

THE MODERN MODEL OF TRAINING SPECIALISTS IN GEODESY AND LAND SURVEYING FOR TERRITORY PLANNING

СУЧАСНА МОДЕЛЬ ПІДГОТОВКИ ФАХІВЦІВ ІЗ ГЕОДЕЗІЇ ТА ЗЕМЛЕУСТРОЮ ДО ПЛАНУВАННЯ ТЕРИТОРІЙ

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The article is dedicated to reevaluating the priority directions of higher education development with the aim of creating an effective model for the professional training of specialists in the field of geodesy and land surveying. Given the increasing demands for highly qualified professionals capable of undertaking tasks related to territory planning, the authors analyze the relevance and necessity of modernizing educational programs. The research results are aimed at improving the quality of training in the field of geodesy and land surveying, as well as adapting educational programs to contemporary challenges in this area. The article highlights crucial aspects and prospects of higher education development in geodesy and land surveying, aiming to ensure the efficient preparation of professionals who can meet the current demands of the job market. With the growing needs for highly skilled specialists, the primary focus of the authors is on rethinking priorities in higher education and modernizing educational programs. The authors of the article analyze the relevance and necessity of adapting educational programs to contemporary challenges in geodesy and land surveying, particularly in light of increasing demands for professionals in territorial planning. They emphasize that the success of graduates in the job market is determined not only by deep theoretical knowledge but also by their practical application in real-world conditions. The article covers key aspects such as optimizing the step-by-step training process, developing innovative pedagogical technologies, and providing a scientific rationale for the mechanisms of their implementation. It specifically draws attention to the importance of introducing innovative pedagogical methods that foster active interaction between theoretical knowledge and practical skills. The authors identify three criteria for the formation of professional competence in future specialists: motivational-value, cognitive, and activity-based. These criteria aim not only to convey theoretical knowledge but also to instill motivation for professional development, foster critical thinking, and develop the ability to engage in effective practical activities. The research results presented in the article aim to enhance the quality of training for professionals in geodesy and land surveying, facilitate their successful integration into the job market, and adapt educational programs to contemporary challenges in this field.

Key words: professional education, professional training, geodesy and land management, territorial planning, professional competences.

Стаття присвячена переосмисленню пріоритетних напрямків розвитку вищої освіти

з метою створення ефективної моделі професійної підготовки фахівців у галузі геодезії та землеустрою. У зв'язку із зростанням вимог до висококваліфікованих спеціалістів, здатних виконувати завдання з планування території, автори аналізують актуальність та необхідність модернізації освітніх програм. Результати дослідження спрямовані на покращення якості підготовки фахівців у галузі геодезії та землеустрою, а також на адаптацію освітніх програм до сучасних викликів у цій області. Стаття висвітлює важливі аспекти та перспективи розвитку вищої освіти в галузі геодезії та землеустрою, покликани забезпечити ефективну підготовку фахівців, які зможуть відповідати сучасним вимогам ринку праці. Враховуючи зростання потреб у висококваліфікованих спеціалістах, основна увага авторів зосереджена на переосмисленні пріоритетів у вищій освіті та модернізації освітніх програм. Автори статті аналізують актуальність та необхідність адаптації освітніх програм до сучасних викликів у галузі геодезії та землеустрою, зокрема, з огляду на зростання вимог до фахівців у сфері планування території. Вони підкреслюють, що успішність випускників на ринку праці визначається не лише глибокими теоретичними знаннями, але й їхнім практичним застосуванням в реальних умовах. У статті висвітлено ключові аспекти, такі як оптимізація ступеневої підготовки, розробка інноваційних педагогічних технологій та наукове обґрунтування механізмів їх реалізації. Зокрема, звертається увага на важливість впровадження новаторських педагогічних методик, які сприятимуть активному взаємодії теоретичних знань із практичними навичками. Автори визначають три критерії сформованості професійної компетентності майбутніх фахівців: мотиваційно-ціннісний, когнітивний і діяльнісний. Ці критерії ставлять за мету не лише передачу теоретичних знань, але й формування мотивації до професійного розвитку, розвитку критичного мислення та здатності до ефективної практичної діяльності. Результати дослідження, які представлені у статті, мають на меті покращити якість підготовки фахівців у галузі геодезії та землеустрою, сприяти їхньому успішному впровадженню на ринок праці та адаптації освітніх програм до сучасних викликів у цій області.

Ключові слова: професійна освіта, фахова підготовка, геодезія та землеустрій, планування території, професійні компетентності.

Problem statement in general terms. In recent times, significant changes have occurred in the higher education system of most countries worldwide. In Ukraine, these trends are accompanied by challenges arising from war-related issues and the constant reformulation of the higher education

system, unwarranted educational initiatives, rapid commercialization, and a decrease in the number of applicants, among other issues. All these processes significantly impact the quality of training for specialists in geodesy and land surveying, necessitating a reevaluation of the content and outcomes of education,

teaching methodologies and technologies, as well as existing educational programs and curricula.

The post-war development of Ukraine is an integral part of ensuring its territorial integrity, defense capability, and economic stability. In contemporary conditions, enhancing the quality of higher education in geodesy and land surveying is particularly crucial. Addressing this issue requires the modernization of the curriculum, optimization of methods and technologies for organizing the educational process, and a reconsideration of the purpose and expected outcomes of education.

A modern professional with higher education must possess a diverse range of competencies, defining them as a professional and well-rounded individual. In Ukraine, specialists in the field of geodesy and land surveying are trained under the specialty code 193 in higher education institutions, including national and technical universities, as well as state and agrarian universities. Ensuring high-quality education in this field is a crucial prerequisite for cultivating highly qualified professionals and contributing to the development of our country.

Analysis of recent research and publications.

Analysis of recent research in the field of science indicates a lack of works dedicated to the theoretical and methodological aspects of preparing future specialists in geodesy and land surveying in higher education institutions. Meanwhile, in the field of psycho-pedagogical science, significant scientific experience exists, which can serve as a foundation for addressing this issue. Notably, scholars such as A. Aleksyuk, L. Biryuk, V. Bondar, H. Vasyanovych, I. Ziazun, M. Yevtukh, L. Kravchenko, N. Kurmysheva, L. Lukyanova, N. Nychkalo, L. Nychuhovska, V. Onipko, H. Sotska, V. Strelnikov, H. Tereshchuk, L. Khomych, N. Shyian, and others have developed conceptual and methodological foundations for the professional training of future specialists in higher education institutions.

Concurrently, there is a growing interest among researchers in analyzing higher education systems in European countries. This indicates the necessity of summarizing and systematizing their scientific inquiries, particularly regarding the experience of professional training for specialists in geodesy and land surveying for territorial planning.

Identification of previously unresolved aspects of the general problem. The problem of preparing future specialists in the field of geodesy and land surveying arises due to various factors such as the updating of educational content, significant expansion of professional responsibilities for experts as active participants in territorial planning and regional development, a constant need for improving regional development methods, considering real conditions and practical requirements. A crucial role in this lies in the

ability to effectively apply conceptual principles of territorial planning [1].

Research on land use and spatial development in the context of global trends, increasing competition between territories, and their rational development has drawn the attention of many scholars, both in Ukraine and beyond. Various concepts, strategies, plans, and programs for socio-economic development of the country's regions, which define a multi-level state regional policy, serve as evidence of the nationwide recognition of the relevance of these issues. In this context, territorial planning becomes a key element, as decisions regarding defense, economic, social, demographic, or environmental development of territories involve land management materials, functional zoning, and land suitability for various land uses. The experience of developed countries underscores the mandatory presence of urban planning documentation at all levels of regional governance and adherence to a sequence in its development and planning decisions [2].

Recognizing territory as a potent integral regional resource indicates the necessity of a geographical rethinking of the complex interdisciplinary category "territorial planning" and the exploration of new theoretical, methodological, and methodical approaches to this process at various levels of societal organizational life and in regions with different strategies of socio-economic development.

Traditionally in Ukraine, specialists in planning, organization, and use of territories receive education at the architectural faculties of higher educational institutions. However, in the modern context, territorial planning has become one of the most effective means of rational territory organization on various levels, from nationwide to local. The application of territorial planning methods extends across different fields and sectors, making the development of a system for preparing future specialists in geodesy and land surveying for territorial planning an ongoing and relevant challenge. Nevertheless, the current state of professional training for specialists in geodesy and land surveying for territorial planning is characterized by a sharp deficit in theoretical research and educational-methodical developments.

The aim of the article is to reconsider the priority directions of higher education development, including the establishment of an effective model for the professional training of specialists in geodesy and land surveying. These professionals should be prepared to undertake tasks related to territorial planning.

Presenting the research findings. The study of any sphere of social life indicates that the development of humanity is becoming increasingly dynamic. The change in ideas, knowledge, and technologies occurs faster than generational shifts. As noted by V. Kremen [3, p. 7], under traditional

education, it is impossible to educate a person for a lifetime, even if they study in a good school or the best university. The knowledge acquired in educational institutions may not necessarily remain relevant in life, and conversely, individuals must constantly acquire new knowledge, without which professionals become less effective and lose competitiveness. Quality higher education is a complex of professional knowledge and skills that allows each individual to maximize their intellectual and creative potential and adapt effectively to rapid changes in the job market [4, p. 72]. During education, students should receive not only static but also dynamic knowledge that can be continually updated and expanded throughout life.

In Ukraine, there exists a gap between the level of quality provided by the existing professional training for future specialists in geodesy and land surveying and the requirements posed by modern society to higher education. The key to addressing this problem is to search for ways to improve education in the field of higher education, its dissemination, and practical application. Despite the increased interest in education and its growing value among the population, educational institutions do not always consider the dynamics of the labor market. Employers now set new requirements for their employees [5, p. 22], including active participation in the development of production in various positions, corresponding to the requirements of rapid change and technological complexity, improving production methods to reduce costs. Independence in solving professional tasks is also required, along with possessing critical and creative thinking, adaptive flexibility in changing life situations, self-sufficiency in acquiring and applying knowledge in practice, the ability to generate new ideas, demonstrate a creative approach to problem-solving, proficiency in effective information processing, communicability, and the ability to work in a team within different social groups while avoiding or skillfully resolving conflicts.

It is essential to understand that this is not just about various educational institutions of architectural or agrarian orientation but about a system within which their functioning interacts closely and is subordinate to the general goals and tasks of the entire system. The systematic nature of continuous education, based on a degree-based approach, significantly expands its possibilities, providing flexibility and responsiveness to changes in the needs of society, social groups, and individual personalities. The components of this system not only perform specific local tasks but also exist in various relationships, constantly changing their qualitative and quantitative characteristics when transitioning from one level of professional training to another.

Modern professional pedagogy employs systemic, activity-based, and personality-oriented approaches, emphasizing the importance of andragogical and

synergetic concepts, elevating the ideas of continuous education to a new level. The practical implementation of the competency approach is based on defining the hierarchy of competencies [6, p. 21]. Such a system includes supra-subject, key competencies, which may act as a “umbrella” over the entire educational process; general-subject competencies formed during the study of specific subjects; and special-subject competencies developed during the study of a particular subject over a certain level of education. The introduction of a competency-based approach to shaping the content of education requires the development of assessment technologies for the level of competencies, determining the effectiveness of educational systems.

Formation of professional competence in future specialists in geodesy and land surveying is considered a complex process, implemented through a model of step-by-step professional education, culminating in the achievement of professional mastery during work activities.

In the model of step-by-step learning, the formation of general-professional and technological competencies is a particularly important element. These competencies constitute the basis for the future professional mastery of specialists in geodetic profiling. The development of geodesy and land surveying professionals begins in specialized pre-higher education institutions, continues in higher education institutions, and is enhanced throughout their professional careers. General scientific competence is primarily formed during the study of natural sciences, and higher education institutions provide opportunities for its development through research projects and qualification works. Inseparable components of the professional competence of geodesy and land surveying professionals are general cultural and personal competencies, which refine key competencies and determine the intellectual and cultural level of an individual regardless of their education [7, pp. 4–8].

Current trends in professional education are characterized by the growing demand for professionals who, in addition to professional knowledge and skills, possess developed socio-professional qualities of a “polyprofessional” nature [8, p. 132]. Contemporary geodetic and land management production requires competent professionals who combine deep professional knowledge and advanced skills with general education, intelligence, communicative and managerial qualities. Defining the content of professional training involves analyzing the specificities of activities in the field of architecture and construction in Ukraine.

The basis for the quality preparation of geodesy and land surveying professionals, which is a scientific and high-tech specialty, is a model of continuous education. The modern job market demands from

graduates not only profound theoretical knowledge but also the ability to apply them independently in non-standard, dynamic production conditions, learn new technologies and materials, improve their own skills, and achieve success. Continuous professional education involves systematic, purposeful activities to enhance competence by acquiring and improving knowledge, skills, and abilities in the field of geodetic and land surveying production, which can be carried out in educational institutions or through self-education. Gradual professional training of future specialists in geodesy and land surveying is a necessary component of continuous education and includes obtaining various educational qualification levels at relevant stages (degrees) of higher education. All aspects of professional training for future specialists in geodesy and land surveying are considered in the unity of regular interrelations, based on the general theory of managing complex dynamic systems.

The activity-based approach aims to develop students' abilities to act based on modeling specific aspects of future professional activities. The personality-oriented approach, associated with the principle of humanism, determines the organization of professional training for future specialists in geodesy and land surveying based on considering individual needs and capabilities, regarding students as conscious and responsible subjects of educational interaction [9, p. 102].

The competency-based approach focuses on educational outcomes, defining competency as a person's ability to act effectively in various problem situations. The key criterion is the ability to succeed and feel comfortable in different spheres of personal and social life. Competence combines personal experience and knowledge, interconnected by motivation and values, resulting in cognitive and practical skills that allow judgment of a person's competency level.

Professional competence of future specialists in geodesy and land surveying is defined as their ability, based on integrated knowledge, skills, experience, and personal qualities, to perform professional functions at the achieved qualification level. Indicators of professional competence include not only knowledge, skills, and abilities that form a general professional intellect but also professional position and individual-mental characteristics, such as motivational-value components.

Considering professional development as an integral component of personal development, it is necessary to address complex issues typical of the student age, which interact with each other. The choice of a pedagogical system and teaching methods should primarily consider the psychological characteristics of students.

The use of complex educational and methodological support, integrating modern technologies of geodesy

and land surveying, promotes high-quality teaching and material assimilation at different stages of learning. This contributes to the development of positive motivation and the successful formation of professional competence in specialists. Adherence to defined pedagogical conditions will allow implementing the concept of professional training in conditions of continuous education.

The formation of professional competence, beginning at the stage of step-by-step education and continuing in professional activities, is linked to social orders and employer requirements on one hand, and individual interests and aspirations of students on the other. Based on the analysis of the concept of continuous education and modern approaches to learning, conceptual principles of step-by-step training of future specialists in geodesy and land surveying can be identified:

- introduction of a systemic approach to forming professional competence at different education levels, considering production requirements, acmeological and synergetic principles, and innovative pedagogical trends;
- integration of traditional educational content and establishing connections between curricula at different education levels;
- use of innovative teaching technologies and various methods facilitating effective material acquisition;
- creation of a complex educational and methodological support system considering modern pedagogical trends and production peculiarities.

Formation of professional competencies in the field of geodesy and land management is considered a multidimensional process in which humanitarian and socio-economic preparation is recognized as essential. The fundamental principles of general and professional education, such as professional orientation, continuity, fundamentality, integration, and informatization, determine the effectiveness of interaction between different levels of education and the success of shaping future specialists. Key pedagogical conditions, such as content integration, encouragement of positive motivation, activation of learning-cognitive activity, and systematic methodological support, contribute to the efficiency of the learning process in continuous education conditions.

Thus, ensuring the quality formation of professional competencies in geodesy and land management requires a comprehensive approach, taking into account the psychological characteristics of students and the use of modern teaching methods and technologies. The formation of professional competence of future specialists in geodesy and land management is a complex process, the effectiveness of which depends on coordinated actions of all participants in the educational process – educational institutions, academic staff, employers, and learners. Integration

processes in the higher education system, comprehensive use of innovative teaching technologies, emphasis on intensive, active, and individualized forms and methods of learning should become the methodological basis for preparing education seekers in this specialty.

The process of implementing innovative technologies in higher education institutions involves parallel changes in the main components of the educational process – target, content, procedural, methodological, and diagnostic. The main goal of the educational process remains the improvement of the formation of professional competence of future specialists in geodesy and land management. The content component of technologies involves integrating the content of natural-science and professional training with an approach close to modern technologies. Changes in the procedural component relate to the methods of organizing and conducting educational-cognitive activities, such as using interactive, activity-based methods, problem-solving approach, project activities, and forming positive motivation directed towards success.

The effectiveness of implementing innovative technologies depends on systematic methodological support for the educational process. The diagnostic component undergoes changes due to the application of diverse didactic means of pedagogical control. The key principle of designing pedagogical technology is a competency-based approach aimed at developing key and subject competencies and forming components of professional competence through solving tasks related to future professional activities. The use of modular-rating learning technology, based on acmeological strategy, contributes to achieving the peaks in the development of each student and teacher, as well as developing the creative potential of future specialists and their socialization in often challenging life conditions. Personalized learning involves organizing the process based on respect for the student's personality, considering the features of individual development, and treating them as a conscious and responsible subject of educational interaction. Self-education, the ability, and the need to replenish and generate knowledge, the ability to navigate complex databases and knowledge systems are essential conditions for professional competence, both for the teacher and the future specialist. Pedagogical innovations are associated with the use of interactive and activity-based methods [11, p. 18].

The systematic use of a problem-solving approach in organizing the educational process leads to increased educational-cognitive interest in the discipline, increased student activity in perceiving material, and incorporating modern scientific achievements into existing knowledge and experience, allowing them to participate more consciously in educational activities. Problem-based sessions contribute to the

development of productive, creative thinking in future specialists in geodesy and land management, both in colleges and universities [12, p. 76]. The use of various assessment methods, such as tests, oral interviews, and calculation works, ensures adequate evaluation of students' knowledge. The application of tasks with a four-level structure, including different levels of complexity – reproductive, reconstructive, productive, and creative, allows for the effective integration of classical concepts, laws, and materials applied in geodesy and land management. The use of a comprehensive systemically organized complex of educational and methodological support, including manuals, lecture notes, guidelines for laboratory work, self-study, control, ensures high-quality study of disciplines at each stage of education. Educational and methodological materials, designed with consideration for high scientific and methodological levels, adapted to the needs of students, are the main methodological tool for teaching in professional disciplines.

Reproductive level. The innovations in the reproductive level of contemporary education for professionals in geodesy and land surveying with a focus on territory planning represent a crucial aspect of academic development. The dynamic nature of this field necessitates a forward-thinking approach to training that incorporates modern methodologies and technologies. One key innovation lies in the integration of cutting-edge technologies into the curriculum. Embracing advancements such as Geographic Information Systems (GIS), remote sensing, and global positioning systems (GPS) provides students with practical skills and enhances their ability to analyze and interpret spatial data for effective territory planning.

Another innovative approach involves the incorporation of real-world scenarios and hands-on experiences into the learning process. Simulations, fieldwork, and internships enable students to apply theoretical knowledge in practical settings, preparing them for the challenges they will face in their professional careers. The use of interdisciplinary learning is also a notable innovation. Recognizing the interconnectedness of geodesy and land surveying with other fields such as environmental science, urban planning, and architecture enhances the holistic understanding of territory planning. This approach equips future professionals with a comprehensive skill set and a broader perspective. Furthermore, the focus on sustainable practices and environmental considerations represents an innovative shift. Integrating concepts of sustainable development, green infrastructure, and ecological planning into the curriculum ensures that future specialists are well-equipped to address contemporary challenges related to environmental conservation and resilience in territory planning. Adopting a competency-based education model is another innovative strategy. This approach emphasizes the

development of specific skills and competencies required in the professional field, ensuring that graduates are not only knowledgeable but also capable of applying their expertise effectively in diverse scenarios.

In conclusion, innovations in the reproductive level of education for geodesy and land surveying professionals, particularly in the context of territory planning, involve embracing technological advancements, providing practical experiences, fostering interdisciplinary learning, incorporating sustainability considerations, and adopting competency-based education. These innovations collectively contribute to a more dynamic and responsive educational framework that prepares professionals for the evolving demands of the field.

Reconstructive level. Innovations at the reconstructive level of contemporary education for geodesy and land surveying professionals in the field of territory planning encompass several key aspects aimed at enhancing the educational process and adapting to modern challenges in this domain.

1. Digital Technologies and GIS. Increased utilization of digital technologies and Geographic Information Systems (GIS) in the educational process allows students to acquire skills in working with modern tools used in geodesy and land surveying [13]. This may involve learning software for processing geospatial information, visualization, and data analysis.

2. Project-Oriented Learning. The application of teaching methods based on real projects enables students to address specific tasks related to territory planning. This fosters the development of practical skills and prepares them for real-world work conditions.

3. Interdisciplinary Approach. Incorporating elements from other disciplines such as architecture, ecology, economics, etc., expands students' understanding of the impact of geodesy and land surveying on various aspects of territory planning.

4. Sustainable Development Strategies. Integrating concepts of sustainable development, green infrastructure, and ecological planning into the curriculum contributes to the development of sustainability in professionals and enhances their readiness to consider sustainability aspects in territory planning.

5. Enhancement of Practical Experience. Providing students with opportunities for practical experience through internships, site visits, and interaction with practicing professionals helps transform theoretical knowledge into practical skills.

6. Development of Technical Skills. Emphasizing the teaching of technical skills, such as the use of modern equipment and tools for land surveying, helps graduates be well-prepared for challenges in the field of territory planning [14].

These innovations are directed towards ensuring a more effective and balanced approach to the

education of future professionals in geodesy and land surveying, enabling them to successfully meet the challenges and demands of the contemporary job market.

Productive and creative levels. Innovations at the productive and creative levels of modern education for geodesy and land surveying professionals in the field of territory planning encompass several key aspects aimed at stimulating creative thinking and highly productive learning.

1. Integration of Artificial Intelligence (AI) Technologies. The use of advanced artificial intelligence technologies in educational programs allows students to more effectively address tasks related to geodesy and land surveying. The implementation of automated analysis and processing systems for geospatial information expands possibilities and enhances the productivity of task-solving.

2. Creative Teaching Methods. Utilizing creative methods and tasks that stimulate students' creative thinking develops their ability to approach territory planning tasks with an innovative mindset. Projects actively encouraging a creative approach contribute to the development of unique solutions.

3. Interactive Learning and Virtual Reality. The use of interactive teaching methods and virtual reality allows students to gain practical experience in controlled virtual environments, increasing their engagement and providing opportunities to experiment with ideas.

4. Group Projects and Collaborative Work. Promotes the development of creativity and communication skills among students. Group projects enable the merging of different approaches and ideas, fostering the emergence of innovative solutions in the field of territory planning.

5. Experiential Learning on Real Objects. Organizing excursions and practical training on real objects allows students to gain hands-on experience with real challenges and situations, enhancing their effectiveness in future professional activities.

6. Development of Environmental Perception. Incorporating aspects of environmental planning and sustainable development into educational programs expands students' understanding of the importance of environmental factors in territory planning and land surveying.

These innovations are intended not only to increase the efficiency of the learning process but also to provide students and future professionals in the specified field with creative and innovative skills for effectively addressing challenges in geodesy and land surveying.

Conclusions. The preparation of future professionals in geodesy and land management holds significant importance for the stable development of Ukraine's economy. An analysis of research by Ukrainian and foreign scholars allows the identification of

key concepts in education, based on a gradual learning model.

The primary goal of education is to mold competent professionals capable of effectively utilizing modern geodetic and land management technologies and implementing innovations in production processes. The success of a graduate in the job market depends not only on deep theoretical knowledge but also on the ability to independently apply them in non-standard situations, learn new technologies, and continually refine their skills.

Despite the presence of numerous educational institutions in Ukraine, there is a shortage of well-explored opportunities to optimize the gradual training of future specialists in geodesy and land management. There is a lack of a clear concept of the content of continuous learning and insufficiently scientifically substantiated mechanisms for implementing innovative pedagogical technologies. The main challenges of professional adaptation for young professionals are associated with a low level of professional and key competencies formed in educational institutions. In the job market, preference is given to graduates who studied for a shortened period, combining practical skills with theoretical university training.

The professional competence of future specialists in geodesy and land management is defined as their ability, based on integrated knowledge, skills, experience, and personal qualities, to effectively perform professional functions at the achieved level of qualification. Competence indicators include not only knowledge, skills, and abilities, forming a general professional intellect but also professional attitude and individual-psychological characteristics, such as motivational-value, cognitive, and activity components.

There are three criteria for the formation of professional competence in future specialists: motivational-value, reflecting their attitude towards the chosen profession and education; cognitive, indicating the level of knowledge acquisition and flexibility of thinking; and activity-based, determining their ability to apply integrated experience in creative tasks.

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