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MAJOR ASPECTS OF STEM EDUCATION BASED ON U.S. GOVERNMENT INITIATIVES

КЛЮЧОВІ АСПЕКТИ STEM-ОСВІТИ НА ОСНОВІ ІНІЦІАТИВ УРЯДУ США

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ABSTRACT

Purpose. *The article is devoted to the study and historical and pedagogical analysis of the development and current state of STEM education in the United States of America, and with the identification of features, and significant changes in the regulatory framework, content, forms and methods of implementing STEM education in the USA. Studying the experience of the United States in the development of the STEM education sector, based on Federal Government initiatives, and studying the experience of training STEM specialists, can contribute to bringing the quality of Ukrainian education closer to international standards.*

Methodology. *The methodology includes specific-search and logical-synthetic analysis (for collecting, analyzing, systematizing and generalizing the provisions of historical, scientific-pedagogical, periodical, methodological, reference literature, and regulatory documentation); and system-structural analysis (for systematizing scientific*

Мета. *Стаття присвячена дослідженню та історико-педагогічному аналізу становлення, розвитку та сучасного стану STEM-освіти в Сполучених Штатах Америки, з визначенням ознак, сутнісних змін нормативної бази, змісту, форм та методів реалізації STEM-освіти у США. Вивчення досвіду Сполучених Штатів у розвитку сфери STEM-освіти, на основі ініціатив Федерального уряду, дослідження досвіду підготовки STEM-фахівців, може сприяти наближенню якості вітчизняної освіти до міжнародних стандартів.*

Методологія. *Методологія дослідження охоплює конкретно-пошуковий та логіко-синтетичний аналіз (для збору, аналізу, систематизації та узагальнення положень історичної, науково-педагогічної, періодичної, методичної, довідкової літератури, нормативної документації); системно-структурний аналіз (для*

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facts about education and STEM education in the USA).

In addition, we carried out chronological analysis (for describing the stages of development and highlighting the periods of reform of STEM education in the USA); statistical analysis (collection, processing, analysis of US educational statistics data); and comparative analysis of individual aspects of the development of STEM education in the USA. Theoretical-generalizing method and interpretation method (for formulating and substantiating conclusions based on the results of the study) were also used.

Results. *It is proven that during the second half of the 20th and early 21st centuries STEM education as a separate field has not only received Federal support and funding from the US government, but has also become a national priority of US public education policy, at each stage of development presented in the study.*

Conclusions. *Recognizing the decline in the literacy rate of the United States population in the second half of the 20th century and the increase in the gaps in the knowledge, skills, and professional competences of specialists in various fields, the US Government has made every effort to correct the situation. It adopted step by step a number of Laws that have become the basis and building blocks in building a STEM educational environment.*

There was the large-scale implementation of educational reforms in the US, innovations, and investments in those areas that worked to improve STEM teaching and learning, resulting in the coverage of STEM education by a larger part of society and the implementation of the «Education for All» strategy. It led to the wide access of the US population to high-quality continuing STEM education, and the country's achievement of leading positions in the field of STEM literacy, STEM innovations, and STEM professions.

Keywords: *STEM, STEM education, United States of America, school, university, Federal Government, Congress, law, President, Ukraine.*

систематизації наукових фактів про освіту та STEM-освіту США).

А також хронологічний аналіз (для опису етапів розвитку та виділення періодів реформування STEM-освіти США); статистичний (збір, обробка, аналіз даних освітньої статистики США); порівняльний аналіз окремих аспектів розвитку STEM-освіти у США. Теоретико-узагальнюючий метод та метод інтерпретації (для формулювання та обґрунтування висновків за результатами проведеного дослідження) ще були використані.

Результати. *Доведено, що протягом другої половини XX – початку XXI ст. STEM-освіта як окрема галузь не лише отримала Федеральну підтримку та фінансування уряду США, а й перетворилася на національний пріоритет державної освітньої політики США, на кожному етапі розвитку, наведеному в дослідженні.*

Висновок. *Визнаючи зниження рівня грамотності населення Сполучених Штатів Америки у другій половині XX ст. та збільшення прогалин у знаннях, навичках та фахових компетентностях спеціалістів різного напрямку, Уряд США доклав максимальних зусиль щоб виправити положення. Він приймав крок за кроком ряд Законів, які стали підґрунтям та цеглинами в будуванні STEM-освітнього середовища.*

Відбулася масштабна імплементація освітніх реформ в США, інновації та інвестиції в ті галузі, які працюють для покращення викладання та навчання STEM, результатом чого стало охоплення STEM-освітою більшої частини суспільства та запровадження стратегії «Освіта для всіх». Це сприяло широкому доступу населення США до високоякісної безперервної STEM-освіти та досягненню країною лідируючих позицій у галузі STEM-грамотності, STEM-інновацій та STEM-професій.

Ключові слова: *STEM, STEM-освіта, Сполучені Штати Америки, школа, університет, Федеральний уряд, Конгрес, закон, Президент, Україна.*

INTRODUCTION

A large-scale education reform is underway in Ukraine, which is reflected in a number of provisions, laws and measures, known as the Concept of Development of Science and

Mathematics Education (STEM education) (Cabinet of Ministers of Ukraine, 2021; Order of the Ministry of Education and Science of Ukraine № 1438, 2024; Order of the Ministry of Education and Science of Ukraine № 1462, 2024; Order of the Ministry of Education and Science of Ukraine № 1816, 2024).

STEM education has attracted significant global attention in the world, from teachers and researchers to politicians and financiers. The complexity of the modern world requires that the community of people be equipped with a certain set of professional skills and competences, the ability to solve complex problems, collect and evaluate evidence and make sense of the information they receive from various digital media.

STEM education helps to develop these skills and prepare students for further professional careers. It is recognized as a key driver of opportunities, where a set of basic cognitive knowledge and competences associated with STEM education is in demand not only in traditional STEM professions, but also in almost all sectors of the economy. Indeed, the education system cannot stand still, and the need for STEM education is widespread.

The Incheon Declaration «Education 2030» recommends strengthening STEM education as a key strategy for achieving the Sustainable Development Goals (UNESCO, 2015). In the last decade, STEM education has been seen as a means of increasing the global competitiveness of nations and ensuring their economic future (Breiner, et al., 2012; Gough, 2015; FIRST, 2025).

The acronym STEM stands for four interdisciplinary fields of education: science, technology, engineering and mathematics (Sanders, 2009). The United States of America is the basis of the conceptual foundations of the formation of STEM education in the global society. It was the first country to invest in the STEM ecosystem in order to maintain its primacy in world politics and increase its competitiveness in the global financial labor market.

Scientific and practical research shows that the need for STEM knowledge and competences will grow and will continue in the future (McComas & Burgin, 2020; Batyuk & Zhernovnykova, 2022). Significant socio-political and economic changes that are taking place during Ukraine's transition to an innovative path of development put forward new requirements for the professional training of specialists, especially highly qualified pedagogical personnel for work in a market economy (Batyuk & Zhernovnykova, 2023).

Studying the experience of developed countries in this area can help bring the quality of education in Ukraine closer to international standards. Therefore, research into the formation and development of STEM education in the United States of America, as a world leader in this field, based on Government initiatives and the experience of training specialists by American educational institutions, is interesting and necessary for Ukraine.

The **purpose** of the article is to conduct a historical and pedagogical analysis of the development and current state of STEM education in the United States of America, and to define a number of criterion features, namely, significant changes in the regulatory framework, content, forms, and methods of implementing STEM education in the United States.

METHODOLOGY

The article uses specific-search and logical-synthetic analysis (to collect, analyze, systematize and generalize the provisions of historical, scientific-pedagogical, periodical, methodological, reference literature, regulatory documentation); system-structural analysis (to systematize scientific facts about education and STEM education in the USA); chronological analysis (to describe the stages of development and highlight the periods of reform of STEM education in the USA); statistical analysis (collection, processing, analysis of US educational statistics data).

The comparative analysis of individual aspects of the development of STEM education in the USA; theoretical-generalizing method and interpretation method (to formulate and substantiate conclusions based on the results of the study) were also used.

RESULTS

The emergence of STEM education in the United States has a long history and a well-developed infrastructure, thanks to the adoption in the middle and late 20th century and early 21st century of basic laws on elementary, secondary, and higher education. The basic education laws adopted during this period created the prerequisites for the development of more specific acts for STEM education in the United States. One of them is the Elementary and Secondary Education Act (ESEA), signed by President Lyndon B. Johnson in 1965 (ESEA, 2025; Zascavage, 2010).

The Elementary and Secondary Education Act was a personal attempt by the President to improve the state of education in the United States; a kind of “cornerstone” in the war on poverty and illiteracy of the United States population (McLaughlin, 1975). This Act put public education at the forefront of the national attack on poverty and became a landmark commitment of the US Government to equal access for all educators to quality education (Jeffrey, 1978; Education Lawyers, 2025).

The framework of the Elementary and Secondary Education Act is a multi-faceted, broad statute that funds elementary and secondary education, emphasizing high standards and accountability. Under the Act, the U.S. Government provides funds for professional development, instructional materials, resources to support educational programs, and to promote parental involvement in children’s education. The Act was signed into law on April 9, 1965, and its appropriations were to be made over five fiscal years. The Government has reauthorized the Act for additional amendments every five years since its enactment.

During these reauthorizations, various amendments and additions have been made to the Act. Thus, the Elementary and Secondary Education Act focused on providing funds for disadvantaged children, library resources, textbooks, and other instructional materials for use in elementary and secondary schools. Moreover, this Act authorized the issuance of several grants to higher education institutions, organizations, and individuals to conduct research in the field of education. The Act has been updated several times over the past five decades (Federal Register, 2025).

Title I, a provision of the Elementary and Secondary Education Act, is essentially a program designed by the United States Department of Education to allocate funding to schools and school districts with a high percentage of students from low-income

families. This title has attracted the most attention from policymakers and legislators, as it accounted for 5/6 of the total funds approved by the ESEA.

In its original conception, Title I was designed to close the gap in literacy, numeracy, and education (now known as STEM education) between low-income children in urban or rural school systems and middle-class children in suburban school systems. Title II supported school libraries and textbook purchases for both private and public schools, and funded preschool programs. Title III, cited as the Adult Education Act of 1966, stated that centers and services for additional education would receive funding for additional support services to increase school attendance.

In addition, Title III provided for mandatory educational programming even when the school was not located in a formal school building and provided for special education and related services in isolated or rural areas. An amendment to the act in 1968 became the basis for the Bilingual Education Act and the Handicapped Education Act. Title IV of the Elementary and Secondary Education Act provided $100 million over a five-year period to fund educational research and training. Title V supplemented grants created under Public law to state departments. Finally, Title VI provided definitions and limitations related to the act (Jeffrey, 1978).

The public expectation of the Act was that once schools received the money, school systems would immediately reform and reach those children who had long been neglected by the U.S. education system. Although the Title I gains under the Act were modest and did not justify the rhetoric of Presidential administrations during the «War on Poverty», they were valuable in raising questions among educators about how best to educate the poor or undereducated (Jeffrey, 1978).

A vocal critic of ESEA, President Richard Nixon, signed amendments to Title II of the ESEA in 1969 that provided funding for programs for refugee children and children living in public or low-rent housing. Title VI was rewritten to address the education of individuals with disabilities, while Title VII strengthened the Vocational Education Act of 1963. Title VIII defined gifted and talented children and established the concept of a Teacher corps (Jeffrey, 1978; Zascavage, 2010).

The ESEA was revised in 1972 when Congress passed the Education Amendments of 1972 (Public Law № 92-318, 86 Stat. 235) as an amendment to the Higher Education Act of 1965, the Vocational Education Act of 1963, the General Education Provisions Act, and the Elementary and Secondary Education Act of 1965 (Bills and Statutes, 2025). The most controversial was Title IX, which is a comprehensive federal law that protects individuals from discrimination based on sex, male or female, in schools or other federally funded programs (United States Environmental Protection Agency, 2025).

In 1981, during the administration (1981–1989) of President Ronald Wilson Reagan, in order to reduce the federal influence of Title I regulations, the U.S. Congress passed the Education Consolidation and Improvement Act (ECIA) (Title I was renamed Chapter I). This reflected the Reagan administration's position that money should be in the hands of states and local jurisdictions, not held at the federal level. Despite these changes outlined in the ECIA, and the new definition of the Title, little to no progress was made in implementing it, and traditional Title I practices continued (Zascavage, 2010).

The Reagan Amendments emphasized mandatory bilingual educational programming, exemplified by Title II. Title VI of the Emergency Immigrant Education Act of 1984 provided state financial assistance to immigrants to cover the cost of English language instruction and other bilingual services. In addition, Title IV included important notes to the Women's Education Equity Amendments of 1984 and included amendments to the education of Native Americans (Zascavage, 2010).

In 1988, the Hawkins-Stafford Elementary and Secondary School Improvement Act refocused Chapter I on cultivating school programs of improvement and excellence. The conversation around Chapter I shifted from financial regulations to student achievement. The amendments called for synchronization between Chapter I and classroom instruction, raising the standard of achievement for low-income students by emphasizing advanced skills rather than basic skills, and increasing parental involvement.

It also introduced two new provisions: curriculum improvement and school-wide projects. All of these important changes were prerequisites for the emergence of STEM education and STEM projects. Curriculum improvement is a change that had to occur if the performance and proficiency of students receiving funding did not improve. Under the new Chapter I amendments, school-wide projects replaced the requirement that local funds had to match school-wide funding, a change that allowed more high-need schools to implement school-wide programs.

One of the key aspects of the development of STEM education in the US educational environment is the creation in 1992 of the «Dwight Eisenhower National Information Center» (ENC), whose mission is to identify effective educational resources and reproduce high-quality materials for the professional development of teachers and students and to disseminate useful information, educational materials, books and textbooks to improve the teaching and learning of mathematics and natural sciences in the K-12 education system.

It maintained a repository of educational materials and programs in elementary and secondary schools in natural and mathematical disciplines, as well coordinating databases, including curricula and educational materials in these disciplines at the expense of US Federal programs (Garet, et al., 1999).

Founded by the U.S. Department of Education at Ohio State University, the Eisenhower National Information Center in 2025 provides information on more than 24,000 curriculum resources and has more than 200 million connections to educators, schools, and universities; collaborates with professional organizations in STEM education and with federal agencies to increase public awareness; and participates in several digital library projects funded by the U.S. National Science Foundation (https://www.nsf.org/).

Seventy percent of the Eisenhower National Information Center's audience consists of STEM education teachers; 10% of the audience and registered online users are parents of students; and 20% are other members of the U.S. community. Improving teaching and student learning by providing high-quality professional development activities and funding in core subject areas (science, technology, mathematics, and engineering) to educational institutions and higher education institutions is the primary goal of the Dwight Eisenhower National Information Center (Eisenhower National Clearinghouse, 2025).

To encourage lifelong learning in the United States and improve the global job market, in 1995 the U.S. Department of Education additionally established the Eisenhower Regional Education Consortium for Mathematics and Science, which consists of 10 regional centers (U.S. Department of Education, n.d.). The main goal of the Regional Education Consortium is to reach a wider population and help elementary and secondary school students, teachers, and administrators implement teaching methods and use materials.

Among the innovations and achievements of the Eisenhower National Information Center, for the period from 2019 to 2025, the most important are support for STEM education policies, privileges for STEM research and grant programs, development of an academic research base, acquisition of literacy in mathematics, technology, engineering, and science, and standards-based learning.

Another, no less important program, in the early 1990s The National Teacher Training Project (NTTP) was created, aimed at non-profit educational institutions and designed to provide in-service training for teachers. Since 1990, this program has provided continuous training to improve the pedagogical, scientific and technical competence and professionalism of teachers at the federal, state and district levels.

The prerequisite for the creation of the National Teacher Training Project was a series of laws of the US Federal Government, which provided funds for the improvement of the qualifications of educators. Each state was required to review and reform state requirements for licensing and certification of teachers, develop performance assessments, and ensure the improvement of teachers' ability to use technology for students' understanding of core subjects. Priority in improving qualifications was given to natural and mathematical disciplines.

According to the NTTP charter, training that serves to form the pedagogical experience of stakeholders is carried out in each of the demanded disciplines, in mathematics and the natural sciences. The National Teacher Training Project had some influence on teacher education.

This influence was most noticeable in the mid-1990s, when a prominent group of deans of leading educational institutions, collectively known as the Holmes Group (Origins of The Holmes Partnership, 1997), initiated innovative changes in the teacher education program. They pioneered changes in professional development schools, and changes in general teacher certification requirements and educational programs that transformed the then United States education system so much that the result of its innovations and achievements is still used today (Youngs & Grogan, 2013; Snyder et al., 2019; The White House, 2025).

On October 20, 1994, William Jefferson Blythe III, the 42nd President of the United States, known as Bill Clinton, signed the Improving America's Schools Act (P.L. 103-382), better known as IASA (H.R., 2025). The Act's goal was to ensure that all students in the United States receive high-quality education, including those from low-income families or those struggling with poverty.

Thus, areas with a higher proportion of low-income families were to receive more funding than areas with higher-income families (Riddle, 1994). This law, supported by increased funding ($10 billion since 1994) aimed at improving the quality of teaching and

learning for students in U.S. schools, effectively reauthorized the 1965 Elementary and Secondary Education Act (ESEA) (Every Student Succeeds Act, 2025).

The 1993 National Chapter I Assessment highlighted the shortcomings of the 1980s Title I reforms. These shortcomings catalyzed the Improving America's Schools Act (IASA) of 1994, which significantly revised the original ESEA. IASA attempted to coordinate federal resources and policies with existing state and local efforts to improve learning for all students. This reform made three major changes to Title I:

1) Standards were added in mathematics and reading/language arts, to be used to assess student progress and ensure accountability;
2) The threshold for schools to implement school-wide programs was lowered from 75% of poverty to 50%. Schools were given a longer period of time to use federal funding from several programs to distribute funds at the school-wide level;
3) The Improving America's Schools Act provided more local control, coordinating efforts so that federal officials and states could waive federal requirements that hindered school improvement.

The Improving America's Schools Act initiated the trend of state assessments, extended the duration of existing school programs by five years, provided compensatory education for individuals with disabilities, created linkages between programs, and became the basis for the educational reform known as STEM/STREAM education (Riddle, 1994; Stedman, 1994; U.S. Department of Education, 1995).

Under the Act, schools, institutions, and districts that wished to continue receiving grants were required to develop a curriculum plan and an assessment plan. States were required to develop and administer assessments in at least mathematics, reading, or language arts within four years. In addition, the law established several programs to improve the quality of education.

The Improving America's Schools Act of 1994 allowed private foundations to support the use of technology in teaching and learning in elementary and secondary schools. Under the law, the United States Secretary of Education, Richard Wilson Riley (in office from 1993 to 2001), was to develop a national long-term plan for future U.S. education policy, in consultation with stakeholders such as U.S. national agencies and higher education institutions (Collection, 2025).

States that received or sought funding were to develop a statewide educational technology plan (Education Week, 1994). IASA authorized funds to improve the quality of science and mathematics teaching in U.S. elementary schools. One of IASA's programs was the Elementary Mathematics and Science Equipment Program (Ozfidan, et al., 2017); the purchase of equipment and materials needed for hands-on learning was also funded through the Improving America's Schools Act.

It is also important to mention the National Center for Education Statistics (NCES), which has existed in one form or another since 1967. The name and status of the agency have changed many times: first the agency was under the U.S. Department of the Interior, then the Federal Security Agency, then the U.S. Department of Health, Education, and Welfare. Since 1979, when the current U.S. Department of Education was created, NCES has been part of the Office of Educational Research and Improvement (OERI).

The Education Reform Act of 2002 placed NCES within the Institute of Educational Sciences (IES) of the U.S. Department of Education. The center continues to support the collection and presentation of statistical data and information to study the state and development of education in the United States and other countries in order to improve education in the United States (NCES, 2025; Snyder, et al., 2018).

The Clinton Administration's Education Act, signed into law in early 1994 and known as the Educate America Act (H.R. 1804 - Goals 2000: Educate America Act, 2025), set forth a set of national education goals for implementation and established a system of competitive discretionary grants to be awarded to states. United States Secretary of Education Richard Riley called it the "framework" for all other education initiatives that would follow the Act in the future.

One such initiative, early in Clinton's first term, was the Direct Student Loans program, under which the Department of Education provided money directly to students pursuing higher education, thereby saving taxpayers billions of dollars.

Another initiative was the annual "America Goes Back to School" campaign launched by the U.S. Secretary of Education, in which various Cabinet members frequently visited schools, and Riley himself took a "Success Express" bus tour, stopping at a number of rural schools, talking to teachers, and emphasizing academic standards, education as a social enterprise, and opportunity for all.

As the Washington Post wrote: "The Department of Education is powerless to shape how schools operate, and its work is more about raising awareness than launching programs" (Walker, et al., 2017).

The No Child Left Behind Act (P.L.107-110), known as NCLB, was signed into law by U.S. President George W. Bush in 2002 and reinstated the Elementary and Secondary Education Act of 1965 (ESEA) and served as the primary law for United States schooling, known as K-12, from 2002 to 2015 (No Child Left Behind, 2005).

This groundbreaking bipartisan law united Republicans and Democrats to expand opportunities for American children from all walks of life and provide all children with the quality education they deserve while maintaining control over education. The main focuses of U.S. education policy at this time were student assessment, the quality and relevance of the accountability system, and teacher qualifications (The White House, 2025).

One of the main goals of the law was to provide all students and educators, without exception, with quality education and knowledge; knowledge that will allow them to achieve, at least at a minimum level, knowledge that will meet the state standards and accepted educational norms. Each state in the country had to demonstrate that it had adopted challenging content and assessment standards. Each state had to have academic standards for all students, at a minimum in mathematics, reading, or language arts, and at a maximum in all natural sciences.

The goal was that by 2014, all students would be able to pass the assessment and reach the average level in the classroom. In addition, each state had to have annual statistics that would help to show the result of learning at the state level, and which were to be established separately for the assessment of mathematics, reading, natural sciences or other types of lessons, such as language arts.

As President of the United States, George W. Bush increased federal funding for schools to help students meet these expectations. He gave parents more information about schools and a greater say in how their children were educated. The rules ensured that parents received clear and timely notice of additional educational services in their public schools.

This guaranteed that states and districts would provide the public with more information about available tutors, how those providers were approved and monitored, and how effectively they were helping students learn. As a result, NCLB gave all students an equal chance to learn and achieve their dreams.

The results are clear: African-American, Hispanic, and white students in the United States achieved record-breaking performance in a number of categories over the years. NCLB required that annual assessments measure students' academic achievement in several subjects. Under the law, each state was required to test students in reading and math in grades 3-8 and once in high school.

They were required to report results for the student body as a whole and for specific "subgroups" of students, including English language learners and special education students, racial minorities, and children from low-income families. Until the 2013-2014 school year, states were required to bring all students to "proficiency" on state tests, although each state was required to decide individually what "proficiency" should look like and which tests to use.

By law, schools were required to measure their achievement of their goals using an "adequate yearly progress" or AYP report. If a school failed to meet its state's annual targets for two years or more, either for all students or for a specific subgroup, it was designated as "not making AYP" and subject to a series of increasingly severe sanctions (Klein, 2015).

The allocation of federal funds for STEM education since 2010 varies by type of higher education institution: some types of institutions may receive a greater share of support in the form of research and development, while others may have a greater share of scholarships, internships, training grants, or investments in general support for STEM/science and engineering, as the latter types of funding are considered fundamental to the development of research capacity.

Information on how the United States Federal Government allocates funds can be found in the National Center for Science and Engineering Statistics (NCSES) Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, which now serves as the module on Federal Science and Engineering Support in the Survey of Federal Research and Development Funds (Federal Research and Development Funds) and in the Office of Management and Budget.

Sixty-seven percent of U.S. jobs and 69% of the nation's gross domestic product (GDP) are supported by science, technology, engineering, and mathematics (STEM). An analysis conducted by FTI Consulting on behalf of 10 leading U.S. science, engineering, and industry organizations, including IEEE-USA, found that STEM supports a huge share of the U.S. economy and generates $2.3 trillion in federal tax revenue each year (https://ieeeusa.org/stem-supports-two-thirds-of-u-s-jobs/).

Created in 2010 under President Barack Obama, the Committee on STEM Education (known as CoSTEM) – a multi-agency federal agency – released its first five-year federal report in 2013, «Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) Education for America's Future» (President's Council of Advisors on Science and Technology, 2010), which identified all four STEM disciplines, including engineering and computer science, as fundamental components of a comprehensive education for all. The report also included information on promoting local innovation and investment in areas that work to improve STEM teaching and learning (The White House, 2016).

In 2025, the Committee on STEM Education continues its work and issues a new report that clearly spells out the responsibilities of CoStem (White House Office of Science and Technology Policy, 2025) for:

1. Coordinating STEM education programs or activities conducted by U.S. Federal agencies;
2. Administrative and budgetary management;
3. Striving to increase innovation and entrepreneurship in STEM education, programs, and grants;
4. Increasing documentation of indicators of participation rates of women, minorities, and individuals living in rural areas in STEM education activities;
5. Developing and implementing a 5-year STEM Education Strategic Plan that should include:
   - Short-term and long-term priorities;
   - Formulating and describing the standards for using and assessing progress toward goals;
   - Describing approaches to assessing the effectiveness of goals;
   - Identifying and engaging STEM education agency stakeholders;
   - Reporting on a list of Federal STEM education programs and activities to assess the same aspects of program and activity effectiveness.

The main goals of the Committee on STEM Education are to improve federally funded STEM education investments; government efficiency, coordination, and outreach to nongovernmental organizations; support youth and community engagement in STEM; improve undergraduate STEM education; improve STEM education for groups historically underrepresented in STEM; and improve graduate education to create new models for leveraging STEM assets and expertise.

The CoSTEM Strategic Plan builds on the strengths of the U.S. education system. The U.S. government's robust federal investment and state support for education policies have led to a surge in the number of students enrolled in graduate programs in STEM fields, from 303,000 in 1975 to nearly 668,000 in 2015, and to one million in 2023, according to the National Center for Science and Engineering Statistics (https://ncses.nsf.gov/).

According to the National Center for Science and Engineering Statistics «most of the growth during this period [in STEM enrollment] occurred in the 2000s, with steady

enrollment between 2008 and 2013 and renewed growth in 2014 and 2015» (https://ncses.nsf.gov/). The number of degrees awarded in STEM fields also increased significantly. In 2015, approximately 225,500 STEM degrees were awarded, including 181,000 at the master's level and 44,500 at the doctoral level. In 2023, 1.2 million individuals held a research doctorate in USA of a STEM fields (NCSES, 2025).

In 2016, the National Commission on Teaching and America's Future sent recommendations to the White House, declaring STEM education a national policy priority for the United States and providing ten reasons why STEM education was identified as a top priority for the nation's next innovation (Department of Education, Australian Government, n.d.).

In 2018, President Donald Trump signs the Inspiring the Next Generation of Women Space Pioneers, Innovators, Researchers, and Inventors (INSPIRE) Act, which prioritizes encouraging women and girls to pursue careers in STEM fields and to work at the National Aeronautics and Space Administration (H.R. 321, 2025).

On January 23, 2025, President Donald John Trump, who is the 47th and current president of the United States since 2025, signed the Executive Order as known as President's Council of Advisors on Science and Technology (PCAST) (The White House, 2025c), which establishes the Council of Advisors of the President on Science and Technology, designed to unite the brightest minds from academia, industry and government to lead the United States to America's leadership in science and technology. PCAST will cease to operate after two years from the date of this order, unless extended by the President.

The Executive Order consists of seven sections. Section 3 states that PCAST advises the President on issues related to science, technology, and education and innovation policy. The Council also provides the President with scientific and technical information necessary for the implementation of state policy concerning the American economy, American specialists, national and internal security research projects, including the research community; private sector; universities; national laboratories; state, local and tribal authorities; funds; and non-commercial organizations; and other topics.

Section 3(b)(iii) also provides that the Council shall serve as an advisory committee referred to in section 101(b) of the High-Performance Computing Act of 1991 (Public Law 102-194), as amended (15 U.S.C. 5511(b)), as PCAST will be called the Presidential Advisory Committee on Innovations and Technologies. Section 3(b)(iv) authorizes the Council to serve as an advisory group specified in section 4 of the 21st Century Nanotechnology Research and Development Act (Public Law 108-153), as amended (15 U.S.C. 7503), in which capacity PCAST will be called the National Advisory Group on Nanotechnology.

Pursuant to Section 4 (d), the Department of Energy shall provide such funding, as well as administrative and technical support, as may be required by PCAST, to the extent authorized by law and authorized by existing appropriations.

DISCUSSION

The main results of the study show that during the second half of the 20th and early 21st centuries, STEM education as a separate field not only received Federal support and

funding from the US government, but also became a national priority of US public education policy.

Each stage of development is presented in the study, starting with the Elementary and Secondary Education Act (ESEA), which was signed by President Lyndon B. Johnson in 1965 (P.L. 89-10), the adoption of the Individuals with Disabilities Education Act (IDEA) in 1975, which guaranteed free and appropriate education for students with disabilities (An Act, 1975; Ross, 2022).

It leads to the 1994 Improving America's Schools Act (IASA) and the Educate America Act, to the 2002 No Child Left Behind Act (NCLB), to the «Committee on STEM Education» (CoSTEM) founded in 2013, and to the Executive Order of US President Donald Trump and the creation of the «President's Council of Advisors on Science and Technology» (PCAST) and to legitimization of STEM education.

It began with the US concern about the low level of student achievement in science and mathematics and the recognition of the need to take drastic measures to improve the state of science and mathematics education, as well as the integration of technology and engineering into the specified subject areas, to the stages of standardization of STEM education, with the development of a number of professional associations, educational content standards, standards for assessing student achievement, and standards for professional training of teachers in the field, in both separate and integrated STEM disciplines.

It also led to the systematic implementation of STEM education through federal initiatives aimed at the development of STEM education, increasing funding for the specified field, and involving traditionally underrepresented categories of the population in STEM education.

The current stage (Lebedeva, Norik, Lebedev, 2022), (Chernenko, 2021) of the development of the phenomenon under study is characterized by the large-scale implementation of educational reforms in the United States, which resulted in the coverage of more students with STEM education and the introduction of an education for all strategy, which made it possible to provide wide access to high-quality continuing STEM education and achieve leading positions in the country in the field of STEM literacy, STEM innovations, and STEM professions.

CONCLUSIONS

The United States of America is a nation whose development, for a long time, in the realities of the global economic society was accompanied by persistent inequality in access, participation and success in education, limiting students in educational opportunities.

Recognizing the increasing gaps in knowledge, skills and professional competences of specialists, the US Federal Government has made maximum efforts to correct the situation, adopting step by step a number of Laws that have become the basis and bricks in building a STEM educational environment.

STEM education has provided the US nation with the opportunities and capabilities to close the gaps of knowledge poverty, meet the needs of a technology-driven economy,

ensure national security and maintain US superiority in scientific research and technological innovation.

It is likely that the education system, including STEM education, will continue to develop and adapt in response to changing social needs and the achievements of nano-technologies and the development of artificial intelligence. The use of technology in the classroom is likely to become even more widespread through the integration of virtual and augmented reality, online learning platforms, and other educational technology tools.

The education system will continue to become more inclusive and accessible, providing opportunities for a wider range of people from diverse backgrounds and communities to obtain quality education. Overall, the future of education is shaped by a combination of societal needs, technological advances, and ongoing efforts to improve and adapt the education system.

CONFLICT OF INTERESTS

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