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FEATURES OF MODERN HIGHER EDUCATION IN THE USA: STEM EDUCATION

***Abstract**. Obtaining higher education in the United States of America is a key catalyst for social mobility of the population, public confidence, which provides many individual advantages in modern society. In 2023-2024, graduates of higher education institutions in the United States will make up a larger share of employees in both public and private enterprises, compared to those with a lower level of education. The economic and social development of Ukraine, as a world leader, requires investment in education. In this regard, it is relevant to study the implementation of STEM education in higher education institutions in the United States of America, since over the past three decades the importance of STEM education for the country's economic competitiveness has been recognized by the United States Government as a level of official resolutions, laws and regulations, as an area that supports the development of ideas and solutions necessary to solve the country's global problems. The article examines the impact of the decentralization of the US higher education sector on the strategy, oversight, and accreditation of higher education institutions in the United States. The presence of independent and autonomous accreditation agencies in the US that can assess the performance of US higher education institutions is analyzed. The procedure for assessing the performance of US higher education institutions, which is implemented through funding for needs-based research, innovative programs, and individual federal loans, is analyzed, and covers such university areas as student education, management, academic programs, faculty and staff qualifications, and finance. The specifics of the distribution of STEM degrees in the field of bachelor's and master's degrees in private and public institutions are considered. The concept of «conceptualizing culture» in undergraduate STEM education is investigated. The influence of curators and teachers of STEM disciplines on the ability of students to succeed in STEM education is investigated. It has been determined that STEM education in the United States is characterized by support from the Federal Government and is the national educational framework of the United States, which ensures the competitiveness of the state in the field of future employment.*

***Keywords**: STEM education, USA, Ukraine, higher education institutions, teacher, bachelor's, master's.*

Introduction. The adoption in August 2020 by the Cabinet of Ministers of Ukraine of the Concept for the Development of Science and Mathematics Education (STEM Education), the implementation of which is planned until 2027 (Cabinet of Ministers of Ukraine. Order No. 960-p., 2020), (Cabinet of Ministers of Ukraine. Order No. 131-p., 2021) is a key link in the implementation of STEM education in Ukraine. This concept provides for a priority direction of science and mathematics educational disciplines in our country. It is obvious that the country needs millions of trained, creative scientists, scholars and teachers, specialists in science and mathematics, engineering, and technical fields, and it is also obvious that achieving the set goal is possible only by educating future generations. STEM education in schools and higher education institutions should be accessible to all, not only for reasons of equality, but also so that a democratic society can solve the problems facing it (Order of the Cabinet of Ministers of Ukraine № 286-r, 2022). Student education is always a complex and multifaceted process, built on the cooperation of the teacher and the student, based on the principles of socially significant and personally-oriented learning. Currently, these efforts are largely focused on inspiring students to pursue a career in STEM. This emphasis leads to educational programs that are targeted at specific groups of students and take into account the importance of science as a fundamental discipline for all students. The economic and social development of Ukraine, as a world-leading state, requires investment in education. In this regard, it is relevant to study the implementation of STEM education in higher education institutions in the United States of America, since over the past three decades, the importance of STEM for the country’s economic competitiveness has been recognized by the United States Government through official decrees, laws, and regulations (Co STEM), as an area that supports the development of ideas and solutions necessary to solve the country's global problems, namely, specialists with STEM degrees have, respectively, higher salaries and lower unemployment rates, and also eliminate the gender pay gap in many STEM fields. STEM degrees not only provide specialists with competencies that demonstrate knowledge in specific STEM fields, but also indicate that these individuals are likely to possess skills that are used and valued in various sectors of the financial and economic labor market. In addition to the interest in providing STEM knowledge and skills that will be valuable in the economy, there is the value of such knowledge and skills in supporting responsible citizenship in a democratic country. Studying STEM fields can enrich people as they fulfill different roles in society.

The purpose of the article is to investigate the implementation of STEM education in higher education institutions in the United States of America, and to determine the need to implement innovative conceptual ideas from the American experience in the context of the development of STEM education in Ukraine.

Methodology. In the process of writing the article, specific-search and logical-synthetic analysis were used (for collecting, analyzing, systematizing and generalizing the provisions of historical, scientific-pedagogical, periodical, methodological, reference literature, regulatory documentation); system-structural analysis (for systematizing scientific facts about education and STEM education); chronological analysis; statistical (collection, processing, analysis of data); comparative analysis of individual aspects of the development of higher education and STEM education; theoretical-generalizing method and interpretation method (for formulating and substantiating conclusions based on the results of the study).

Analysis of scientific research and publications. The analysis of scientific, methodological and pedagogical sources showed that certain issues of education in a multicultural and diverse ethnic society, such as the United States of America, occupy a significant place in the scientific research of domestic and foreign scientists. The research of Ukrainian scientists Ya. Belmaz, Ya. Huletska, O. Elbrecht, I. Zvarych, O. Koshmanova, M. Nagach, I. Pasynkova, O. Romanovsky, etc. is devoted to certain aspects of the development of higher education and pedagogy in the United States of America. Various aspects of the methodology of comparative pedagogy in higher education in the United States were studied in the works of such scientists as N. Avsheniuk, I. Bakhov, N. Bidyuk, O. Dzhurynsky, V. Zhukovsky, O. Ponomarenko, K. Rybachuk, etc. The formation and development of STEM education are highlighted in the works of such researchers as V. Boychenko, N. Valko, O. Kuzmenko, V. Pikalova, A. Rakhmaninova, O. Pylypenko, et al.

Higher education in the United States is a key catalyst for social mobility, public confidence, which provides many individual and societal benefits in modern society. The average annual earnings of those who have received higher education are significantly higher among college and university graduates than among those who have a certificate of complete secondary education (U.S. Bureau of Labor Statistics, 2023a). In 2023–2024 academic year, graduates of higher education institutions will make up a larger share of employees in both public and private enterprises, compared to those with a lower level of education (U.S. Bureau of Labor Statistics, 2023a). The unemployment rate among Americans with a bachelor's degree in 2023-2025 was just 2.1 %, about a third of the 5.8 % unemployment rate for those with a high school diploma (Figure 1). The unemployment rate for Americans with no high school diploma is about 4.0 % lower than for those with a college degree. And the unemployment rate for Americans with some college or associate’s degree is 3.1 % lower than for those with a bachelor’s degree (U.S. Bureau of Labor Statistics, 2023b). With some security and investment in their future, Americans with higher education also tend to have better health (National Center for Health Statistics, 2018, 2019), a sense of civic engagement, and are more socially active and involved in their communities (U.S. Census Bureau, 2021).

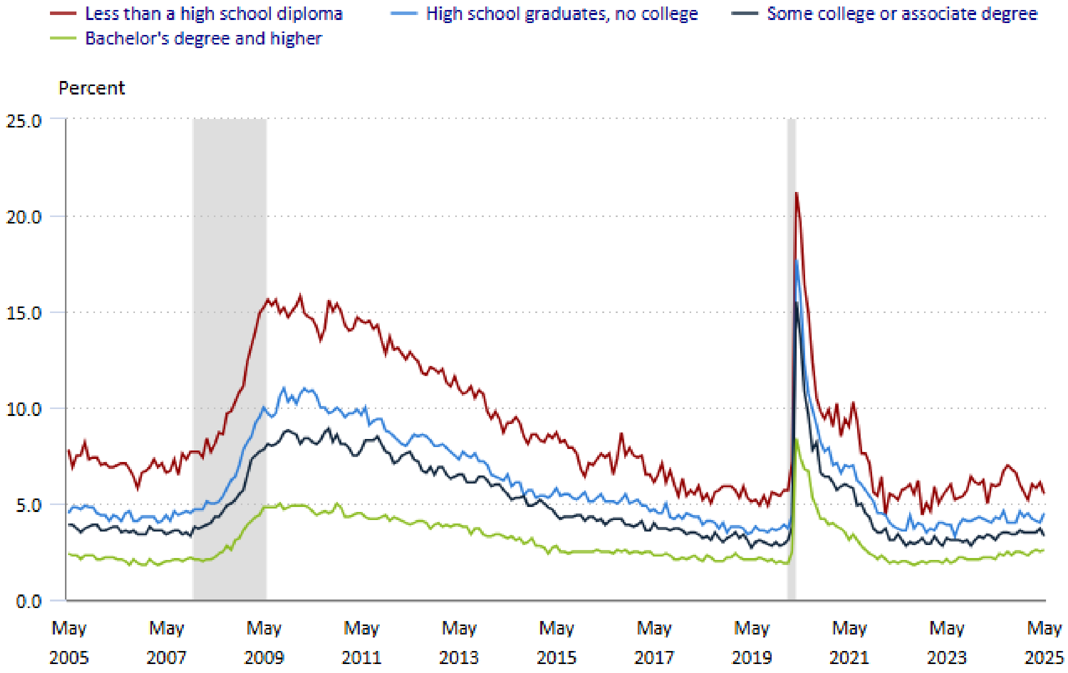

Fig. 1. Unemployment rate in USA from 2005 to 2025
by the level of education* (*Source: U.S. Bureau of Labor Statistics)

The decentralized higher education sector in the United States, which numbered 7 021 higher education institutions in 2015–2016, declined by approximately 2% during the 2023–2024 academic year, from 5 918 higher education institutions in the 2022–2023 academic year to 5 819 higher education institutions in 2024 (National Center for Education Statistics, 2025). Virtually all higher education institutions in the United States can be classified as private, public higher education institutions, technical colleges, community colleges, and liberal arts colleges.

Public universities in the United States are universities that exist and provide education to students at the expense of state taxes and in 89 % of cases are a certain structure, or a collection of public universities operating separately in different states of the country, but having a common management and administration. All courses and degrees at such universities can be offered at various levels of post-secondary education. Another significant difference is the tuition fee, which may be slightly higher for international students than for American students, but is usually lower than at private universities. The most popular public universities in the United States in 2025 are: University of California-Los Angeles (UCLA), University of California-Berkeley, University of Michigan-Ann Arbor, and University of Virginia (Top Public Schools, 2025). Unlike public universities, private universities are universities that are not sponsored or supported by the United States Government. They receive private funding through research grants awarded to outstanding faculty, through alumni donations, and through fairly high tuition fees. However, private universities are not completely independent, some of them receive government funding in the form of preferential tax conditions for the university, public student loans and grants provided by government organizations of the United States. Tuition fees at these universities are a little higher, unlike public universities, but remain the same for local and international students. Popular private universities according to the ranking in 2025 are the following universities: Harvard University, Stanford University, Columbia University New York, Massachusetts Institute of Technology (MIT), University of Pennsylvania, Duke University, Yale University. Additionally, universities like University of Southern California, Johns Hopkins University and New York University (World Scientist and University Rankings, 2025).

Four-year colleges and universities, both public and private, offer students the opportunity to earn a bachelor's or master’s degree after four years of study. Master’s and doctoral degrees can be earned at these institutions after two to seven additional years of study. In addition to institutions of this type in the United States, there is a well-developed two-year education sector or community college sector. In this educational space, you can also earn associate degrees, certificates, and transfer to four-year colleges. These are liberal arts colleges, well-known educational institutions that pay special attention to undergraduate studies in the humanities, natural sciences, and social sciences, which have fairly high academic standards that provide an individual approach. The best Liberal Arts Colleges in 2025 are Williams College (Williamstown, Massachusetts); Amherst College (Amherst, Massachusetts); Swarthmore College (Swarthmore, Pennsylvania); United States Naval Academy (Annapolis, Maryland); Bowdoin College (Brunswick, Maine) and other (Crimson Education, 2025). In addition to liberal arts colleges in the United States, there are community colleges that offer a two-year associate degree, which allows graduates to obtain a bachelor's degree at other colleges or universities after graduation, which is a fairly popular direction of study in the United States. Community colleges do not have dormitories on campus or student housing; in addition, community colleges have a limited number of student activities and sports teams or academic associations. However, these colleges are ideal for students with limited financial resources, as they allow you to get an education relatively inexpensively, unlike a full four-year education. This sector of education is in quite high demand among the public, and is the most important link for society and the workforce (Jurgens, 2010; Ma & Baum, 2016). Public institutions predominate among two- and four-year colleges, but private colleges are a prerequisite for those who have not passed the exams but want to obtain a higher education with minimal fees. Support for higher education by the Federal Government is a national framework in the United States that ensures the competitiveness of the state in the field of future employment. In addition to Federal support from the Government, education and universities in the United States are supported even at lower levels of government, the organizational structure is built in such a way that institutional charters are granted at the state level, and institutional accreditation is controlled at the regional level (Eaton, 2015).

The phenomenon of decentralization extends to the strategy, oversight, and accreditation of higher education institutions in the United States. In the United States, there are four types of independent, autonomous accrediting agencies that can conduct assessments of U.S. higher education institutions. These agencies include: 1) national accrediting agencies that are religiously or otherwise affiliated; 2) national accrediting agencies that are career-related; 3) regional accrediting agencies; and 4) specialized or programmatic accrediting agencies (Eaton, 2015). National accrediting agencies that are religiously and career-related conduct comprehensive reviews for higher education institutions with a particular affiliation, either religious and denominational (religiously affiliated) or career-related. Regional accrediting agencies conduct holistic institutional reviews of both public institutions of higher education and private two- and four-year institutions, but their work is limited to certain states.

Institutional review is conducted through needs-based research funding, innovation programs, and individual federal loans (Department of Education, 2018). Review is conducted every five to ten years and covers a broad range of university areas, including student learning, governance, academic programs, faculty and staff qualifications, and finance (Wheelan, 2016). Specialized, or program-based, accreditation agencies evaluate academic programs that are located within larger academic structures, such as law, health professions, and teacher education programs (Eaton, 2015).

The higher education system in the United States of America is well diversified, which can be represented in the form of a pyramid, where community colleges are at the base of the pyramid, and public universities and research universities are at the top. There are many public and private institutions for a student to choose from. A student can start his studies at a community college and graduate from a research university. In Europe, such transfer and mobility opportunities are practically impossible to achieve, unlike the American ones, which are built on competition for almost everything: professors, administrators, students, laboratory assistants, and, of course, grants. Thus, competition in almost all aspects of university academic life and funding somehow distinguishes American universities in a better light among universities in the rest of the world. But the recent financial turmoil, adopted by the decrees in the White House of Donald Trump's cabinet, has put, especially public institutions, in a financial difficult situation due to cuts in public funding across the country. The financial burden of higher education is having a profound impact on social mobility. Social mobility has always been a hallmark of American society, allowing a significant portion of it to move upward to participate in the "American dream." Ultimately, this could jeopardize access to universities for ordinary citizens.

Results. As defined by the National Academy of Engineering and the National Research Council in 2009, STEM education should include the following areas of study:

1) Science, which is the study of the natural world, human behavior, interactions, and social and economic systems. The study of this area includes the study of the laws of nature associated with physics, chemistry, and biology, and the development or application of facts, constants,

principles, concepts, theories, or conventions that are closely related to these disciplines.

2) Technology, which encompasses the entire social grouping of people and their organizations, as well as the knowledge, processes, tools, and devices used to create and operate technological facts and artifacts, and should also encompass the artifacts that are being or will be studied.

3) Engineering, as the complete body of knowledge about the design and creation of products that have been or will be created by man, and the process of solving problems that arise in the use of these products. The process is understood as designing under constraints, where one type of constraint in engineering design is the laws of nature, or science. Other types of constraints may include factors such as time, money, available materials, ergonomics, environmental regulations, manufacturability and maintainability. Engineering uses concepts from science and mathematics, as well as technological tools.

4) Mathematics, which studies the patterns and relationships between quantities, numbers, and shapes, and can include both theoretical mathematics and applied mathematics.

The National Science Foundation (NSF) has recognized the areas of use and learning of STEM as that are physical, biological, Earth, atmospheric, and ocean sciences; mathematics, statistics, and computer sciences; social, behavioral, and economic sciences; and all areas related to engineering and technology.

During the period of STEM education, the total population of the United States increased from 282 million to 329 million between 2002 and 2024, and society became more diverse (Vespa et al., 2020). At the same time, the overall share of the population with a college degree, defined as an associate degree or higher, increased from 35.0 % in 2002 to 48.1 % in 2024. Hispanics, African Americans, Native Americans or Alaska Natives, Native Hawaiians, and people from other Pacific Island communities were less likely to have completed college. These disparities in higher education attainment play a significant role in the growth of social and economic mobility among the country’s residents (U.S. Department of Education, 2016). College and university graduates are more likely to earn more over their lifetime than those with only a high school education. They are also more likely to vote, volunteer, and be responsible for themselves and their families (Ma & Pender, 2023).

The private sector, which provides opportunities for students to receive STEM higher education in the United States, differs significantly from the public sector in several ways. These sectors, when providing education to students, differ in their finances, management, and orientation of STEM specialists to rapid economic changes in the market. The private sectors are accountable to investors and shareholders who are guided by the principles of obtaining greater profits, as well as to state and federal governments, and they have a strong orientation to attracting students to study, because they must be able to quickly adapt to the economic growth of interest in the field of STEM specialties. Private higher education institutions can be both small enterprises represented by family firms and large corporate structures. In the United States, there are several types of for-profit educational institutions that offer students certificates and training without obtaining a degree, and are also entitled to award accredited associate, bachelor's, and master's degrees. They are usually accredited by national government agencies at the state level. Some offer STEM qualifications that do not require a 4-year degree, in a market area where there is an urgent need for specialists and the demand for students is very high. Private and public educational institutions provide certificates in the field of STEM education (Table 1).

Table 1

STEM certificates education (2024, USA)

STEM education	Private nonprofit (%)	Private for profit (%)	Public (%)
Science Technologies/Technicians	100,77	25,22	0,49
Engineering Technologies	2,33	6,58	8,48
Physical Sciences	4,83	6,81	3,26
Mathematics and Statistics	4,18	0,25	2,26
Computer and Information Sciences	8,28	96,73	9,18
Biological and Biomedical Science	17,21	50,71	10,20
Health education	52,28	83,5	56,81
Total	100	100	100

The most popular majors at private universities and colleges, such as California Institute of Technology (Caltech), Stanford University, Massachusetts Institute of Technology (MIT), Princeton University, Harvard University, Yale University, Johns Hopkins University, are Science Technologies/Technicians, Health Sciences, Biological and Biomedical Science, and Computer Science. Nonprofit private educational institutions in the United States, which are not for profit and are funded by public and sponsorship revenues, are heavily involved in private universities and colleges, as well as private high schools and boarding schools. Bachelor's degrees accounted for a much smaller share of total STEM education in fields such as Engineering Technologies, Physical Sciences, Mathematics and Statistics (see Table 1). Nevertheless, the number of graduates in the private sector and the scale of the for-profit sector are significant. While STEM degree awards at the bachelor's and master's levels have increased during the COVID-19 pandemic, doctoral degrees have decreased from 2020 to 2021.

When looking at the impact of STEM education on higher education in the United States in 2021, it should be noted that the number of STEM degrees awarded has increased as a percentage of the total number of degrees awarded from 2012 to 2021. In 2021, the majority of associate's degrees in STEM and related fields were awarded by community colleges. The most popular majors for students were health professions and related programs. The number of diplomas awarded to students in science and/or engineering and the number of doctoral degrees awarded by for-profit institutions increased by 58 % and 203 %, respectively, between 2012 and 2021. And the number of associate, bachelor's, and master's degrees awarded by for-profit institutions decreased by 82 %, 54 %, and 18 %, respectively.

Among the total number of education seekers, 79 000 higher education seekers received certificates in the field of STEM specialties; 155 000 higher education seekers received a junior specialist degree in the field of science and technology (STEM); 812 000 higher education seekers received a bachelor's degree in the field of science and technology (STEM); 217 000 higher education seekers received a master's degree in this direction (STEM). 48 000 seekers received a doctorate in the field of science and technology (STEM), which accounted for 66 % of the total number of doctorates.

STEM education has made a positive impact on the United States' diverse community. The percentage of certificates, diplomas, and degrees awarded in science and technology for American Indian students or students Alaska Native, Black or African American, and Hispanic for students increased at every qualification level between 2012 and 2021. STEM education has helped increase the number of international graduate students in science and technology studying in the United States, exceeding pre-COVID enrollment levels, from approximately 196,000 students in fall 2020 to 308 000 students in fall 2022. According to the National Center for Science and Engineering Statistics (NCSES), for 2025, in 2020, India issued the largest number of bachelor's and master's degrees in STEM, at 2.5 million, followed by China, which issued 2.0 million bachelor's and master's degrees in STEM to students, and the United States in third place. The United States issued 900 000 bachelor's and master's degrees to students. China awarded the largest number of doctorates in STEM, with 43 000 STEM doctorates awarded. China is followed by the United States, which awarded 42 000 STEM doctorates (National Center for Science and Engineering Statistics, 2025).

The availability and accessibility of a number of programs, such as the UTeach program, which is implemented at 46 American universities, or programs such as the Meyerhoff Fellows Program at the University of Maryland, Baltimore County, which is a unique educational and professional program, provide students with the opportunity not only to obtain a degree in STEM but also to address a number of social and relational aspects of STEM learning. In addition to teaching, these programs typically provide students with a range of extracurricular supports, as well as introducing changes to classroom teaching practices, changing teachers' expectations of underrepresented minority students, and creating modern learning environments and facilities.

The first UTeach program was introduced in 1997 at the University of Texas at Austin as "an innovative way to engage students majoring in science, technology, engineering, and mathematics (STEM) into the teaching profession and prepare them for professional and pedagogical work" (Marder, 2022). Unlike traditional teacher training programs that focus on secondary education or a STEM-related subject area, the UTeach program aims to simultaneously provide a bachelor's degree in an integrated STEM field and a secondary school teacher certificate. The program is four years long. The UTeach program is characterized by its compactness (total credits range from 120 to 126), achieved by reducing the number of required courses and eliminating a small number of courses that are higher-level in content. Upon completion of the UTeach program, students receive a bachelor's degree (BSc) in biology, chemistry, physics, mathematics, computer science, or engineering, and a teacher certificate (Partner with Us: Transform Your STEM Teacher Preparation Program, 2025). A scholarship program for undergraduates known as the Meyerhoff Scholarship began even earlier, in 1988, funded by Robert and Jane Meyerhoff and led by then-provost and later president Freeman Hrabowski. Later funding was also provided by the Howard Hughes Medical Institute and the National Institutes of Health. The program's original goal was to provide financial assistance, mentoring and advising, research experience, and access to quality education to black male students pursuing Ph.D. degrees in mathematics, science, and engineering, in what is now known as STEM. In 1990, the program was expanded to include black female students. According to a telling advertisement on the program's website, the program operates on "the principle that among like-minded people working closely together, positive energy is contagious. By bringing together such a high concentration of high-achieving students in a close-knit learning community, students continually inspire each other to do more and better" (UMBC, 2025). The program is largely focused on pushing students toward their goal of earning a Ph.D. degree. Supervision of Meyerhoff Fellows is highly structured, with frequent academic advising, preparation for graduate school and professional studies, and assistance with any personal issues that may interfere with their studies. Faculty members are responsible for advising fellows: students are encouraged to strive for not just straight A's but also straight A's. Advisors, mentors, and coaches discuss values such as outstanding academic achievement, reaching out for help, reaching out to tutors, advisors, and a variety of sources, among others. Students are repeatedly told that nothing is impossible if they try hard enough, put in the effort, and go for it. This program is one of many that best meets the core components of success in STEM education, which include the right selection of scientific, pedagogical, and organizational staff, financial assistance for students, program values, community, study groups, professional teachers and mentors, tutoring, counseling, a variety of summer research internships, many online programs, faculty involvement in student learning and life, administration involvement, and family involvement.

According to a study conducted by the National Research Council, the understanding of «conceptualizing culture» is very relevant for undergraduate STEM education (National Research Council, 2011). This direction of higher education prepares applicants to become members of professional groups, namely scientists, technologists, engineers, or mathematicians. Thus, STEM education can be viewed as a cultural process of the United States, in which educational disciplines, practical, and laboratory classes in the field of STEM reflect the cultural traditions and cultural values of future STEM specialists. But for the United States, as a multinational and diverse community, there are certain barriers, differences between culturally conditioned epistemological beliefs and the beliefs of the generally accepted scientific context. These barriers may not be seen by teachers, or they may be perceived as resistance or avoidance of students' interest in receiving STEM education. These barriers are particularly pronounced for Native Americans and Alaska Natives, and other indigenous peoples of the United States, whose ways of knowing and views of the nature of the world often differ from those found in classical STEM education (Aikenhead, 1998), (Bang et. al., 2007), (Cobern and Aikenhead, 1998), because STEM teaching that portrays scientific ways of knowing as free from contextual values may conflict with their cultural identity. Also important are the differences between groups of students who have traditionally been grouped along racial and ethnic lines. For example, among Latino students, 44.4 % of high school graduates in the South aged 18 to 24 enrolled in college in 2022, compared to 31.8 % of Puerto Ricans in the same demographic group. Among Asian students, the proportion of those ages 18 to 24 enrolled in college in 2022 ranged from 71.9 % for Asian-Americans to 51.4 % for Japanese adults. The fastest growth in undergraduate enrollment between 1999–2000 and 2019–2020 was among Latino students, who accounted for 11.3 percent of the total at the start of the 20-year period, 15.8 percent in 2011–2012, and 20.5 % in 2019–2020. Women accounted for more than half of undergraduate enrollment among all groups. The largest gender gap was among African-American students; in 2019–2020, 65.8 % of African-American undergraduates were women. African American students were the lowest-income group, with 43.9 % coming from families in the lowest income of students. White students were the highest-income group, with 34.5 % coming from the highest income quartile. Women were more likely than men to attend for-profit institutions (71 % vs. 58 %, respectively).

Increasingly, research on students' abilities regarding their academic abilities in STEM has linked with students' own beliefs about their academic performance and persistence in STEM (Carleone & Johnson, 2007), (Chemers et al., 2011), (Perez et al., 2014), (Williams & George-Jackson, 2014). Of course, ability signals which are describes in American learning culture namely, who is capable of learning and who is not are typically transmitted in academic settings and historically embedded in the structure and practices of student learning. These signals may influence students' views of their own abilities in STEM learning. Historically, research on implicit ability beliefs has shown that students who view abilities as fixed respond differently to academic environments than those who view abilities as flexible (Dweck & Leggett, 1988). The significant positive impact of support from STEM administrators and teachers aimed at convincing students of their ability to succeed in STEM subjects has been shown to help students achieve success in STEM, suggesting that the causes of low grades are unstable (i.e., related to effort rather than ability (Snipes et al., 2012), (Dai & Cromley, 2014). The positive relationship between beliefs and student achievement is particularly pronounced among Black students (Fleming, 1984). Thus, the academic climate at an educational institution may contribute to students' success and persistence in studying STEM subjects through a positive impact on students' self-esteem. In addition to self-confidence, students' connection to their communities may also improve students' academic engagement and, consequently, students' identification with their subject, including future positive grades in the subject. Connection with Community encompasses both a sense of belonging to an academic environment (institution, department, group) and a psychological sense of community (Good, 2012), (Hurtado et al., 2008), (Johnson, 2011, 2012), (Ko et al., 2014), (Locks et al., 2008). A study of an introductory electrical engineering course at a university in the Northwestern United States demonstrated that positive affect and positive relationships between students and other students and faculty were correlated with positive classroom experiences (Lee et al., 2006). In addition, these students had more positive career prospects. Students who did not feel a sense of community or belonging in STEM fields were more likely to leave STEM majors without completing their studies in higher education institutions (Smith et al., 2013).

In 2010, nearly 40 percent of students entering 2-year and 4-year colleges and universities intended to major in a STEM field during their studies. Today, about half of students who intend to earn a bachelor's degree in STEM and more than two-thirds of those who intend to earn a master's degree in STEM do not earn these degrees within the stated time frame and are enrolled longer than the stated duration of their programs (Eagan et al., 2014), (Van Noy & Zeidenberg, 2014). For example, students who intend to earn a bachelor's degree in biology enter the program expecting to graduate in 4 years, based on information provided to them by biology departments and colleges. But the extended time to earn a degree introduces new, increased costs that students and their families are often unprepared for. Understanding the challenges students face in obtaining STEM degrees and the reasons for the lengthening of their studies provides an opportunity to make STEM education more effective by offering new ways, means, and strategies for the development of higher education institutions in their pursuit of studying and obtaining STEM degrees.

Discussion. Educators and educational researchers devote countless hours and resources to improving undergraduate and graduate STEM education, working to help other educators who teach students after high school adopt a more inclusive, evidence-based approach to STEM education. They work locally and nationally through a variety of networks focused on a particular discipline (e.g., physics, biology, mathematics, or earth sciences) or to improve approaches to teaching STEM subjects (e.g., course-based research or high-quality educational resources) that can make learning engaging for a wide range of students. How can we minimize the attrition of students who, for various reasons, do not earn a STEM degree and achieve greater effectiveness? Understanding the challenges of the current system of 2- and 4-year STEM degrees has important implications for national education policy planning in the United States. Efforts by federal and state agencies and departments, as well as private funders of higher education, rely on representative data and analysis of what works, how it works, who needs it, under what circumstances, and what the state will actually and ultimately receive. Unfortunately, much of the data that could help address these national priorities in education and the workforce for 2025 remains either uncollected or collected in idiosyncratic formats that make it difficult or impossible to analyze future projections and hinder informed decision-making at all levels of the national education system in the United States. As in Ukraine, the United States still has an unresolved problem of tracking part-time students or students who transfer between institutions: both types of students represent a growing share of the total number of undergraduate students choosing STEM education. There are also no clear statistics that provide insight into the pathways students take to earn a STEM degree, including whether they enroll in a STEM program first or choose a STEM program later, and there is no data on students transferring between institutions. In the United States, these transfers can encompass a wide variety of combinations of STEM education, including transfers from a 2-year to a 4-year institution, or vice versa, students transferring from a 4-year to a 2-year institution, transfers between 2-year institutions, transfers between 4-year institutions, and combinations where students attend multiple institutions. Over the course of the development of STEM education, the model of student learning in the United States has changed significantly. In addition to the interest and motivation that students brought with them in the 1990s and 2000s, today's students of 2020-2025 bring with them experiences and cultures that the academic departments and institutions they enter must respond to, contributing to both the current outcomes and the more or less successful accreditation of these institutions in producing STEM graduates. They are valued by institutions, students, and policymakers because they are seen as meeting the primary purpose of most college students (Bailey & Xu, 2012). Furthermore, data on completion and progress are widely available and easier to collect consistently than other outcomes such as wages or employment.

However, it should be noted that graduation rates alone are not a complete measure of success, as they are influenced by factors beyond the control of the institution. Graduation rates are also influenced by the characteristics of the students who are admitted to the institution, with highly selective institutions of higher education being expected to have higher graduation rates than less selective institutions of higher education. Furthermore, a degree is not the ultimate goal of college students in the United States, especially among 2-year students: they may also seek to transfer to 4-year institutions without a degree in order to obtain a certificate or acquire professional competencies that are relevant to future work. Thus, graduation rates provide some insight into the success of a university STEM program, but this information must be supported by hard data on student preparation. A broader vision of STEM education success as a national educational framework in the United States is emerging from definitions developed by various stakeholders, including the American Association of Community Colleges, the Aspen Institute, the Bill & Melinda Gates Foundation, the National Association of Executives, and others, which shift the focus of the STEM education vision to a broader set of academic indicators, such as success in additional courses, required first-year completion, credit accumulation, clearly defined time to degree, retention and transfer rates, degrees earned, student diversity (gender and ethnic), and learning outcomes. This focus has been incorporated into the core STEM education framework, which includes factors such as academic performance and the quality of STEM education. For example, the Association of American Universities (AAU) framework that assesses the success of master's degrees in STEM education focuses on improving STEM teaching at the graduate level and on improving the culture of the learning environment. This framework includes three factors: 1) pedagogy, 2) cultural change, and 3) improvements in equipment, technology integration into classroom instruction, teacher professional development, and the use of data for continuous improvement. The National Research Council of the United States includes interpersonal and psychological factors as components of student success in its STEM education sector framework, namely, student academic engagement, interpersonal relationships, and student psychological well-being, recognizing flourishing as a desirable goal for students, by which they mean more than "survival" during college and graduation. Student flourishing means that students at all levels of education are engaged in the learning process; make the desired effort to achieve important educational goals; are able to effectively manage their time and commitments to others, teachers, and family members; have a positive attitude towards their choices in STEM education values; value differences in others; interact with others in healthy ways; contribute to the community and have an optimistic view of their future. Learners have an optimistic view of their future precisely because success is achieved when learners who are interested in STEM education are able to make informed decisions about the vector of learning; have an idea about motivation and career aspirations in STEM education; have a clear understanding of the content and variety of potential career paths associated with a STEM degree; have minimized the number of obstacles that can prevent progress in acquiring a STEM qualification; realize the connection between STEM education and societal problems; and have the goal of obtaining a degree or certificate in STEM education.

Conclusion. Science and mathematics (STEM) teachers at all levels are the key to realizing the vision of high-quality, engaging, active, and student-centered STEM education. Teachers must be fluent in the subject they teach, fluent in the pedagogy and scientific methodology of effective STEM teaching, and possess professional competence at a level sufficient to provide students with opportunities to develop their knowledge through problem-solving and experimentation (Batyuk, Zhernovnykova 2022). The US education system is structured in such a way that after successful enrollment in higher education institutions, students choose specialized and general educational disciplines under the guidance of experienced teachers, which made it possible to implement the basic principles of higher education in the United States of America, such as freedom of choice and differentiation of learning, where the student is not only a passive learner, but also an active participant in planning his educational STEM-learning process, during which his interests, capabilities and skills are taken into account. Analysis of the content of education at the bachelor's and master's levels in higher education institutions in the US indicates the training of specialists who meet the requirements of the time and is a necessary prerequisite for the progress and prosperity of the country. American scientists, teacher-scientists, as well as Ukrainian researchers, study not only various issues of teacher training in higher education institutions, but also the process of their continuous education and development throughout social life. The professional level and level of competence of a teacher at a higher education institution depends on the level of general educational and general cultural training of the teacher, on how the teacher understands the accreditation requirements for himself, as a teacher who can relate to the position of a professional teacher. An analysis of the experience of training bachelors and masters in STEM education in the United States of America, within the framework of the national educational framework, identified a row of scientific, pedagogical and multicultural principles in the structure and content, such as the functioning of various programs and educational disciplines; courses and educational camps; a favorable attitude towards students' creative abilities and thinking; motivation of students for lifelong education and work in a multicultural ethnic society; mentoring systems under the guidance of teachers and the organization of reference and consulting work of teachers on various issues of STEM education; familiarization of teachers with new developments in the field of theory and practice of pedagogical activity; progressive pedagogical technologies of teaching; introduction of flexible curricula and variable curricula; establishment of special boards for the assessment of professionalism; introduction of accreditation and certification procedures. STEM education is an important tool of the modern scientific and educational environment, which is successfully used by the educational environment of the United States of America of our time, as a result of which it has become a fundamental concept that improves the quality of decision-making in almost every aspect of the daily life of an educated person and the national priority that it should be, where local communities have the opportunity to provide high-quality, rigorous educational experiences equally to all students from elementary school to higher education.

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ОСОБЛИВОСТІ СУЧАСНОЇ ВИЩОЇ ОСВІТИ США: STEM-ОСВІТА

Отримання вищої освіти в Сполучених Штатах Америки є ключовим каталізатором соціальної мобільності населення, громадської впевненості, яка забезпечує багато індивідуальних переваг у сучасному суспільстві. У 2023-2024 рр., випускники закладів вищої освіти США становлять більшу частку працівників як на державних, так і на приватних підприємствах, порівняно з тими, хто має нижчий рівень освіти. Економічний та соціальний розвиток України, як держави-світового лідера вимагає інвестицій в освіту. В цьому аспекті доречним є дослідження впровадження STEM-освіти в заклади вищої освіти Сполучених Штатів Америки, оскільки останні три десятиліття важливість STEM-освіти для економічної конкурентоспроможності країни, була визнана Урядом Сполучених Штатів на рівні офіційних постанов, законів і нормативних актів, як сфери, що підтримує розвиток ідей та рішень, необхідних для вирішення глобальних проблем країни. У статті розглядається вплив децентралізації сектору вищої освіти США на стратегію, нагляд і акредитацію вищих навчальних закладів у Сполучених Штатах. Проаналізовано наявність в США незалежних та автономних акредитаційних агентств, які можуть провести оцінку роботи вищих навчальних закладів США. Проаналізовано порядок оцінки роботи вищих навчальних закладів США, який реалізується за рахунок фінансування досліджень на основі потреб, інноваційних програм та індивідуальних федеральних позик, та охоплює такі університетські сфери, як навчання студентів, управління, академічні програми, кваліфікація викладачів та персоналу, а також фінанси. Розглянуто специфіку розподілу ступенів в галузі STEM в області отримання ступеня бакалавра та магістра в приватних та державних установах. Досліджено поняття «концептуалізації культури» в STEM-освіті бакалаврів. Досліджено вплив кураторів та викладачів STEM-дисциплін на здатність студентів досягти успіху в STEM-навчанні. Визначено, що STEM-освіта в США характеризується підтримкою на Федеральному уряді та є національною освітньою рамкою США, яка забезпечує конкурентоспроможність держави в сфері майбутньої зайнятості.

***Ключові слова**: STEM-освіта, США, Україна, заклади вищої освіти, викладач, бакалавр, магістр.*

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