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ТЕМАТИЧНА СКЛАДОВА STEM-ОСВІТИ В ЗАКОНОДАВЧО-НОРМАТИВНИХ ДОКУМЕНТАХ В ГАЛУЗІ ОСВІТИ І НАУКИ УКРАЇНИ ТА СПОЛУЧЕНИХ ШТАТІВ АМЕРИКИ

У статті здійснено порівняльно-аналітичний огляд тематичної складової STEM-освіти в законодавчо-нормативних документах у галузі освіти і науки України та Сполучених Штатів Америки. Проаналізовано наявні закони, стратегії, державні програми й підзаконні акти, що визначають напрями розвитку STEM-освіти, її цілі, механізми впровадження та інституційну підтримку на національному рівні.

Встановлено, що у США STEM-освіта закріплена як довгостроковий державний пріоритет із чіткою міжвідомчою координацією, стабільним фінансуванням та орієнтацією на інновації, національну безпеку й конкурентоспроможність економіки. Нормативні документи США характеризуються системністю, спадковістю та прямим зв'язком між освітою, наукою, технологічним розвитком і ринком праці. Водночас в Україні нормативно-правове забезпечення STEM-освіти формується переважно через рамкові закони про освіту і науку, концепції, стратегії та державні програми, що відображають адаптаційний і трансформаційний характер освітньої політики в умовах суспільних викликів і воєнного стану.

З'ясовано, що спільною рисою законодавства обох країн є інтеграція STEM-підходів із цілями розвитку інноваційної економіки, цифрових компетентностей і підготовки фахівців для високотехнологічних галузей. Відмінності полягають у рівні нормативної деталізації, ступені інституційної зрілості та механізмах реалізації STEM-освіти. Отримані результати можуть бути використані для наукових досліджень у сфері порівняльної педагогіки, освітньої політики, а також для обґрунтування напрямів удосконалення нормативного забезпечення STEM-освіти в Україні з урахуванням досвіду США.

Ключові слова: *STEM-освіта, законодавчо-нормативні документи, освітня політика, Україна, США, наука й інновації.*

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THEMATIC COMPONENT OF STEM EDUCATION IN LEGISLATIVE AND REGULATORY DOCUMENTS IN THE FIELD OF EDUCATION AND SCIENCE OF UKRAINE AND THE UNITED STATES OF AMERICA

The article provides a comparative and analytical review of the thematic component of STEM education in legislative and regulatory documents in the field of education and science in Ukraine and the United States of America. The existing laws, strategies, state programs and by-laws that determine the directions of STEM education development, its goals, implementation mechanisms and institutional support at the national level are analyzed.

It is established that in the USA STEM education is established as a long-term state priority with clear interagency coordination, stable funding and orientation towards innovation, national security and competitiveness of the economy. US regulatory documents are characterized by systematicity, heredity and a direct connection between education, science, technological development and the labor market. At the same time, in Ukraine, the regulatory and legal support for STEM education is formed mainly through framework laws on education and science, concepts, strategies and state programs that reflect the adaptive and transformative nature of educational policy in the context of social challenges and martial law.

It was found that a common feature of the legislation of both countries is the integration of STEM approaches with the goals of developing an innovative economy, digital competencies and training specialists for high-tech industries. The differences lie in the level of regulatory detail, the degree of institutional maturity and the mechanisms for implementing STEM education. The results obtained can be used for scientific research in the field of comparative pedagogy, educational policy, as well as to substantiate the areas of improving the regulatory support for STEM education in Ukraine, taking into account the experience of the United States.

Key words: *STEM education, legislative and regulatory documents, educational policy, Ukraine, USA, science and innovation.*

STEM education (Science, Technology, Engineering, Mathematics) in the modern world is considered as a strategic direction of education and science development, which provides training of specialists capable of operating effectively in the conditions of an innovative economy, digital transformation and global competition. Its key feature is the integration of natural science, mathematics, engineering and technological knowledge into a holistic system focused on solving practical problems, developing critical thinking, creativity and interdisciplinary interaction skills. In the context of national educational systems, the thematic component of STEM education in legislative and regulatory documents in the field of education and science reflects the priorities of state policy, the level of development of science and technology, as well as the demands of the labor market. For Ukraine, STEM education is an important tool for the modernization of education, integration into the European and global scientific and educational space, and the formation of human resources for the restoration and sustainable development of the country. At the same time, in the United States of America, the STEM direction has long been a system-forming factor in educational policy, closely related to the development of high technologies, innovative research and global leadership in the field of science. A comparative analysis of the thematic component of STEM education in legislative and regulatory documents in the field of education and science in Ukraine and the USA allows us to identify common features and differences in approaches to the formation of the content of education, the definition of priority scientific and technological areas, as well as mechanisms for integrating education, science and production. Such research is important for substantiating ways to adapt best international practices to the national educational environment and improving the quality of training of education seekers in the context of global challenges of the 21st century.

The purpose of the article is to explore the thematic component of STEM education in key legislative and regulatory documents in the field of education and science of Ukraine and the United States of America, which form the legal basis and the main legislative field for conducting scientific research in the field of education and science on issues of Ukrainian-American cooperation in the field of education and pedagogical science.

In the context of education, «Law» and «Right» are often defined through Kant's «Categorical Imperative» [28], [32], [10], [40] which requires acting as if your rule (maxim) could become a universal law for everyone, and treating people as ends, not just as means. This means that rules in education should be general, fair, and respect the dignity of the individual, forming responsible citizens who are aware of their moral duty to society.

The main aspects of this imperative in education are

1) Universality of rules: Educational norms (rules of conduct, laws of school life) should be the same for all students, regardless of their status or circumstances, and everyone should follow them.

2) Respect for the individual: Education should cultivate respect for the dignity of every person, both student and teacher, seeing them as ends in themselves, and not as a means to achieve certain goals (e.g., high grades).

3) Autonomy and responsibility: Students learn not just to follow orders, but to understand and make laws, feeling like legislators (members of the «kingdom of goals»), which develops internal discipline and self-control.

4) Moral law: «Law» in this sense is not only external rules, but also an internal moral obligation that guides actions, making them just.

Thus, education, based on this imperative, seeks to educate not just bearers of knowledge, but conscious, ethical individuals capable of creating a just society [1].

The relationship between the category's «Law» and «Right» within the framework of legal sciences is determined by the following imperative: «they exist at different levels of legal reality [6]. Law is an external form of expression of law». Law is formal rules established by the state; law is the opportunities, freedoms and guarantees of a person and communities. In STEM education, they perform different but interrelated roles. The thematic component of STEM education in legislative and regulatory documents in the field of education and science in Ukraine and the USA provides legal conditions for innovations; forms responsibility and an ethical culture; promotes sustainable development and safe implementation of technologies; prepares education seekers for real professional practice. The key difference is in the pedagogical sense: the category «Law» forms normative thinking (to act according to the rules, responsibly, safely). The category «Right» forms value-based and civic thinking (to protect oneself, others and the results of innovations). In practice, the «Law» corresponds to how STEM should be organized and controlled. The «Right» corresponds to what a participant in STEM education can and should have.

The basis of the regulatory and legal support for STEM education in Ukraine is

1. The Concept for the Development of Natural Sciences and Mathematics Education (STEM Education), approved by the Cabinet of Ministers of Ukraine on 05.08.2020 (Order № 960-p) with implementation until 2027 [19]. The document defines the terms, goals and priorities for the development of STEM; includes such concepts as STEM laboratory and STEM center. The concept emphasizes the integration of natural sciences, mathematics, technology and engineering to form 21st century competencies (critical thinking, creativity, technical skills).

2. Legislative basis. STEM education in our country is based on a broad legislative field:

1) Law of Ukraine «On Education» [3], Law of Ukraine «On Complete General Secondary Education» [4], Law of Ukraine «On Professional (Vocational and Technical) Education» (repealed from 12.09.2025, basis – 4574-IX) [5], Law of Ukraine «On Higher Education» [2], etc. [20].

2) State educational standards, which provide for interdisciplinary competencies and practical training [11], [12], [13], [15].

3. Regulatory acts of the Ministry of Education and Science. Separate orders and letters of the Ministry of Education and Science/IMZO regulate the practical aspects of STEM education:

1) Order on the creation of working groups to develop standards and equipment for STEM laboratories (Order of the Ministry of Education and Science № 1247/2025) [18], [17].

2) On some issues of implementing an innovative educational project at the all-Ukrainian level on the topic «Robotics design system in computer science lessons in basic school» in September 2024 – August 2029 (Order of the Ministry of Education and Science № 400/2025) [14].

3) Methodological recommendations for the development of STEM in general secondary and extracurricular education (Letter of the Ministry of Education and Science № 21/08–624 dated 07/18/25) [7].

4) On the organization and conduct of scientific and practical events «STEM-school – 2025» (Order of the Ministry of Health №. 21/03–1 dated January 17, 2025) [16].

Scientific intelligences assessing the thematic component of STEM education in legislative and regulatory documents in the field of education and science of Ukraine shows that STEM education in Ukraine is

a) systemic in nature and fixed at the level of conceptual policy;

b) focused on the formation of complex competencies and interdisciplinary connections;

c) the implementation tools (laboratories, centers, action plans) are gradually detailed through secondary legislation.

Unlike Ukraine, the USA does not have a single global federal law, which is directly called the «STEM Education Law», but STEM is thematically integrated into a number of laws and policies at the federal and state levels (Batyuk, 2025), which allows implementing STEM education in the regulatory field of the United States of America. The federal legislation and strategy of the US Government in the field of education and science have a number of current provisions, among which the list of US laws related to STEM education stands out:

1950s–1970s. First major steps towards science and technology education:

1) National Defense Education Act (NDEA) of 1958 — Federal law aimed at strengthening education in science, mathematics, foreign languages, and technical fields in response to the space and scientific challenges of the time. It is considered the basic law that created federal attention to science and technology [34].

2) Elementary and Secondary Education Act (ESEA, 1965, as amended) – Framework Act, which was replaced by ESSA; provides for policies to support educational programs, including STEM components [24]. Education law that established federal funding for school education, including programs to strengthen science and mathematics disciplines. It is a platform for subsequent STEM initiatives (later reorganized and expanded).

3) Vocational Education Act of 1963 (later developed into the Perkins Act), which included technical and science programs [44].

1980s–2000s Successive expansion of support for technical education:

1) Carl D. Perkins Vocational and Technical Education Act (1984, 1990, 1998, 2006, 2018) — A series of laws supporting vocational education, including the integration of academic and technical knowledge that is now part of STEM-oriented career paths. Most recently reauthorized: Perkins V, which took place in 2018, effective until 2024 [29], [38], [39].

2) Education Sciences Reform Act of 2002 — An act that created the Institute of Educational Sciences (IES) and strengthened research in education, including methods for assessing STEM components [23].

2010–2025 Formalization of STEM education in federal documents:

1) STEM Education Act of 2015 (Public Law 114-59) — A law that defined STEM education at the federal level, included computer science in its composition and expanded the powers and capabilities of the National Science Foundation in supporting STEM programs, supporting grants for STEM programs, including informal learning [41];

2) Every Student Succeeds Act, ESSA, 2015 — the main federal law on school education in the United States, known as K–12, which replaced the No Child Left Behind Act [21], [26], with provisions supporting science, technology and mathematics in school programs. This «core» education law established a framework for supporting STEM through public funding and standards, such as Title IV-A (Student Support and Academic Enhancement Grants – SSAE) of the Act. STEM programs are supported under Title IV-A, and the Student Support and Academic Enhancement Grants (SSAE) provide funding for comprehensive education (including STEM/CS), technology integration (digital literacy, professional development), and a

percentage of funding for student safety/health. This funding allows for hands-on learning, teacher development, curriculum enhancement, and STEM pathways to enhance student interest and skills.

Over time, Title IV-A (SSAE) has become a flexible U.S. federal grant under the Ensuring Every Student Succeeds Act (ESSA) with the option to fund schools under the «Well-rounded» (WRE) program. This program is one of three priority areas of Title IV-A, supporting and funding activities such as arts, civics, and college readiness; student safety and health (mental health), and creating a safe and healthy environment.

Title IV-A supports STEM education specifically under the «Well-rounded» program and funds activities such as purchasing science kits, implementing hands-on STEM projects, integrating art/history into STEM education, and supporting STEM education in computer science to increase student interest and participation. The program provides funds to states and districts to improve student achievement and learning environments, with a strong emphasis on community participation in planning activities. The funding is a targeted grant provided to states, distributed among local educational authorities (LEAs), with the possibility of flexible use of funds within three priority areas, depending on the needs of the state:

a) Well-rounded Education (WRE): art, music, civics, STEM, foreign languages, AP/IB, college/career counseling, environmental education.

b) Safe and Healthy Students (SHS): mental health, substance abuse/violence prevention, trauma-informed practices, physical education, bullying prevention.

c) Effective Technology (EIT): digital literacy, blended learning, infrastructure, professional development.

In practice, it is not a separate program, but a functional educational module that provides access to subjects that go beyond basic academic education. School districts act as local controls, forming groups of stakeholders (parents, teachers, local community representatives) to make decisions on how to spend funds, ensuring that local needs are met with effective use of technology, namely, supporting professional development of teachers, integrating technology for personalized learning and increasing digital literacy with setting limits on spending on technical equipment/software.

The Student Safety and Health Program funds programs that promote positive school environments that indirectly support academic success, including in STEM (science, technology, engineering, and mathematics) fields. Of course, there are funding requirements and flexibility in selecting participants. The percentage of spending (for districts with a budget of more than $30,000) is: a minimum of 20% for Well-rounded Education (WRE); a minimum of 20% for Student Safety and Health (SHS).

The Effective Technology Use (EIT) program has technology infrastructure restrictions: just over 15% of the funds allocated for equipment (devices, software) can be spent on one-time equipment purchases. All programs must coordinate their activities with other school/community services and may collaborate with higher education institutions. Examples of funded STEM projects include the purchase of scientific equipment and teaching materials in STEM disciplines; providing professional development for STEM teachers; developing 3D printing sites and workshops; and creating specialized schools or areas of study focused on STEM education.

The overall goal of all three priority areas is to build the capacity of local educational institutions in each state to ensure comprehensive education, school safety, and effective use of technology, consistent with broader federal goals for 21st century learners and job readiness.

3) 42 U.S. Code § 18991 — PreK–12 STEM Education (within the framework of the US federal code) — a provision that provides for support for STEM education programs, including the establishment of pilot programs for educators; support for the National STEM Teacher Corps and programs for best practices in STEM teaching in elementary and secondary education [45].

4) The Higher Education Act (HEA): A Primer (2023) — in the context of STEM education, The Higher Education Act in the USA serves as the structural and financial core of the education system, creating stable conditions for the development of STEM fields [43]. In Ukraine, STEM education is normatively supported mainly through strategic and program documents, which determines its flexibility, but at the same time limits its systematicity and long-term stability. The American experience indicates the feasibility of strengthening the legislative level of STEM education in Ukraine, taking into account the national context. The Higher Education Act (HEA) in the presentation of the analytical review A Primer (2023) testifies that the HEA is the basic regulatory and legal mechanism for ensuring the accessibility, institutional sustainability and human resource potential of STEM education in the United States in the next decade. Although the law does not have a sectoral STEM focus, it is through it that the key conditions for the functioning and scaling of STEM education as a component of national innovation policy are implemented. The most direct connection of the HEA with STEM education is provided through Title IV, which regulates federal financial assistance to students: Pell Grants, Federal Direct Loans, Work-Study significantly reduce financial barriers to entry into STEM specialties, which are traditionally more expensive due to laboratory facilities, equipment and duration of study. The HEA promotes the involvement of students from socially vulnerable groups in STEM fields, which is a strategic objective of the US STEM policy. The HEA creates economic prerequisites for mass participation of students in STEM education.

Institutional support for STEM programs is provided through Title III and Title V HEA: it funds the development of higher education institutions with limited resources (including Minority-Serving Institutions); indirectly supports the creation and modernization of STEM programs, laboratories, and research infrastructure; expands the participation of minorities in STEM education, which is a key national goal of the United States. Title II HEA focuses on the quality of teacher training, which is of direct importance for the training of teachers of STEM disciplines; improving the quality of STEM education in universities and schools; disseminating modern methods of teaching science, mathematics, and technology. HEA forms the human resource base of STEM education through teacher training policies.

The connection of STEM education with science and innovation is regulated through Title VI HEA: international education, scientific research and interdisciplinary programs are supported; conditions are created for the integration of STEM education with scientific research and global innovation processes. HEA promotes the inclusion of STEM education in a broader scientific and research context. In the US educational legislation system, HEA does not define STEM as a separate object of regulation; but acts as a financial and institutional «foundation» on which specialized STEM laws are based (America COMPETES Act, STEM Education Acts, National STEM Strategy). STEM education in the US is not developing in isolation, but is embedded in the general system of higher education, the core of which is HEA.

Some important acts and provisions have had an indirect, but nevertheless important impact, for example, the US Department of Education strategic plans, memoranda on STEM education 2017–2026, etc., but they did not have the status of laws of Congress [21]. National strategies/strategic plans, and, accordingly, federal plans (STEM 2026, 5-year strategies [35], [27] form a vision for the development of STEM at the level of government agencies and cooperation with other structures [46].

Federal plans for STEM education through 2026 focus on a new approach. The Five-Year Strategic Plan for STEM Education (2024-2029) [46], [21] emphasizes equity, accessibility, and workforce readiness, building on the CHIPS program and the Science Act [31], with agencies such as the U.S. National Science Foundation (NSF), Department of Energy (DOE), and Department of Defense (DOD), key U.S. federal agencies that fund scientific research, with NSF specializing in basic science and engineering across a broad range of disciplines, DOE focuses on energy and nuclear research, and DOD funds science related to national security and defense; all play critical roles in advancing American technology and knowledge, working in different but sometimes overlapping areas, all allocate significant funds to STEM education, and all develop their own funding lines for future years. All U.S. Federal STEM education plans are aimed at ensuring U.S. leadership in innovation and creating a diverse, skilled STEM workforce to meet the challenges of the future.

The Federal Strategic Plan for STEM Education (2024-2029) published by the White House is a keynote and is aimed at achieving universal literacy and leadership in STEM education, with a focus on inspiring youth, expanding access, building a diverse STEM workforce, and fostering partnerships [21].

NSF Strategic Plan for Fiscal Years 2026-2030: Aims to build a strong STEM workforce by attracting, training, and retaining talent, with an emphasis on collaborating with industry, and scaling science-based approaches to meet changing needs [22], [36].

The CHIPS and Science Act of 2022 is the primary legislation funding STEM education and workforce development that supports these strategic goals through significant public investment [31].

STEM 2026 (Vision): An earlier U.S. Department of Education document that outlines a vision for a continuum of STEM education, although the new 2024 plan is the current framework [42]. The primary goals are: a) equity and inclusion, namely, eliminating disparities and expanding participation and leadership in STEM by underrepresented groups;

b) workforce development, namely, the preparation of a skilled workforce with diverse skills to meet future economic and security needs;

c) partnerships: promoting collaboration between government, industry, educational institutions, and local communities;

d) innovation: promoting the development of advanced research and technological skills, including computational thinking.

Key agencies involved in this project include the National Science Foundation (NSF) as a key funder and strategic leader; the Department of Education, which aims to focus on education from elementary to higher education; the US Department of Defense and the US Department of Energy, the two largest STEM funding organizations and in need of STEM specialists; and the National Institutes of Health (NIH) and NASA, which are significant players in research and development.

Other legislative initiatives and acts that are no less important in the field of education and science are:

1) INSPIRE Women Act (2017) — a law aimed at attracting women and girls to STEM through mentorship and career guidance programs. The INSPIRE Women Act (2017), officially known as the Inspiring Future Space Pioneers, Innovators, Researchers, and Explorers (INSPIRE) Women Act, is a United States law that mandates NASA to encourage women and girls to pursue STEM careers in the aerospace industry, where women make up only about 25% of the workforce, despite the majority having a college degree, by supporting mentorship and outreach programs such as NASA GIRLS & NASA BOYS, Aspire to Inspire, and SISTER, aimed at increasing the representation of women in space and STEM fields

[30]. NASA GIRLS & NASA BOYS are virtual mentoring programs that connect students with NASA mentors. Aspire to Inspire (A2I): Uses NASA early career professionals to showcase opportunities in STEM fields. Summer Institute for Science, Technology, Engineering and Research (SISTER): Provides middle school girls with an opportunity to explore non-traditional careers at the Goddard Space Flight Center.

2) The Mathematics and Science Partnerships (MSP) policy under ESSA/No Child Left Behind, which promotes partnerships between universities and schools to improve the quality of mathematics and science education [25], [33], [37].

Table 1 «General characteristics of STEM education in legislative and regulatory documents in the field of education and science of Ukraine and the United States of America» not only records the differences between the countries, but also identifies potential areas for borrowing positive US experience to improve the regulatory support of STEM education in Ukraine, taking into account the national context, educational reforms, and challenges of wartime.

Table 1

General characteristics of STEM education in legislative and regulatory documents in the field of education and science of Ukraine and the United States of America

Comparative Criterion	Ukraine	USA
Presence of a national conceptual document	Yes: Concept of STEM development until 2027	No: there is no single document with this title
Level of legislative consolidation of STEM education	Through a number of laws on education and by-laws: STEM education is integrated into framework laws («On Education», «On Scientific and Scientific and Technical Activities»), concepts and strategies for the development of education and science	STEM education is enshrined in specialized federal laws, national strategies and program documents: through general laws on education (ESSA, STEM Education Act)
Development Strategy	There is an action plan for the Concept, approved by the Cabinet of Ministers	There are several federal strategies/plans focusing on STEM
Existence of separate STEM strategies	Implemented through state concepts, roadmaps and projects, without a separate basic STEM law	There are coherent national STEM strategies with clearly defined goals, indicators and implementation mechanisms
Systematicity of the regulatory framework	The regulatory framework is in the stage of formation and modernization, characterized by fragmentation	High level of systematicity, continuity and stability of legislation
Specific initiatives (support for groups)	So far more generalized	There are laws for specific groups (women, inclusion)
Target orientation of STEM education	Modernization of education, formation of key competencies, integration into the European educational space	Innovative development, technological leadership, national security and economic competitiveness
Institutional support	Coordination is carried out mainly by state authorities and educational institutions	Interdepartmental coordination (education, science, defense, economy) is in place, federal agencies are involved
Financing of STEM education	Limited, often project or grant, depends on state programs and international assistance	Stable state funding, long-term investments, private sector participation
Integration of education and science	Declared at the regulatory level, partially implemented through educational and scientific programs	Implemented at the system level through research programs, grants and innovation clusters
Connection of STEM education with the labor market	Is being formed, requires increased interaction with employers and industry	Clear and normatively established connection with the needs of the economy and the defense-industrial complex
Flexibility and adaptability of regulatory policy	High adaptability to societal challenges, including martial law	High stability and predictability of educational policy
General nature of STEM policy	Transformational and adaptive	Strategic and long-term

Structurally, the table «General characteristics of STEM education in legislative and regulatory documents in the field of education and science of Ukraine and the United States of America» covers the following comparative blocks:

Level of legislative consolidation of STEM education. In the USA, STEM education is clearly enshrined in specialized federal laws and strategies that are long-term in nature. In Ukraine, STEM education is integrated mainly into general educational laws, concepts and state programs, without a separate specialized law.

Systematicity and consistency of the regulatory framework. The American regulatory system is characterized by the inheritance and continuity of STEM policy, while the Ukrainian model is at the stage of formation and updating, which is due to educational reforms and social transformations.

Target orientation of STEM education. In the USA, the emphasis is on innovation, economic competitiveness, national security and training personnel for high-tech sectors. In Ukraine, the priorities are the modernization of education, the development of key competencies and adaptation to European educational standards.

Institutional and financial support. The table shows that the USA has an extensive system of institutional support for STEM education with guaranteed funding, while in Ukraine funding is more limited and project-based.

Integration of education, science and the labor market. In the USA, regulatory documents clearly combine STEM education with scientific research, innovative activities and labor market needs. In Ukraine, such integration is declared, but has not yet been fully implemented in practice.

Flexibility and adaptability of regulatory policy. The comparative conclusion emphasizes that the Ukrainian system is more flexible and adaptive in conditions of martial law [8], [9], while the American system is stable, predictable and strategically oriented.

Scientific research evaluating the thematic component of STEM education in legislative and regulatory documents in the field of education in the United States shows that STEM education in the United States has

a) a decentralized structure: STEM education is formally included in the broader legislative framework of general education; separate acts specify federal goals, standard requirements, funding and partnerships;

b) the main focus is on inclusion and accessibility. Some US political circles emphasize the expansion of the participation of underrepresented groups in STEM (women, minorities, etc.);

c) agencies and strategies for the development of education play a large role in the educational field. Separate documents and strategies determine the direction of education development, but there is no mass implementation, and these proposals are more recommendatory and programmatic in nature than strict mandatory requirements for all states.

The regulatory framework for STEM education in Ukraine and the United States of America has different levels of institutional maturity and detail. In the United States, STEM education is clearly defined as a strategic priority of state policy, enshrined in specialized laws, national strategies, and long-term programs. In Ukraine, STEM education is largely integrated into framework laws on education and science, as well as in the concept and strategy for the development of education.

The American model of regulatory support for STEM education is characterized by systematicity, continuity, and stability. US legislative acts demonstrate a close relationship between STEM education, scientific research, innovative activity, economic competitiveness, and national security. This ensures the consistency of educational policy with the needs of the labor market and technological development.

The Ukrainian regulatory framework for STEM education is in a state of active formation and adaptation. It reflects modern challenges, in particular, digital transformation, the needs of the defense sector, and post-war recovery. At the same time, the fragmentation of regulatory acts and the dependence of the implementation of STEM initiatives on subordinate legislation and pilot programs are characteristic.

A common feature of the legislation of Ukraine and the USA is the orientation of STEM education on the development of key competencies of the 21st century: critical thinking, engineering approach, digital literacy, the ability to interdisciplinary integration of knowledge and practical activities. In both countries, STEM education is considered as a tool for training personnel for high-tech industries and science.

The key differences lie in the mechanisms for implementing STEM education: in the USA they have clear financial, institutional and interdepartmental support, while in Ukraine the effectiveness of STEM implementation largely depends on regional initiatives, international support and flexibility of educational institutions.

The analysis shows that the experience of the United States can be used in Ukraine to improve the regulatory framework for STEM education, in particular in terms of developing specialized laws or state programs, strengthening coordination between education, science, and the innovation sector, as well as ensuring sustainable financing of STEM initiatives. In general, the thematic component of STEM education in the legislative and regulatory documents of both countries confirms its strategic role in the development of modern education and science, while indicating the need for further systematization and deepening of regulatory regulation of STEM education in Ukraine, taking into account best international practices.

Література

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