integrated learning content and constructing innovative, competency-based lessons using cloud services, AI systems, and data visualization tools.

Such a multi-faceted and multi-component structure of a teacher's information-digital competence necessitates a radical departure from outdated, techno-centric teacher training focused on the isolated study of purely technical skills ("hard skills"). Instead, the conceptual focus shifts to the comprehensive, harmonious development of methodological, ethical-deontological, safety-related, emotional, and communicative skills (both "soft" and digital). In this context, mastering digital devices or software applications is viewed not as an end in itself, but as a flexible toolkit for addressing complex pedagogical, analytical, and communicative challenges.

Such a transformation of approaches within the system of continuous teacher education makes it possible to shape an adaptive, reflective, and professionally mobile teacher capable of acting effectively and confidently amidst high uncertainty, rapid technological change, and military-social challenges. By combining digital literacy with a high level of emotional-ethical and evaluative-analytical competencies, the educator gains the ability to systematically design a high-quality, humanistically oriented, psychologically comfortable, and safe educational process within the modern digital space.

The mass adoption of artificial intelligence (AI) technologies has emerged as a powerful new driver, transforming the modern educational environment; it is radically altering the architecture of pedagogical practice and establishing fundamentally new requirements for the teacher's professional profile. As highlighted in the National Report on the State and Prospects of Education Development in Ukraine (2026), AI in education can no longer be viewed merely as a localized experiment by an individual innovative educator or as a passing technological trend; rather, it is rapidly becoming a new imperative for the digitalization and systemic transformation of the educational landscape. Amidst current security and socio-economic challenges, the integration of AI tools emerges as a critical nationwide instrument aimed at effectively compensating for significant infrastructure losses suffered by educational institutions, as well as addressing deep-seated educational gaps and competency deficits among learners – issues stemming from martial law, systematic blackouts, forced interruptions to in-person instruction, and the frequent shifting of the educational process to online formats.

The implementation of AI creates a new technological and didactic platform for personalizing and intellectualizing learning. In particular, the use of generative AI algorithms and adaptive educational systems enables the personalization of students' educational pathways – specifically by flexibly adapting the complexity, pace, and delivery format of learning materials based on each learner's individual needs, cognitive capabilities, and proficiency level; optimize the teacher's time (automate routine tasks such as developing instructional content and test items, lesson planning, and maintaining records and analytical documentation, thereby freeing up time for direct facilitation, emotional support, and creative interaction with

students); strengthen the analytical and assessment components (integrate artificial intelligence tools into formative and summative assessment processes, providing immediate visibility into student progress analytics and enabling the timely identification of learning gaps); to ensure inclusivity and accessibility: to compensate for the lack of physical or material-technical resources in regions most affected by the war and to provide students with equal access to high-quality, interactive learning materials, regardless of their location.

In this way, artificial intelligence becomes not merely a technical aid but a strategic resource for the recovery and modernization of the national education system; this requires teachers to possess a high level of information-digital, emotional-ethical, and evaluative-analytical competencies to ensure its informed, safe, and human-centric application [35].

Ukraine is demonstrating a proactive and consistent approach to shaping the regulatory framework for AI use in education, opting for flexible sectoral regulation and gradual alignment with the European Union's stringent standards. The foundation of this process is the Concept for Artificial Intelligence Development through 2030 (adopted by a decree of the Cabinet of Ministers of Ukraine), which designated AI as a national strategic priority for the economy and education [36].

To implement these conceptual principles, the Ministry of Digital Transformation of Ukraine, in cooperation with the Ministry of Education and Science of Ukraine and leading scholars from the National Academy of Educational Sciences (NAES) of Ukraine, developed and approved comprehensive "Methodological Recommendations on the Responsible, Ethical, and Effective Use of Artificial Intelligence Technologies in General Secondary and Higher Education Institutions." This regulatory and methodological framework outlines a clear structure for integrating AI tools into the educational process, focusing not only on the technologies' didactic potential but also on critically important deontological, legal, and security aspects.

The developed methodological guidelines anchor the digital transformation of the education system in such fundamental principles as human-centricity and agency (preserving the leading and decisive role of the educator – the "human-in-the-loop" – in the design, implementation, and evaluation of the educational process), where AI acts exclusively as

an assistant and a tool to augment human potential rather than replace it; ethics and adherence to academic integrity (fostering a culture of transparent and responsible use of generative AI algorithms among participants in the educational process, defining clear boundaries regarding the permissible use of AI in research and academic assignments, and preventing plagiarism and improper use of source material); personal data protection and cybersecurity (strict adherence to legal standards regarding privacy, the protection of learners' rights, and the security of the information environment when interacting with external digital platforms and AI services); countering algorithmic bias (critically evaluating AI-generated content for discriminatory distortions, disinformation, stereotypes, or fabrications – "AI hallucinations" – which requires a high level of critical thinking and media literacy on the part of the teacher); ensuring inclusivity and equal access (bridging the digital divide and creating a level playing field for all learners to use innovative technologies, regardless of their socioeconomic status, geographic location, or special educational needs). Thus, the adoption of these regulatory and methodological documents sets a course for the systematic, safe, and pedagogically sound integration of AI technologies, aligning the national education system with advanced international and European standards of digital ethics and quality [37].

Two large-scale national projects – the "Diia.Osvita" national platform and the "Mriya" intelligent state educational ecosystem – have become key practical tools for implementing state policy regarding the digital transformation, digitalization, and intellectualization of the education sector during the 2022–2026 period. These infrastructural innovations form an integrated technological complex that facilitates both the enhancement of educators' general digital literacy and the direct automated support of the educational process within educational institutions.

"Diia.Osvita" the national non-formal education platform that has reached over 2.9 million users across Ukraine, serves as a key tool for the non-formal and informal professional development of educators, as well as for fostering AI and digital literacy among the general public. Regarding teachers' professional development, the platform's functionality enables the independent mastery of cutting-edge digital technologies through innovative microlearning formats. In particular, the platform hosts a specialized series of educational programs – such as "Artificial Intelligence: From Basics to

Application" and "Digital Business and Future Technologies" – that enable learners to build foundational knowledge regarding the operating principles of neural networks, algorithms, and generative AI tools; interactive educational simulators for prompt engineering that enable teachers to practice formulating precise, safe, and high-quality prompts for artificial intelligence when developing learning materials; a national guide on AI ethics outlining the deontological and ethical boundaries for the use of digital technologies and generative models in the public and educational sectors; and the "Tsyfrohram" national test, which serves as a diagnostic tool allowing teachers to conduct a comprehensive, independent, and objective assessment of their digital competence level in accordance with the European DigCompEdu framework.

Unlike the "Diia.Osvita" platform, which focuses on public awareness and information, the "Mriya" intelligent state educational ecosystem – launched as a pilot project in September 2024 and reaching over 500 general secondary education institutions across Ukraine by 2026 – is designed to deeply automate educational management and practically personalize students' learning experiences through artificial intelligence algorithms. The central AI product in the "Mriya" ecosystem, developed specifically to facilitate educators' work, is an intelligent generator of tests, assignments, and didactic materials. The technological foundation of this tool relies on a fully digitized, structured, and verified collection of 1,300 school textbooks – comprising over 300,000 pages of educational content approved by the Ministry of Education and Science of Ukraine. The functional capabilities of the intelligent generator enable the teacher to: automate lesson preparation (creating differentiated worksheets, test items, interactive exercises, and formative assessment materials in mere minutes); and ensure personalized learning (generating tasks calibrated to the cognitive profile, pace of learning, and specific educational gaps of an individual student or group of children); optimize professional time (freeing up the educator’s time from exhausting, mechanical, and routine tasks and redirecting it toward direct interaction with students, implementing project-based and social-emotional learning, and providing tutoring and psychological support to children) [39].

At the same time, the widespread adoption of generative AI tools in the educational process has brought to the fore critical ethical and security

challenges that directly impact the scope of a teacher's information and digital competence. A key issue is upholding academic integrity and combating covert plagiarism stemming from students' unchecked use of text generators for homework or research assignments. In light of this, the state strategy entails implementing sector-specific standards on liability for AI-generated plagiarism; this requires teachers to be able to critically verify information, instruct students on the ethics of interacting with AI, and incorporate reflective practices.

In their practice, educators must guide learners to clearly distinguish between work performed independently and ideas generated by AI, and – most importantly – to demonstrate how they have critically re-evaluated and verified the results produced by algorithms. This approach lays the foundation for an ethical perspective on collaborating with technology and fosters the development of research skills, creative autonomy, and logical thinking among adolescents.

The rapid intellectualization of the educational environment has necessitated the identification of a new, highly specialized component within the structure of a teacher's information-digital competence: artificial intelligence (AI) competence. A teacher's AI competence is defined as the ability to integrate AI technologies into professional practice – consciously, responsibly, ethically, and methodologically appropriately – for the purposes of designing learning materials, automating assessment, managing the educational process, and supporting students' individual learning trajectories. The works of I. Vorotnykova has become a key scientific reference point for research on this issue in postgraduate teacher education. The researcher established the conceptual framework for a teacher's AI competence, which encompasses four key domains of professional activity:

– the "Teacher's Professional Engagement" domain – reflects the educator's ability to use AI tools to establish transparent, effective interaction with all stakeholders in the educational process, optimize professional communication, and build a personal learning network for continuous self-development;

– "Instructional Design" domain – entails the ability to independently develop didactic methods, adaptive technologies, innovative integrated lessons, and formative assessment tools by integrating AI systems into subject-specific teaching methodologies;

– "Content Selection and AI Ethics" domain – encompasses the teacher's cognitive capacity to critically analyze and evaluate the quality, accessibility, and safety of AI-based educational resources, the ability to identify the technology's technical and sociocultural risks, and a deep understanding of the ethical standards governing interaction with intelligent assistants;

– the "Educational Competencies" domain defines an educator's readiness to purposefully develop a wide range of AI literacy skills in learners, foster critical thinking in children when using technologies, and prepare the younger generation for the demands of the future labor market [40].

To assess the actual state of readiness and educators' needs regarding the development of AI competence, staff from the Institute for Digitalization of Education of the NAES of Ukraine and Borys Grinchenko Kyiv Metropolitan University conducted a series of representative empirical studies between 2023 and 2025. The results of the teacher survey demonstrated the high relevance of this issue: 81.2% of the educators surveyed already use AI tools in their daily practice – primarily for lesson preparation, test development, and professional self-study – whereas only 18.8% do not use AI at all. At the same time, the vast majority of respondents expressed an urgent need for systematic scientific and methodological support, as well as for practice-oriented training sessions on integrating AI into instructional systems.

An in-depth study of the needs of 77 natural science and mathematics teachers revealed that 66.2% of the respondents possessed extensive teaching experience (over 20 years) yet demonstrated a high level of adaptability and professional mobility. More than 87% of the respondents rated their digital competence as above average and expressed full readiness for the digital transformation of instruction. 38% of educators see real potential for using AI in education. In comparison, only 12% believe the technology’s risks outweigh its benefits, and a mere 4% of respondents expressed a firmly negative attitude toward implementing AI. These findings convincingly demonstrate that today’s Ukrainian teachers possess the necessary basic digital literacy and a strong, conscious motivation to master AI tools; however, they require the development of clear, practical methodologies

and adaptive educational programs within the postgraduate teacher-training system [40].

A study by I. Vorotnykova and O. Zakhar (2025), which analyzed responses from 180 computer science teachers regarding their AI competence, revealed significant differences in the needs of computer science educators compared with other teachers. Computer science teachers demonstrate significantly higher technical readiness to use complex AI tools and work with code and neural networks; however, they identify a need to develop their understanding of the regulatory, ethical, and emotional contexts of AI usage [41]. The findings substantiate the advisability of engaging computer science teachers with a high level of AI competence to serve as tutors and mentors for peer learning, as well as establishing specialized regional AI hubs within postgraduate education institutions to coordinate educators' efforts.

Effectively implementing digital modernization of the educational process and putting teachers' AI competence into practice requires a clear systematization of existing AI-driven services, based on their utility for creating instructional materials and organizing the learning process. Based on a synthesis of theoretical research and practical experience with the piloting of AI technologies in domestic schools (works by V. Kovalenko [2024], P. Bielchev [2024], and I. Hrynko [2025]), it is proposed to classify modern educational AI services into seven key functional areas [42; 43; 44].

The systematized list of services (presented in Table 3) illustrates AI's didactic potential to modernize educational practice radically. A particularly significant role in the teaching of natural science and mathematics is played by the integration of computer vision and deep learning systems into GeoGebra or Wolfram Alpha, enabling students to explore complex spatial concepts through interactive simulations and real-time measurements. The use of modern virtual laboratories and simulation platforms (such as Labster, PhET Interactive Simulations, Algodoo, etc.), integrated with intelligent AI assistants and personalized tutors, is fundamentally transforming the methodology of STEM education. This synergy of digital tools enables high-quality, safe, and visually engaging experimental and inquiry-based learning in real time, even within fully remote or hybrid formats. Amid wartime threats, the need for sheltering during prolonged

air raid alerts, and regular power outages (blackouts), integrating virtual simulations with AI tools eliminates limitations caused by the absence or damage of physical equipment and facilities in school physics, chemistry, biology, and geography classrooms. Virtual laboratories enable every learner to safely model complex physicochemical processes, conduct interactive experiments, and test research hypotheses, regardless of external circumstances or their physical location.

An equally important methodological and deontological aspect of integrating generative artificial intelligence into the educational process is the purposeful instruction of students in the culture of prompt formulation (prompt engineering), alongside the consistent development of critical thinking and media literacy during interactions with AI agents. In this context, the educator plays a pivotal role, systematically demonstrating to learners that generative AI models are merely instrumental aids rather than absolute sources of truth.

Particular emphasis in training should be placed on understanding the specific operational nature of neural networks; due to the probabilistic nature of their data processing, they can make factual, logical, and calculation errors, as well as generate false facts or non-existent sources (so-called "AI hallucinations"). In this regard, teachers must instill in students a consistent habit of mandatory, multi-level verification (fact-checking) for every result obtained from AI by: cross-referencing answers with verified academic sources, textbooks, and scholarly publications; analyzing primary sources and verifying logical connections within generated texts or calculations; and conducting independent analysis and comparative evaluation of several alternative solutions.

Such a pedagogically sound approach lays a solid foundation for ethical, safe, and responsible engagement with cutting-edge technologies; it prevents the development of passive "intellectual consumerism" and academic dishonesty, while powerfully fostering the research skills, analytical competence, creative autonomy, and flexible critical thinking of today's adolescents.

Table 3

Systematized overview of AI services in educational practice

Area of AI service application	AI platforms and tools	Methodological possibilities in the educational process
Tools for working with text and developing lesson plans	ChatGPT, Gemini, Claude, Khanmigo	Generating lesson scripts; creating exercises and problems of varying complexity; summarizing sources; drafting texts; translating academic papers
Creation of presentations and mind maps	Gamma, Slidesgo, Canva, MagicSchool	Automatic creation of interactive slideshows, design selection, and generation of mind maps based on text prompts
Generation of visual objects and models	Midjourney, DALL·E, Google Teachable Machine	Visualization of complex abstract concepts, creation of unique educational images and diagrams, learning the fundamentals of machine learning
Solving complex problems, assessment	Photomath, GeoGebra, Wolfram Alpha, Socrative	step-by-step solution of math and physics problems, plotting 2D/3D graphs and functions, instant automated assessment of knowledge
Organizing game-based and quest-based learning	Kahoot!, Quizizz, LearningApps, Blooket	Creating interactive games and formative quizzes with gamification elements to boost learning motivation
Adaptive learning systems and platforms	Smart Sparrow, Century Tech	Analysis of student actions at every step; automatic adjustment of content difficulty to the teenager's cognitive profile
Virtual laboratories, simulators, STEAM projects	Labster, PhET, Nearpod, Desmos	Conducting complex and hazardous scientific experiments in a virtual environment during remote learning

Source: Compiled by the author based on a synthesis of academic and regulatory sources

The transformation of teachers' information and digital competence in basic and upper secondary schools cannot be achieved through sporadic, fragmented professional development courses based on reproductive models. It requires creating a holistic regional ecosystem for continuous professional development that flexibly integrates formal, non-formal, and informal teacher education throughout teachers' careers. The organizational and legal foundation for establishing such an ecosystem was the

implementation of the fundamental requirements of the Law of Ukraine "On Education" (2017), which introduced the concept of academic freedom into teachers' professional development. This model, actively implemented in Ukraine since 2020, has granted teachers the right to independently select educational service providers, training programs, and professional development formats based on their individual needs.

The strengthening of teachers' professional autonomy in 2026 was also facilitated by the piloting of the state initiative "Money Follows the Teacher" (MFTT). Under this mechanism, fixed-state funds are credited directly to educators' virtual accounts. Through the state digital platform "Vector" (https://vector.uied.gov.ua/uk/), they can independently select a professional development provider and register for a relevant program designed to build digital or AI competencies. This fostered healthy competition among education service providers and stimulated the development of unique, practice-oriented, and high-tech training programs for teachers.

Research conducted by the Department of Comparative Studies on Information and Educational Innovations at the Institute for Digitalization of Education of the NAES of Ukraine (under the supervision of O. Ovcharuk) regarding the development of teachers' ICT competence within a cloud-oriented learning environment has demonstrated the high effectiveness of using blended and hybrid (in-person and remote) professional development models. The implementation of content developed by the authors – covering modules on European best practices, cloud environment design, and the creation of electronic educational resources – has fostered sustained growth in educators' digital literacy. A significant role in this process is played by self-assessment tools – specifically, the MENTEP project's TET-SAT online test and the European DigCompEdu framework – which enable teachers to proactively identify their methodological gaps and design an individual professional growth trajectory [45].

A modern, innovative strategy in postgraduate education is the creation of flexible digital teacher micro-profiles based on the analysis of educational data (Learning Analytics). This technology integrates digital traces of a teacher's educational activities across various platforms (Moodle, Google Workspace, ePortfolio, "Mriya") into a unified, personalized academic profile for professional development, enabling proactive recommendations for individualized support and helping prevent teacher burnout. Combining

analytics tools, mentorship, and the development of a digital culture among the teaching staff creates a solid foundation for ensuring high-quality, continuous education amidst today's turbulent conditions.

A synthesis of the theoretical foundations and practical results regarding the transformation of educators' information-digital competence within the ecosystem of lifelong learning demonstrates that the digital transformation of education – amidst martial law and sociocultural challenges – serves as a key factor in ensuring the viability and quality of the domestic education system. An educator's information and digital competence (IDC) has evolved from the traditional mastery of a basic set of computer programs into a holistic, multifaceted personal-professional attribute (Component A3 of the 2024 Professional Standard). This attribute defines a teacher's readiness to operate amidst uncertainty and to fulfill the roles of facilitator, mentor, moderator, and designer of educational experiences.

It is worth noting that the use of AI systems (such as ChatGPT, Gemini, "Mriya," and "Diia.Osvita") enables the optimization of educational management, the personalization of student learning, and the bridging of competency gaps accumulated due to the crisis. The successful implementation of these tools requires educators to develop specialized AI competence, encompassing professional engagement, instructional design, evaluation of educational resources, and adherence to ethical standards and academic integrity.

Consequently, the development of a regional ecosystem for the continuous professional development of educators must be grounded in the principles of academic freedom, differentiation, and flexibility. Research findings and practical data from experimental implementation convincingly demonstrate the high effectiveness of synergistically combining professional development courses with horizontal, non-formal learning within regional and inter-regional professional networks. Such systemic interaction ensures the flexibility, continuity, and personalization of educators' lifelong professional development. The following systemic factors and institutional tools play a key role in ensuring this high level of effectiveness: the operation of the "Vector" national digital platform (a digital tool that facilitates the automated design of personalized professional development pathways for teachers, ensures transparent tracking of their professional achievements, and enables the rapid selection of relevant educational service providers

based on identified professional needs and gaps); implementation of the "money follows the teacher" funding mechanism (2026) (an economic and organizational mechanism that guarantees the teacher's academic and financial freedom, fosters healthy competition among professional development providers, and ensures the targeted allocation of public funds directly to meet the individual educational needs of each teacher); systematic use of international and national self-assessment tools (TET-SAT, DigCompEdu) (the implementation of specialized diagnostic methods enables educators to conduct an objective, regular, and independent reflective assessment of their own digital, methodological, and evaluative-analytical competencies, identifying specific areas for further growth); integration of modern educational analytics technologies (use of individual academic records, micro-profiles, and digital teacher portfolios) makes it possible to carry out continuous, precise monitoring of professional development, forecast the trajectory of competency development and timely adjust the content of postgraduate education based on objective data. Taken as a whole, this set of tools creates an adaptive, high-tech, and human-centric ecosystem model for continuous teacher education that responds flexibly to modern challenges and societal demands.

5. Conceptualization and Technological Toolkit for Developing a Teacher's Evaluative-Analytical Competence within the Lifelong Learning System

The modernization of Ukraine's national general secondary education system, within the framework of implementing the conceptual principles of the New Ukrainian School (NUS), necessitates a fundamental rethinking of the professional roles and functions of the modern teacher. 21st-century education is shifting from a reproductive, knowledge-based approach to a competence-oriented one; this entails developing transversal skills and critical thinking, as well as fostering learners' capacity to act independently and creatively in non-standard life situations. The profound transformation of modern educational priorities and the shift toward a human-centric learning paradigm are inevitably reshaping the requirements for a teacher's assessment practices. The traditional assessment model – which largely amounted to the mechanical assignment of grades based on the reproduction of information – is definitively giving way to formative, developmental,

diagnostic, and motivational assessment. This approach is designed to support and guide each learner's individual educational trajectory, create opportunities for success, alleviate psycho-emotional tension, and encourage students toward independent reflection, cognitive autonomy, and continuous self-improvement.

It is entirely logical that the process of purposefully developing a teacher's evaluative-analytical competence – which is becoming a key instrument for ensuring educational quality – has become a focal point for contemporary researchers, methodologists, and practitioners. In academic-pedagogical discourse, evaluative-analytical competence is interpreted as a complex, multifaceted personal-professional construct that integrates a holistic set of knowledge, skills, values, and reflective capabilities. This construct facilitates activity across two interconnected vectors. The objective-criterial dimension entails the development and application of transparent tools for the criterion-based assessment of students' academic achievements, developmental dynamics, and personal progress, grounded in principles of equality, academic integrity, and a culture of professional ethics. The analytical-predictive dimension entails conducting a deep, reflective analysis of the educational process's effectiveness and interpreting the resulting data (data-driven decision-making) to enable timely adjustments to methodological strategies, the remediation of learning losses and gaps, and the continuous adaptation and quality improvement of the educational environment.

A theoretical analysis of the essence of an educator's evaluative-analytical competence reveals the absence of a unified approach to interpreting this concept within both domestic and international scholarly discourse. For a long time, researchers examined teachers' evaluative and analytical competencies in a fragmented and autonomous manner. Evaluative competence was distinguished as an independent, integrative personal quality, combining a system of knowledge, skills, value orientations, and motives related to pedagogical activity in the realm of measuring and recording learners' academic achievements. In particular, S. Pokrova defines a teacher’s assessment competence as a complex, integrative quality manifested in the systematic, timely, objective, effective, and methodologically sound measurement of student learning outcomes – based on specific subject competencies and aligned with concrete goals

and individual student characteristics while fulfilling the motivating, formative, developmental, diagnostic, and educational functions of assessment [46, p. 61; 47, p. 192].

In turn, a teacher's analytical competence was most often viewed as an ancillary or supporting tool for other activities (such as information-analytical or project-analytical work). It was virtually absent as a distinct item in lists of professional competencies prior to 2020. However, analytical competence offers far greater potential and serves as the core of an educator's professional self-improvement. L. Polovenko defines analytical competence as the ability to conduct a systemic analysis of a specific activity or process in order to address a range of professional tasks using various methodologies and automation tools. This competence is indispensable amidst rapid, unstable, and unexpected changes driven by contemporary societal fluctuations and crises – such as martial law, blackouts, and forced remote learning – as it enables educators to quickly seek solutions based on available, accessible, and reliable information and facts, thereby making optimal decisions "here and now" [48, pp. 256–258].

T. Koicheva and Wang Xiaogang view analytical competence as a specific type of evaluative-analytical competence. The scholars demonstrate the heterogeneous and integrative-cumulative nature of its components and identify three levels of its manifestation: cognitive (theoretical), activity-behavioral (practical), and motivational-value (personal).

In examining the structure of an educator's analytical activity, the authors identify the following complex professional skills: accurately diagnosing a pedagogical phenomenon or situation using logical methods; breaking down pedagogical phenomena into their constituent parts (causes, conditions, motives, forms of manifestation); conceptualizing each component in relation to and in interdependence with the whole; isolating a significant pedagogical problem and determining optimal solutions while accounting for risks; and evaluating, synthesizing, and interpreting the obtained results [49, p. 128].

The essential basis of a specialist's analytical competence – which defines its specific nature within the context of professional functions – consists of a complex of personal intentions and capabilities. In particular, its characteristic features manifest in the individual's ability to fully utilize their own resource and potential base (knowledge, skills, experience,

and personal qualities) and to successfully adapt to the demands of the analytical environment by internalizing its values. Key components of this construct include the ability to conduct a logical-methodological analysis and systematize the source base, to organize disparate data into systematic conceptual-logical and spatio-temporal relationships, and to appropriately reflect on and evaluate pedagogical phenomena, thereby making well-considered managerial-pedagogical decisions.

The integration of evaluative and analytical components into a unified, holistic construct is driven by the evolution of assessment methodologies; these are grounded not merely in recording scores but in a deep analysis of why students' learning outcomes deviate from planned targets, coupled with the immediate adjustment of the educational process. In her research, O. Shunevych notes that even when interpreting a teacher's purely evaluative competence, analytical components inevitably arise – such as the readiness to analyze the consequences of one's own pedagogical influence and to adjust teaching methods to ensure student progress [46, pp. 60–61].

Based on a theoretical-methodological analysis, S. Mykhailenko proposes a refined definition of a teacher's evaluative-analytical competence as the ability to objectively determine students' academic achievement levels in accordance with specific goals and criteria, analyze student learning outcomes and the consequences of one's own pedagogical practice, facilitate self-assessment and peer assessment of student learning outcomes, and analyze options for addressing professional tasks using various technologies and methodologies. This competence is characterized by consistency, systematicity, objectivity, and continuous feedback; it functions not as a separate, isolated element, but as an integral part of the overall mechanism for ensuring the quality of the educational process. A high level of this competence enables the organization of evidence-based pedagogical activity, drawing on an analysis of scientific and methodological literature as well as specific real-life and problematic pedagogical situations [46, pp. 60–61].

The significance of a teacher’s evaluative and analytical activities was recognized at the state level with the approval of the Professional Standard for Teachers in 2020, which designated this competence as a mandatory professional attribute for educators [8]. However, rapid transformations in Ukraine’s educational landscape, the digitalization of learning, and the

challenges posed by martial law have necessitated a systematic review and modernization of the standard. In the 2024 updated professional standard "Teacher of a General Secondary Education Institution," the requirements for the teacher's professional profile were significantly revised and expanded [9].

The first and most notable change in the updated standard was the renaming of the work function encompassing evaluative and analytical activities. While the 2020 standard classified it under the occupational function of "Managing the Educational Process," which carried certain overtones of control and administration, the 2024 revision renamed this function "Conducting the Educational Process." This shift in terminology clearly directs the teacher toward the active, hands-on nature of implementing the educational process, where assessment and analysis serve as tools to facilitate learning and support individual student progress, rather than as instruments of bureaucratic management [8; 9].

Within the scope of the "Conducting the educational process" professional function, a triad of interconnected professional competencies has been retained: prognostic, organizational, and evaluative-analytical. The content of the evaluative-analytical competency is detailed through three professional capabilities (competencies):

– The ability to assess students' learning outcomes (G3.1), which entails the teacher possessing sound knowledge of assessment types (formative, ongoing, summative), assessment forms (oral, written, digital, graphic, practical), and assessment criteria and scales. A teacher must be able to select assessment methods and scales aligned with the lesson objective, adhere to legally established criteria or collaboratively develop them with students, create their own assessment tasks and tests, and record and document student learning outcomes.

– Ability to analyze students' learning outcomes (G3.2). This ability entails mastering methods and techniques for analyzing and reflecting on students' learning activities, identifying the reasons for academic success or learning difficulties, and analyzing common errors. Its practical implementation aims to foster in students the skills of self-motivation, conscious analysis of their activities, and reflection on their own results.

– The ability to develop students' capacity for self-assessment and peer assessment of learning outcomes (G3.3). This requires the teacher to be

proficient in the methods and techniques of student self-assessment and peer assessment, and to create a safe, conflict-free environment for interaction and for teaching students how to provide constructive feedback.

A fundamental innovation of the 2024 Professional Standard is the expansion of the internal structure of each competency in accordance with the National Qualifications Framework. While the description of a competency was previously limited to the traditional triad of "knowledge, abilities, and skills," two entirely new and critically important components have now been added to the structure:

– Communication. This descriptor defines the teacher's ability to competently explain the role of assessment in learning progress to all participants in the educational process (students, parents, and colleagues), to transparently explain the criteria for assessing learning outcomes, and to involve students and parents in the collaborative planning of future individual educational pathways. This requires a high level of empathy, transparency, and the ability to engage in constructive professional dialogue.

– Responsibility and autonomy. This descriptor describes the degree of a teacher's independence in developing and applying assessment tools, their capacity to take responsibility for the objectivity, fairness, impartiality, and integrity of the assessment of student learning outcomes, as well as their readiness to share responsibility with students and their parents regarding the learner's further progress. Autonomy grants teachers the right to develop their own assessment scales and select flexible methodologies, while simultaneously demanding a high level of professional self-discipline and adherence to the principles of academic integrity.

A key feature of the updated Professional Standard for Teachers is the integration of evaluative-analytical competence with information-digital competence (specifically, capability A3.3 – "the ability to use digital technologies in the educational process"). According to the standard, a modern teacher must possess the skills to operate in an electronic educational environment, using it not only for lesson organization but also for conducting assessments and performing flexible, automated analysis of results. The ability to collect, structure, and process large volumes of educational data in digital format is becoming a mandatory requirement for teachers, enabling them to move away from intuitive assessment and engage in evidence-based pedagogical design. This integrated approach reflects the

modern European DigCompEdu framework, in which educators' digital and analytical skills are viewed as a single, interconnected whole.

A sociological study on the implementation of the professional standard in Ukraine, conducted by the Ukrainian Institute for Educational Development (UIED) and the State Service of Education Quality (SSEQ), revealed a strong practical demand for developing evaluative and analytical skills. In particular, 9.4% of the surveyed teachers identified evaluative-analytical competence as an area requiring significant further elaboration of its definition, leading to the conclusion that methodological support is needed during professional development [50, p. 33]. Teachers face the greatest challenges not in the technical recording of assessment scores, but rather in the analytical work involving the data obtained: the in-depth interpretation of results, the identification of the causes of learning difficulties, and the design of individual educational pathways for students based on these insights. More than 65.9% of school administrators and methodologists highlighted an urgent need to develop clear diagnostic tools for measuring students' competence development, as well as criteria for evaluating and analyzing teachers' own performance.

Modernizing the assessment system in Ukraine requires moving away from an authoritarian teaching style and from assigning grades merely as a means of punishment or incentive. Assessing learners' competencies is, by its very nature, a far more complex, profound, and multidimensional process than the traditional testing and monitoring of the mastery of reproductive knowledge and skills. This is because competence, as a holistic personal construct, encompasses not only the cognitive sphere (knowledge and understanding) but also action-oriented components, emotional-value attitudes, intrinsic motivation, ethical guidelines, and the child's unique individual experience. It becomes impossible to evaluate such integrated entities using traditional formalized tests or standard assessments, as this requires teachers to employ new, flexible tools for formative and criterion-referenced assessment. In this context, the value-based, moral-ethical, and humanistic dimension of pedagogical activity assumes exceptional importance and fundamental significance. It serves as a safeguard against subjectivity, bias, formalism, and psychological pressure on the child during assessment procedures. The study and theoretical-methodological substantiation of these normative-ethical imperatives are the focus of

a relatively young yet highly relevant field of scientific knowledge: pedagogical deontology. It defines the professional duty, norms of conduct, moral obligations, and responsibilities of the educator in their interactions with all participants in the educational process.

In her research, T. Smahina substantiates the presence and role of the deontological component within an educator's evaluative-analytical competence. The researcher demonstrates that the motivational-value (personal) component of this competence clearly reveals the teacher's individual moral and ethical traits and acts as a "trigger" for fair, ethical, and motivating assessment. Evaluative activity is inevitably accompanied by situations requiring moral choice, where the teacher faces the challenge of maintaining objectivity while avoiding subjectivity, discrimination, and bias [51, p. 199].

Incorporating a deontological approach into a teacher's assessment and analytical activities entails strict adherence to the following fundamental principles:

– academic integrity and objectivity; ensuring that assessment criteria are transparent, clear, and impartial for every learner, regardless of their personal qualities or prior achievements;

– respect for the child's dignity (human-centric approach): viewing assessment not as a punitive or controlling tool, but as a form of psychological and pedagogical support that tracks personal progress and individual developmental dynamics without comparison to other students;

– ethics of evaluative judgment: maintaining the confidentiality of results and providing constructive, non-confrontational feedback that fosters a sense of success, alleviates school-related anxiety, and motivates self-improvement;

– professional-ethical reflection: the educator's continuous self-analysis of their own evaluative actions aimed at preventing discrimination, bias, or the emotional exhaustion of students.

By drawing upon a developed sense of professional ethics, the teacher fosters a classroom atmosphere where students feel safe making mistakes, expressing unconventional views, and experimenting – understanding that errors are a natural part of the learning process rather than grounds for punishment. From an ethical standpoint, assessment aims to help the learner feel valued, build self-confidence, and cultivate a lasting motivation to learn.

The practical application of evaluative-analytical competence in a teacher's daily work requires mastery of modern technological tools, the core of which is formative assessment technology. Formative assessment is defined as assessment for learning, aimed at tracking the learner's development, providing constructive feedback, and making timely adjustments to the educational process [47].

Formative assessment, as a leading pedagogical approach in the modern educational process, constitutes a holistic, systematic framework focused on the child's personal development. It is designed not merely to gauge current knowledge levels but to continuously support, adjust, and stimulate the learner's educational progress. The basic, fundamentally important, and integral components of the formative assessment approach include:

– formulation of transparent, specific, and relevant learning objectives: operationalizing expected outcomes at each stage of the educational interaction, which entails breaking them down and communicating them to students in language they understand. An effective methodological tool for this is the application of the SMART goal-setting framework (Specific, Measurable, Achievable, Relevant, Time-bound), which enables students to clearly understand the direction of their activities and the criteria for success;

– providing and receiving constructive, dialogue-based feedback: a systematic exchange of timely, detailed information (in written, oral, or digital form) between the educator and learners. The primary ethical imperative of such feedback is the fundamental rejection of criticizing or evaluating the child’s personality; instead, the focus is placed on analyzing specific learning achievements, identifying the causes of errors, and collaboratively determining clear steps to overcome them and foster further development;

– creating a facilitative environment for self-assessment and peer assessment: designing pedagogical conditions under which learners transform from passive objects of evaluation into active agents of their own learning. The systematic use of reflective techniques, checklists, and rubrics enables adolescents to critically analyze their own results, compare them against a standard, evaluate their classmates' contributions, and develop agency, cognitive autonomy, and responsibility for their own educational outcomes;

– prompt, adaptive adjustment of the educational process (data-driven instruction): the teacher's flexible modification of teaching methods, techniques, pacing, and tools – directly during instruction – based on a systematic analysis of real-time data regarding each student's progress. This enables timely mitigation of learning losses, differentiated tasks, and the design of individual development pathways, allowing every learner to achieve the best possible personal outcome [52].

The effective implementation of formative assessment requires a high level of professional expertise from the modern teacher, as well as command of a broad and diverse range of didactic methods and techniques. In the teacher's practice, traditional approaches evolve into a flexible system of diagnostic tools. It is advisable to employ multifaceted oral and written assessment techniques – such as open-ended questions, reflective dialogues, targeted test items, and interactive discussions – that aim to gauge the depth of understanding rather than merely test the rote reproduction of facts. Tools for self-monitoring and reflective self-assessment are effective; systematically engaging learners in self-assessment charts, "sentence completion" techniques, reflective essays, and progress checklists based on specific criteria fosters student autonomy and evaluative thinking. It is also advisable to employ the learning achievement portfolio approach – gathering and organizing individual educational outputs (such as projects, creative works, and research) to track the child's personal growth over an extended period. Gamified and project-based forms of assessment are effective; these include game mechanics, situational case studies, and team research projects, which enable a comprehensive evaluation of key competencies in real-world settings.

An educator's electronic methodological portfolio serves as a vital tool for professional self-reflection, methodological self-analysis, and the validation of their qualification level. It serves as a digital space for systematizing and verifying original assessment criteria, diagnostic materials, sample tests, analytical reports on student performance trends, and reflective notes from piloting new pedagogical technologies. The current stage of the development of the educational environment is characterized by large-scale, profound digitalization, which imposes qualitatively new demands on the teacher's professional profile. Under these conditions, information-digital and assessment-analytical competencies enter into a deep systemic synergy,

forming an integrated construct of the educator's digital analytical literacy.

A new-generation educator must be proficient in using innovative digital tools – such as Google Forms, Quizlet, Kahoot, Moodle, and the built-in learning analytics modules of modern LMS platforms – to rapidly collect raw performance data, conduct automated formative assessments, and visualize results. These digital tools enable the accumulation of data sets that allow teachers to build individual predictive models of students' competency development and identify potential learning losses at an early stage.

The practical application of digital educational analytics tools offers a range of strategic advantages:

– optimization of time resources, involving the minimization of bureaucratic and routine manual tasks related to grading and record-keeping, thereby freeing up time for direct, creative interaction with students;

– increased measurement objectivity, which eliminates the subjective factor in knowledge assessment through transparent, automated evaluation algorithms;

– implementation of the Data-Driven Decision Making concept, facilitating a shift from intuitive to objectively grounded pedagogical design, where every methodological decision is based on a precise analysis of educational analytics;

– ensuring learning adaptability through the flexible and timely adjustment of educational content, pacing, and teaching methods in accordance with the specific needs and learning profile of each learner.

From a methodological perspective, digital educational analytics tools serve as a powerful catalyst for optimizing the educational process, enabling the automated and highly efficient execution of a wide range of key pedagogical functions. Integrating digital analytical systems into teaching practice enables a qualitative transformation of assessment activities by facilitating key functions – specifically the diagnostic function. This function ensures the prompt, objective, and comprehensive identification of the current level of mastery of learning material and the measurement of students' subject-specific and key competencies, as well as the early detection of individual or group knowledge gaps. The corrective-predictive function also transforms, enabling the educator to instantly adapt methodological tools, adjust the pace and complexity of content, and design personalized

pathways to address identified learning gaps based on precise analytical data. The managerial (adaptive-didactic) function optimizes the process of pedagogical decision-making (data-driven decision-making), transforming teaching from an intuitive process into an objectively managed system in which every step is grounded in precise monitoring of learning outcomes.

The use of specialized online platforms enables rapid, objective, and multidimensional assessment of student competencies without imposing significant time or resource burdens on the teacher. This frees up a substantial amount of the educator's time for direct interaction with students – specifically regarding guidance, facilitation, and educational support.

A prime example of the practical implementation of this functionality is Classtime. This innovative domestic interactive platform provides teachers with an advanced toolkit for computer-based testing, featuring instant visualization and result processing. By automatically recording and organizing responses, the system eliminates subjectivity in the grading process, automatically identifies common errors and topics that are difficult to master, and generates detailed analytical reports for both individual students and the class as a whole.

A significant advantage of the Classtime platform for remote and blended learning is its "anti-cheating" functionality (randomization of questions and answer choices, time limits, tracking of browser tab switching, etc.). This serves as a crucial technological asset for upholding academic integrity standards and verifying that students complete their work independently. Furthermore, Classtime holds significant potential as a tool for formative assessment, thanks to the integration of pedagogical commentary and the ability to add custom hints, explanations, and official clarifications to each test item. A key advantage of the platform is its provision of instant feedback – displaying the correct answer and the solution process immediately after a task is completed – which encourages students to engage in immediate reflection. Using the platform fosters reflective autonomy by creating an environment in which students independently analyze their errors, understand the reasons behind them, and adjust their learning paths based on self-monitoring and self-improvement [53].

In the context of the digitalization of the educational process, the Google Forms web service plays a significant role by facilitating automated data

collection, preliminary mathematical and statistical processing, and data visualization through clear graphical models and charts. The platform's functionality enables the export of verified datasets to spreadsheet software (such as MS Excel) and documents in PDF format for subsequent comparative, retrospective, and predictive analysis. The multimedia service Wordwall is an effective tool for implementing interactive, gamified assessments. Its educational potential encompasses the creation of adaptive learning tasks – such as quizzes, crosswords, flashcards, and classification exercises – and the integration of specialized text-to-speech modules, a feature crucial to ensuring educational inclusivity and accessibility for individuals with special educational needs. In addition, the LearningApps platform ensures a high level of interactivity, enabling various forms of cognitive-exploratory interaction (such as "Find a Pair" matching exercises, categorical "Classification," and "Fill in the Blanks" for context restoration). This facilitates the practical application of the principle of immediate feedback, fosters learner autonomy, and stimulates the students' intrinsic motivation.

The systematic integration of these digital resources into a teacher's methodological practice lays the foundation for creating an electronic portfolio of students' educational achievements. It enables the monitoring of the longitudinal development of competencies and facilitates informed management and pedagogical decisions based on objective analytical data (data-driven decision-making).

The formation and development of a teacher's evaluative-analytical competence constitutes a complex, multifaceted, and multidimensional process oriented toward continuous professional and personal growth. This developmental trajectory encompasses the stage of fundamental professional training in higher education institutions and extends continuously throughout the teacher's career within the systems of postgraduate and non-formal education. An analysis of higher education standards (specifically for specialty 013 "Primary Education" and subject-specific specializations within field 01 "Education/Pedagogy," specifically the "Secondary Education" track) and the corresponding educational-professional programs at the first (Bachelor's) level has revealed a significant imbalance in content. Regulatory documents and educational programs highlight, above all, the monitoring and assessment component (specifically, special competence

SC-9, which mandates the ability to implement various forms of assessment activities based on a competence-oriented approach). In contrast, the analytical component is addressed only in a fragmentary manner and lacks sufficient systematicity. The vast majority of educational programs focus on students mastering the normative and criterion-based aspects of measuring academic achievement; however, they fail to provide the necessary conditions for developing the ability to process large educational datasets using computer-mediated methods (educational data mining), identify the causal determinants of educational losses, and design predictive-corrective pathways based on educational analytics [46].

To address the identified content gap in higher and postgraduate pedagogical education institutions, it is necessary to implement innovative teaching strategies to develop an educator's analytical culture and research-oriented reflection systematically. Based on a synthesis of domestic and European educational practices, the following effective methodological approaches have been identified:

– The case-study method and video-case technologies. Research by S. Mykhailenko, V. Kryzhanovska, and N. Maier demonstrates the value of the case-study method as a key didactic resource for developing evaluative-analytical competence. Systemic analysis and situational modeling of real or video-recorded segments of the educational process enable higher education students and practicing educators to evaluate the dynamics of instructional interaction from multiple perspectives (synchronizing the subjective stances of both teacher and students), identify subjective distortions in assessment and measurement activities, and formulate well-founded corrective-methodological solutions [46; 48].

– Professional communities of practice and peer mentoring groups. Research findings by B. Andresen, as well as the representative experience of the Finnish education system, demonstrate the high effectiveness of school-based and regional networked communities of practice. Collaboration among educators within peer mentoring and reflective discussion groups enables the collegial analysis of professional challenges, the joint development and verification of criteria for assessing learning achievements, and the systematic interpretation of students' educational outcomes. This facilitates the formation of a unified professional thesaurus base (a shared conceptual language) and the effective transfer of practical experience [54].

– Problem-Based Learning (PBL) and research-oriented learning. Implementing applied research projects using the Action Research methodology directly within the local educational environment enables educators to conduct a systematic analysis of pedagogical phenomena and processes. Adopting this approach facilitates a shift from making methodological decisions based on intuition and emotion to evidence-based pedagogical practice grounded in objective analytical data and empirical verification [48].

To ensure a managed process of self-development and professional growth for educators, Yu. Vakal and V. Stoma substantiate the advisability of implementing a specialized, task-based approach that simulates the professional's actual information-analytical work. These didactic constructs are categorized based on the level of cognitive complexity and the degree of learner autonomy. Reproductive-type tasks are oriented toward the algorithmic reproduction of a sequence of actions based on a provided model and the recall of previously mastered didactic material (specifically, designing survey tools for a specific topic, generating a QR code, and performing the initial export of data sets to the Excel spreadsheet processor). Analytic-synthetic tasks aim to select and flexibly apply an optimal algorithm – chosen from among known models for resolving problem situations – to develop a teacher's professionally oriented computer technology skills (for example, solving complex educational tasks using a diverse range of digital tools). Inquiry-based problem-solving tasks require a heuristic search for a solution method within traditional pedagogical contexts – in the absence of a strictly determined algorithm – thereby stimulating learner initiative and intrinsic cognitive motivation while enabling the conscious transfer of knowledge (such as solving mathematical models in interactive dynamic mathematics environments). Research tasks are oriented toward the inverse application of generalized theoretical knowledge in non-standard (ill-defined) conditions, where only the general direction of the inquiry is specified – without indicating specific instrumental methods for its implementation (such as designing an extended lesson plan that synergistically incorporates mobile technologies, digital educational resources, or social networks) [55].

Auxiliary technological tools for facilitating reflective support include analytical self-assessment journals, reflective portfolios (including digital and online versions), self-diagnosis charts, and checklists, all of which

serve as standardized instruments for assessment and self-development. Implementing these tools enables the formalization and standardization of procedures for analyzing educational phenomena while simultaneously preserving their heuristic and research-oriented nature. The systematic implementation of these tools directs the educator toward critical reflection and conceptualization of their methodological decisions, facilitates the identification of the causes of professional challenges and gaps, and enables the design of an individual trajectory for continuous professional self-development. This ensures the high-quality conceptualization of accumulated practical experience and its transformation into conscious, evidence-based theoretical-methodological knowledge grounded in pedagogy.

An institutionally significant stage in the system of a teacher's continuous professional development is the independent assessment of professional competencies within the framework of the pedagogical staff certification procedure, administered by the State Service of Education Quality (SSEQ). The conceptual foundation of this certification rests on the principle of "peer assessment" (or "teacher assessing teacher") – a collaborative approach that ensures a high level of trust and collegial objectivity. The certification procedure follows a three-stage structure, in which internal self-assessment of pedagogical mastery and external expert evaluation of practical experience – conducted through direct observation of lessons – play pivotal, foundational roles. This format of evaluative interaction encourages the educator to retrospectively analyze their own methodological practice and identify professional shortcomings and gaps, while also stimulating intrinsic motivation to enhance evaluative-analytical and reflective competencies systematically [56].

The adaptation of educators to the updated framework requirements and competency descriptors in the 2024 Professional Standard for Teachers has created a need for innovative diagnostic and corrective support. To this end, researchers and methodologists at the Ukrainian Institute for Educational Development (UIED) designed and implemented a specialized methodological toolkit compiled in the collection "Teacher Upgrade: Self-Assessment of Professional Practice". The applied and scientific-methodological potential of this complex is realized through an extensive system of standardized questionnaires, self-assessment tools, and a series

of problem-based case studies designed to foster the educator's reflective, critical analysis of their own evaluative-analytical, digital, prognostic, and deontological competencies. The systematic implementation of this diagnostic resource enables participants in the educational process to conduct a comprehensive and objective self-assessment of their professional achievements and students' learning outcomes; critically reflect on challenges encountered in teaching practice; determine strategic goals for their professional growth based on a sound rationale; and design and flexibly adjust a personal trajectory of lifelong learning and self-improvement [57].

To summarize, it should be emphasized that the purposeful and systematic development of an educator's evaluative-analytical competence within the integrated ecosystem of continuous teacher education is a fundamental determinant of the successful implementation and subsequent conceptual and substantive transformation of the principles underpinning the "New Ukrainian School" reform. The successful accomplishment of this task is possible only if educators attain a high level of analytical culture, cognitive flexibility, and reflective autonomy, and achieve proficiency with cutting-edge digital tools (specifically, simulation platforms, virtual laboratories, and AI-powered assistants). The synergy of these factors, together with clearly defined deontological guidelines and axiological values, creates a solid foundation for ensuring the high quality of the educational process and aligning it with European and global educational standards. The established evaluative-analytical framework of pedagogical activity ceases to be merely a technical tool for measuring academic achievement; it transforms into a primary mechanism for designing a modern educational environment. This enables the effective development of key 21st-century competencies in learners – such as a high level of agency, academic autonomy, critical thinking, and deep self-reflection – thereby preparing them for constructive, adaptive, and safe living and self-realization within a highly dynamic, digital information society.

CONCLUSIONS

A comprehensive theoretical-methodological and applied analysis of the transformation of an educator's professional competencies within the ecosystem of lifelong education enables the formulation of the following generalized conclusions:

1. Philosophical-pedagogical and conceptual foundations of an educator's continuous development. The personal and professional formation and self-improvement of a teacher are interpreted as a continuous, dynamic, and staged, long-term process that unfolds sequentially across three interconnected stages: pre-professional, basic professional (in higher education institutions), and postgraduate (lifelong). The pre-professional stage serves as the initial phase of orientation and professional self-determination, during which the foundation of agency is established and value-based orientations – along with an initial interest in the teaching profession – are cultivated through interactive, project-based technologies. The university (foundational) stage ensures fundamental professional training and the definitive formation of professional identity during the student years (ages 18–23) – a period highly sensitive to socialization and cognitive maturation – by integrating theoretical knowledge, basic analytical skills, and initial practical experience. The postgraduate stage operates within the lifelong learning paradigm as a flexible and adaptive system designed to prevent professional deterioration, emotional burnout, and adaptive regression in educators, while fostering their acmeological growth, professional reflection, and continuous self-development through engagement in supervision, coaching, networking, and subject-to-subject collaboration within professional communities.

2. Reconceptualizing subject-methodological competence (A2) in the context of contemporary educational transformations. Amid the consistent implementation of the "New Ukrainian School" reform principles and the UN Global Sustainable Development Goals (specifically Goal 4: "Quality Education"), the essence of subject-methodological competence has undergone a qualitative transformation – shifting from a traditional accumulation of narrow subject-specific knowledge to a complex, multidimensional, and integrated professional-personal construct. The effective development of this competence is driven by three systemic vectors: the implementation of an integrative strategy – shifting from disciplinary fragmentation to interdisciplinary and transdisciplinary learning; the institutionalization of mentorship and partnership – fostering subject-to-subject interaction and collegial support; and the comprehensive digitalization of the educational environment – the active adoption of high-tech tools and digital educational resources. A scientifically grounded

algorithm for designing an integrated educational product is an effective, practical mechanism for fostering a holistic, scientifically sound worldview among learners. At the same time, regional educational networks function as an adaptive, synergistic platform for horizontal, informal learning and the continuous professional self-improvement of educators.

3. Emotional-ethical competence (B2) as a fundamental resource for an educator's resilience and professional practice. The prolonged operation of the education system amidst constant challenges, crises, and martial law necessitates prioritizing emotional-ethical competence as the core of a teacher's professional resilience, psycho-emotional self-regulation, and adaptability. Implementing the methodological principles of Social, Emotional, and Ethical Learning (specifically SEE Learning programs and SEL Kernels practical modules) across three interconnected levels – personal (self-awareness and self-regulation), social (empathy and communication), and systemic (understanding the broader sociocultural context) – ensures the organic and effective integration of "soft skills" into the educational process without artificially overloading the curriculum. Representative empirical data from the PISA 2022 international study on the quality of education demonstrate a direct correlation between a teacher's high level of emotional resilience, empathy, and growth mindset and the effectiveness of addressing learning losses, mitigating psychological trauma, and fostering the dynamic development of students' creative and critical thinking.

4. Information-digital and AI competence (A3) in the context of recent technological transformations. An educator's information and digital competence has evolved from basic computer literacy to a multidimensional, complex construct that is fully aligned with the European Framework for the Digital Competence of Educators (DigCompEdu). The rapid integration of innovative artificial intelligence technologies (specifically generative language models, simulation platforms, and domestic national educational ecosystems such as "Mriya" and "Diia.Osvita") drives the conceptualization and delineation of AI competence across four interconnected domains: professional engagement – the use of AI tools for professional interaction and self-development; and instructional design – the creation of adaptive educational scenarios involving intelligent systems; content selection, validation, and ethics – critical assessment of source data, mitigation of algorithmic hallucinations, and ensuring ethical AI use; teaching and

analytical competencies – facilitation of the educational process, automation of formative assessment, and personalization of learning. Systematizing and classifying modern AI services by functional area significantly optimizes educational management, frees up educators' time, and enhances the quality of didactic materials – provided there is strict adherence to principles of academic integrity, critical analysis of generated data, and the development of a high standard of prompt engineering.

5. Deontological and activity-reflective dimensions of evaluative-analytical competence (C3). Updates to the regulatory framework and competence descriptors of the 2024 Professional Standard for Teachers have led to a significant shift in the focus of this competence toward the direct "implementation and facilitation of the educational process." This underscores the priority of its supportive, formative, diagnostic-corrective, and motivational functions over traditional, subjective, and punitive-administrative forms of control. Modern evaluative-analytical competence emerges as a holistic construct integrating specialized knowledge, subject-specific analytical skills, and effective communication, alongside the educator's high level of professional autonomy and personal responsibility. The consistent incorporation of a deontological (ethical-moral) component ensures impartiality, transparency, adherence to criteria, and fairness in assessment, transforming it from a mere formal recording of results into a powerful tool for profound self-reflection, motivation, and the progressive personal and professional growth of all participants in the educational process.

6. System integration and institutional mechanisms: the successful transformation of educators' professional competencies relies on new institutional mechanisms (2020–2026), specifically the academic freedom to choose professional development providers, the national digital platform "Vector," and the "money follows the teacher" model. Combining professional development with informal network communities, learning analytics, and micro-profiling creates a resilient, adaptive regional ecosystem that ensures educational quality amid modern societal challenges.

The development of a comprehensive qualitative model and diagnostic tools to monitor AI competence levels among educators in the postgraduate education system requires further scientific and applied research. Promising avenues include the theoretical substantiation and experimental validation of

adaptive models for teacher professional development based on the "money follows the teacher" mechanism. The development of long-term programs for mental well-being, resilience maintenance, and the prevention of professional burnout among educators during Ukraine's post-war recovery requires dedicated study, as does the pedagogical design of methods to integrate generative AI tools for automating formative assessment and analyzing learners' academic achievements.

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