STEM-APPROACH IN EDUCATION AND PREPARATION OF THE TEACHER FOR ITS IMPLEMENTATION

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The article considers the essence and potential of STEM-education, the implementation of which is important for the training of specialists of the new generation and socio-economic development of our country. The core of the basic concepts of STEM-education as a new direction in education is revealed, the appearance of the acronym “STEM” is covered, its meaning is discussed, and the conceptual field of its synonymous categories is analyzed. The main advantages of this area and the main issues of STEM-approach implementation in the domestic education system are clarified. The experience of the world’s leading countries (including the USA, Great Britain, and Canada) in the implementation and development of STEM-education is analyzed. The conclusion about efficiency of activity of the establishments of the general secondary education focused on STEM-technologies is made. The necessity of improving the education system of Ukraine focusing on the experience of STEM programs implementation in the above-mentioned countries is substantiated. Possibilities of application of STEM-technologies in the New Ukrainian School (NUS) are defined (at an initial stage of training in particular). The conclusion is made about the need to restructure the whole learning process, which presupposes moving away from the teacher-centered model of learning, giving students initiative, stimulating their activity, activating development of critical thinking and creativity. It is noted that the role of teachers in STEM-education is changing, which, in turn, raises the issue of training and retraining of teachers who could work in this direction and transfer the process of STEM-education from individual to mass. The need to provide educational institutions with appropriate material resources (LEGO designing sets, computers, new generation of textbooks, etc.) has been confirmed.

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**STEM-ПІДХІД В ОСВІТІ ТА ПІДГОТОВКА ВЧИТЕЛЯ ДО ЙОГО ВПРОВАДЖЕННЯ**

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У статті проаналізовано сутність та потенціал STEM-освіти, впровадження якої стимулює зростання фахівців нової генерації та активізує соціальний та економічний розвиток держави. Представлено різноманітність термінологічного поля STEM-освіти як перспективної освітньої технології, простежено історичний шлях поява та розвитку акроніму “STEM”, розкрито його значення та проаналізовано його синонімічні категорії. Визначено основні переваги та проблеми впровадження STEM у систему освіти України. Проаналізовано досвід провідних країн світу (зокрема США, Великої Британії та Канади) у впровадженні та розвитку STEM-освіти. Зроблено висновок про ефективність діяльності закладів загальної середньої освіти на початковому етапі навчання. Зроблено висновок про необхідність забезпечення закладів освіти відповідними матеріальними ресурсами (конструкторами, комп’ютерами, книжками нового покоління тощо).

**Ключові слова:** конкурентоспроможний фахівець, природнича освіта, STEM-освіта, STEM-підхід у навчанні, STEM-технології, проєктні технології, підготовка і перепідготовка вчителя.

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**Introduction of the issue.** The reform of the education system of Ukraine, caused by the need to ensure the growth of its competitiveness in the economic sphere, the total digitalization of social life, the development of the latest technologies require qualitatively new approaches to the organization of the educational process. At the current stage of human development, the stated goals can be achieved only based on effective interaction of science, education, and innovative technologies in all spheres of society. However, we must admit that for now society is experiencing a shortage of specialists who are ready to participate in innovative processes and ensure its stable development.

We consider STEM to be a relevant direction for the modernization of science and mathematics education as it comprises a focused approach to learning that stimulates the increase in the motivation of young people to study subjects of the
science and mathematics cycle, allows us to realize the high demand for workers in the production sphere who can set and perform tasks in the fields of IT, engineering, nanotechnology, medicine, etc.

**Current state of the issue.** The foreign experience represented by the works of H. Gonzalez, J. Kuenzi, D. Langdon, K. Nichols and others is extremely useful and socially significant for the education system of Ukraine. A. Kelly, O. Misk, H. Fleishman, F. Hees, and others can be singled out among US scientists who have devoted their work to STEM education. In their opinion, STEM education is an important and promising direction of innovative education, the purpose of which is to form the ability to effectively apply acquired knowledge in professional activities, solving social problems, and personal self-realization through improving critical thinking skills.

The foreign experience of implementing STEM education and the possibility of its introduction into the education system of Ukraine is presented in the studies of V. Antonov, M. Boichenko, V. Boichenko, O. Buturlina, N. Polihun, K. Postova, I. Slipukhina, H. Onopchenko, O. Onopchenko, I. Khudetsky, and others. Various aspects of the introduction and use of technologies based on the STEM-approach in educational institutions are considered in the works of Ukrainian researchers N. Valko, V. Kamyshin, O. Lisovoi, V. Osadchyi, S. Semerikov, O. Stryzhak, O. Strutyńska, and others.

**Outline of unresolved issues brought up in the article.** At the same time, the theoretical and technological foundations of the implementation of STEM education in teacher training remain insufficiently studied.

**Aim of research** is to study the essence and advantages of STEM education, summarizing the foreign experience of its implementation in institutions of general secondary education and determining the features of the use of STEM technologies in teacher training in Ukraine.

**Results and discussion.** The analysis of research by scientists and regulatory documents on the issue allows us to state that STEM education is a modern дозволяє реалізувати високий запит на працівників виробничої сфери, здатних ставити і виконувати завдання у галузях IT, інженерії, нанотехнологій, медицині тощо.

Аналіз останніх досліджень і публікацій. Надзвичайно корисним та соціально значущим для системи освіти України є зарубіжний досвід, представлений роботами Х. Гонсалеса, Дж. Кунзі, Д. Ленгдона, К. Ніколса та ін. Серед науковців США, які присвятили свої праці STEM-освіті, можна виокремити А. Келлі, О. Міск, Г. Флейшман, Ф. Хес та ін. На їх думку, STEM-освіта є важливим і перспективним напрямком інноваційної освіти, мета якого полягає у формуванні здатності до ефективного застосування набутих знань у професійній діяльності, вирішенні соціальних проблем, особистісній самореалізації через поліпшення навичок критичного мислення.

Зарубіжний досвід реалізації STEM-освіти та можливості його впровадження у систему освіти України представлений у дослідженнях В. Антонова, М. Бойченка, В. Бойченка, О. Бутурліної, Н. Поліхун, К. Постової, І. Сліпухіної, Г. Онопченка, О. Онопченка, І. Худецького та ін. Різні аспекти впровадження й використання технологій на основі STEM-підходу в закладах освіти розглянутого в роботах українських дослідників Н. Валько, В. Камишина, О. Лісового, В. Осадчого, С. Семерікова, О. Стрижака, О. Струтинської та ін. Водночас, теоретичні і технологічні засади реалізації STEM-освіти у підготовці вчителів залишаються недостатньо вивченими.

Метою статті стало вивчення сутності та переваг STEM-освіти, узагальнення зарубіжного досвіду її реалізації у закладах загальної середньої освіти та визначення особливостей застосування STEM-технологій у підготовці вчителів в Україні.

Виоклад основного матеріалу. Аналіз досліджень науковців та нормативних документів з проблеми дозволяє стверджувати, що STEM-освіта – це сучасне педагогічне поняття, яке характеризує педагогічну технологію, спрямовану на формування і розвиток розумових, пізнавальних і творчих
pedagogical concept that characterizes pedagogical technology aimed at the formation and development of mental, cognitive and creative abilities of young people, which determine their competitiveness in the modern labor market, and which is implemented by applying an interdisciplinary approach in the development of educational programs in educational institutions of various levels.

The term STEM is an acronym denoting the first letters of the following areas of education: Science, Technology, Engineering and Mathematics. Note that Science in this context means the natural (environmental) sciences, not science in general, as this concept is interpreted in a number of domestic scientific works. In its current formulation, this term was proposed by the National Science Foundation (NSF) (USA) to denote the named disciplines instead of the acronym SMET. For the first time, the term STEM appears in the text of the NSF project called STEMTEC (Science, Technology, Engineering and Math Teacher Education Collaborative) in 1997.

However, STEM cannot be understood only as technical education since this technology involves the unity of technical knowledge with the individual's ability to creatively interpret it. That is why the content of STEM education combines a purely scientific aspect with the development of a creative component, which includes disciplines of a creative and artistic nature (design, architecture, industrial aesthetics, etc.). As M. Boichenko notes, "STEM education without artistic disciplines and creativity is already yesterday. STEM is transforming into STEAM (STEM + Art – art) – an improved version of STEM education into which art is integrated" [1; 2].

In his research, M. Boichenko notes that in modern conditions there is a whole conceptual field, which includes such concepts as: eSTEM – ecological STEM; METALS (STEAM + Logic), where Logic is added to the list of disciplines; MINT – Mathematics, Information Sciences, Natural Sciences and Technology; STREM – natural sciences (Science), technology (Technology), robotics (Robotics),
engineering and mathematics (Mathematics); STREM – where instead of mathematics, the letter M stands for multimedia technologies (Multimedia); STREAM – science, technology, robotics, engineering, art and mathematics; STEAM – where AM is applied mathematics (Applied Mathematics); GEMS (Girls in Engineering, Math, and Science) - involves the involvement of girls in the study of engineering, mathematics and natural sciences; STEMM – Science, Technology, Engineering, Mathematics and Medicine; AMSEE – applied mathematics (Applied math), natural sciences (Science), engineering and entrepreneurship (Entrepreneurship) [1; 2].

Thus, today the concept of STEM covers almost all natural and mathematical sciences, combining them into a single whole to strengthen the natural and scientific component in educational programs with an emphasis on innovative technologies, which are used even when studying creative, artistic disciplines. Moreover, in some foreign countries, musicians are taught not only to own a musical instrument, but also to be able to use various computer programs to create musical works, since learning is understood as a way of expanding consciousness and changing reality. STEM education in a number of foreign countries is a set of educational courses or special educational programs aimed at preparing students for further education after finishing school and successful employment, in particular in the engineering and technical field. Young people get the opportunity to simultaneously master theoretical knowledge (terminology, rules, laws, etc.) and check their effectiveness in practical activities (development of scientific projects, models, constructions, etc.). In this way, STEM education forms in students the skills and abilities necessary to ensure their competitiveness in the modern labor market.

From the above, we can conclude about the need to implement the STEM approach in education by building educational disciplines based on an interdisciplinary approach. At the same time, the emphasis
is on strengthening the interaction between science and creativity, entrepreneurial and innovative activities. The leading idea of such an approach can be considered the postulate of the need to "study natural sciences through other disciplines and, conversely, study other disciplines through natural sciences." This kind of learning technology allows for the comprehensive formation of key professional, personal and social competencies of young people, which will make them competitive in the labor market in the future. Such properties include the ability to solve complex problems, the presence of developed critical thinking and creativity, the ability to work in a team, carry out innovative activities, etc.) [5]. Under such conditions, the educational process turns out to be much more effective, as it turns into a kind of game that involves modeling, designing, and experimenting, and therefore is positively perceived by schoolchildren.

In addition, with regard to the organization of the educational process, STEM technologies revitalize the educational process; increase cognitive interest; develop flexibility in the application of knowledge; give much more freedom of action for the teacher and students; open opportunities for the implementation of creative ideas and ambitious plans; allow you to use and combine many sources of information, materials and resources; help save time and resources; stimulate the development of independence and responsibility of schoolchildren, help improve their ability to learn; allow taking into account the individual characteristics and psychological traits of schoolchildren; encourage cooperation between the teacher and colleagues, help to more actively involve the integration of educational disciplines.

The first experience of implementing STEM education was carried out in the USA, where today it covers educational activities at all levels of education (from preschool to doctorate) both formal and informal. Most scientists associate the emergence of the phenomenon of STEM education in the USA with the launch of an artificial Soviet satellite in 1957, but American researchers G. Gonzalez and...
J. Kuenzi [10] insist that the federal government’s attention to science and technology literacy is much longer and reaches the roots of the first Congress, when President J. Washington called for the development of such a branch of knowledge as the natural sciences for the development of the Republic. The increasing attention of the US government to STEM education during the second half of the 20th century is due to the country’s constant struggle for world leadership. It is STEM-literacy, together with STEM-professionalism, that American education policymakers consider to be the leading competencies of human capital in the economy of the 21st century.

In the UK, STEM education is the basis for innovation and technological progress, as a shortage of skilled professionals in these fields threatens the country’s ability to develop. That is why the growing need for STEM specialists has been recognized by the Labor Market Audit Agency as a priority area of action. In today’s environment, the UK has seen a significant increase in interest and investment in STEM education from a wide range of stakeholders: government, charities, professional associations, industry, and the scientific community. Various organizations are directing efforts to attract youth to the STEM field, offering a wide range of educational offerings, including numerous STEM-enriched programs in schools and colleges, professional development opportunities for teachers, and the development of educational resources. An important aspect is the introduction of appropriate programs for the professional development of teachers and measures to expand/enrich the content of their training with STEM disciplines [9].

In the field of STEM education, all students are involved in research-oriented learning, cooperation with classmates, open solving of problems arising in the real world, practical classes in STEM disciplines, interaction with scientists, engineers and other specialists. Thus, in the USA, such opportunities are realized mainly within the framework of informal, extracurricular activities (content
Enrichment (for example, summer camps, visits to natural history museums, math circles). Extracurricular education is extremely valuable, first of all, in maintaining interest in STEM, but it is not enough, since students spend most of their time in the educational institution, so curricular and extracurricular activities in this direction must be synchronized.

Early involvement in STEM education is extremely important, as interest in STEM disciplines most often manifests itself in elementary school age, and therefore early immersion in STEM allows for future career choices related to the subject of interest. Because engineering is a highly innovative field, engaging students in engineering (e.g., robotics, invention competitions, etc.) can strengthen interest in STEM. However, involvement in the engineering business within junior and middle classes of GSE (general secondary education) institutions is not widespread enough.

Often, students are underprepared for enriched content because they have not had access to the necessary resources or have not been immersed in a stimulating educational environment. One of the ways to overcome this contradiction is the so-called "bridge programming": specially developed "bridge programs" help to increase the level of the student's educational achievements in such a way that it corresponds to his personal potential, increase the student's confidence in his abilities, and participate in activities on a par with classmates who have high academic achievements [12].

In modern conditions, there are about 100 public high schools in the USA that specialize in the study of STEM disciplines. In such institutions students are combined into groups based on a common interest for in-depth study of STEM content. Schoolchildren are involved in quasi-professional and research activities, where they get to know role models of STEM professions, can feel like real STEM specialists in their workplaces, and even make discoveries. Such educational institutions include charter schools, magnet schools, boarding schools, and provide programs for moving a student from one class in which he is studying to

навчання, співробітництва з однокласниками, відкритого розв'язання проблем, що виникають у реальному світі, практичних занять зі STEM-дисциплін, взаємодії з учнями, інженерами та іншими фахівцями. Так, у США такі можливості реалізуються переважно в межах неформальної, позанавчальної діяльності (збагачення змісту) (наприклад, літні табори, відвідування музеїв природознавства, математичних гуртків). Позашкільна освіта є надзвичайно цінною, насамперед, у підтриманні інтересу до STEM, однак недостатньою, оскільки учні проводять більшість часу саме в закладі освіти, тому навчальна й позанавчальна діяльність у цьому напрямі має бути синхронізовані.

Надзвичайно важливим є раннє зауваження до STEM-освіти, оскільки інтерес до STEM-дисциплін найчастіше проявляється в молодшому шкільному віці, а тому раннє занурення в STEM дозволяє зробити в майбутньому вибір професії, пов'язаної з предметом інтересу. Оскільки інженерія є галуззю, у якій активно запроваджуються інновації, зауваження школярів до інженерної справи (наприклад, робототехніки, винахідницьких змагань тощо) може змінити інтерес до STEM. Однак, зауваження до інженерної справи в межах молодших і середніх класів закладів ЗСО є не досить поширенням.

Часто учні є недостатньо підготовленими до збагаченого контенту, оскільки вони не мали доступ до необхідних ресурсів або не були занурені до стимулювального освітнього середовища. Одним зі шляхів подолання такої суперечності є так зване «місткове програмування» (bridge programming): спеціально розроблені «програми-містки» допомагають підвищити рівень навчальних досягнень учнів таким чином, щоб він відповідав його особистісному потенціалу, підвищити впевненість учні у своїх можливостях, а також брати участь у діяльності на рівні з однокласниками, які мають високі навчальні досягнення [12].

В сучасних умовах у США функціонують близько 100 державних середніх шкіл, які спеціалізуються на вивченні STEM-дисциплін. У таких закладах учнів
another during the school day to enrich the content of education (pull-out programs). About 47,000 schoolchildren receive their education in these educational institutions, most of whom are students at senior secondary schools [11].

Thus, as evidenced by the analysis of foreign experience, STEM education is a rather promising direction, as it allows students to fully reveal their own potential.

In Ukraine, the STEM approach is used in schools and extracurricular education throughout the country, which is associated with increasing the motivation of schoolchildren to study subjects of the natural and mathematical cycle. In addition, in recent times, high demand in the production sphere for highly professional workers in the fields of engineering, IT, construction, nanotechnology, aircraft construction, and others should be expected.

STEM programs, which integrate technology, mathematics, and natural sciences, are aimed primarily at middle and high school students, as well as those pursuing higher education. However, the STEM-approach can be implemented in primary grades and even in preschool education institutions. This process should be carried out by gradually increasing the share of independent activity of students in learning. Thus, in elementary school, the teacher stimulates students to search under his guidance; in elementary school, it becomes possible to independently conduct research within the curriculum (using the appropriate algorithm, go through all the described stages of scientific research and obtain a new fact); high school is characterized by the possibility of independent research on topics that go beyond the scope of the program material (students participate in the work of the National Academy of Sciences, creative contests, tournaments, Olympiads, working independently, sometimes turning to the teacher for advice; the result of this work, as a rule, is writing and defense scientific work); and, finally, at the senior stages of schooling, students are able to carry out scientific research on a topic of interest to them, while achieving a practical result in the areas of their choice.
form of developing their own Startup.

It is worth noting that STEM education involves, first of all, a change in the form of education. The focus of STEM-based classes is on a practical task (problem) that makes learning meaningful for students. They learn to find ways to solve a problem not in theory, but just now through trial and error. STEM learning begins with students learning foundational skills and then using critical thinking to solve a variety of real-world problems. Starting from the initial level of education, specialized tools are used in classes, such as constructors, computer programs for graphics and animation, etc. Students work together in teams and use research materials to solve a problem. Such an educational environment allows children to establish connections between theoretical concepts and how these concepts are applied in the real world [7].

The implementation of the STEM approach in education requires special training for both the practitioner and the future teacher since STEM classes are fundamentally different from a traditional school lesson. First of all, this is a form of material submission, which is carried out using the project method. Students focus on specific projects, within which they have to solve a real problem with the help of technical or engineering solutions, for example: study the essence of friction, designing a car or a ramp surface; shoot a movie (create an animation of the movement of solar flares or develop FlipBooks); try yourself as an engineer (build a simple mechanism for transporting goods for the city of the future); scientific and engineering practice (develop models, make things more powerful or faster, apply logical thinking and knowledge of mathematics); master robotics (learn to manage robots, create the simplest algorithms, form spatial thinking, think consistently and algorithmize processes).

Such classes, as a rule, do not fit into the framework of the traditional class-lesson system. Their duration goes beyond 40 or 45 minutes, requiring a combination of school lessons for the couple. Moreover, students can work on one project for several classes, and often this work
stretches for a month. The project usually ends with a presentation, which the children plan independently, determining its form.

The project method involves a democratic model of communication between the teacher and the students. At the same time, the usual role of the teacher changes, becoming a coach or facilitator, helping students to organize interaction, brainstorming, and telling them how and where to find the necessary information. At the same time, the teacher should not impose his ideas on the students or push them to their conclusions. STEM education is carried out thanks to the cooperation of the teacher and the student: communication, joint research, solving real problems.

With the STEM approach, the child acquires greater autonomy, learns to be independent in making his own decisions, to take responsibility. At the same time, the relationship between the student and the teacher has much less influence on the learning process. This allows to evaluate the progress of each child more objectively.

The importance and value of STEM education also lies in the fact that it encourages the child to think in an integrated way when it is necessary to "extract" information from different fields of knowledge and creatively process it to offer something unique and innovative. Even though STEM education is related to natural sciences and mathematics, the integration of other disciplines (art, Ukrainian language and social and humanities) allows young researchers to see that real-world problems are interdisciplinary and provide unlimited space for creativity.

Another important feature of STEM education is teamwork, which involves a lot of interaction, when there is a need to convince, negotiate, choose the best option, so that the solution satisfies everyone. Such activity forms communicative and social skills, teaches schoolchildren to consider the opinions and needs of other people, contributes to their personal development and socialization.

It is clear that the teacher must be
prepared to organize such a process. However, the modern higher school of Ukraine still provides such training on a point-by-point basis, which is related to the state of teachers’ awareness of the essence and possibilities of STEM education.

A special place in the preparation of the teacher for the implementation of the STEM approach in education is occupied by relevant literature. Today, teachers and parents of students can use educational books for children dedicated to the STEM approach in their activities. First of all, this is a line of books for children 8-12 years old, launched by the "Talent" publishing house under the slogan "STEM education begins at home" [4]. Among them are books by Colin Stewart ("Amazing Atoms and the Chaos of Matter" and "Magnificent Numbers and Cool Calculations") and Nick Arnold ("Fantastic Powers and Incredible Machines" and "Tools, Robotics and Lots of Gadgets"). The child will also be interested in Rob Beatty's book "Amazing Science", which offers experiments that integrate knowledge from various fields (70 experiments that can be carried out at home are described). It is also worth mentioning Mike Barfield’s books "Get rid of this book for science!", "Get rid of this book again for science" and others.

All the above-mentioned books are distinguished by a clear structure and simple explanations of quite complex phenomena or technologies. Each book contains interesting facts and experiments. So, for example, in the book "Tools, robotics and many gadgets" from the chapter on speed boats, you can learn about what the first boats on Earth were like, how they work, how the propeller works, what is Newton’s third law, who is the same Newton. You can even build your own "jet boat" from a plastic bottle, a tube, vinegar, and baking soda, since all the ingredients are at hand, and you can do it at home yourself or with the help of relatives. At the same time, science and research in these books are presented as

науками та математикою, інтеграція інших дисциплін (мистецтва, української мови та суспільно-гуманітарних наук) дозволяє юним дослідникам побачити, що проблеми реального світу є міждисциплінарними і дають необмежений простір для творчості.

Ще однією важливою особливістю STEM-навчання є робота в команді, що передбачає велику кількість взаємодії, коли виникає потреба переконувати, домовлятися, обирати найкращий варіант, щоб рішення задовольнило всіх. Така діяльність формує комунікативні, соціальні навички, навчає школярів враховувати думку та потреби інших людей, сприяє їх особистісному розвитку і соціалізації.

Зрозуміло, що для організації такого процесу вчитель повинен бути підготовленим. Однак сучасна вища школа України поки здійснює таку підготовку точково, що пов’язано із станом обізнаності викладачів із сутністю та можливостями STEM-освіти.

Окреме місце у підготовці вчителя до реалізації STEM-підходу у навчанні посідає відповідна література. Сьогодені вчителі та батьки учнів мають можливість використовувати у своїй діяльності пізнавальні книжки для дітей, присвячені STEM-підходу. Передусім, це лінійка книжок для дітей 8-12 років, яку започаткувало видавництво "Талант" під слоганом "STEM-освіта починається вдома" [4]. Серед них книжки Кольїна Стоарта ("Дивовижні атоми та хаос матерії" і "Чудові числа і круті розрахунки") та Ніка Арнольда ("Фантастичні сили і неймовірні машини" та "Інструменти, роботизація й безці гаджетів"). Зацікавить дитину і книжка Роба Бітті "Дивовижна наука", яка пропонує дослідити, щоб інтегрують знання з різних сфер (описано 70 експериментів, які можна провести в домашніх умовах). Варто згадати й книжки Майка Барфілда "Позбався цієї книги заради науки!", "Позбався знову цієї книги заради науки" та інші.

Всі названі вище книжки відрізняються чіткою структурою і простими поясненнями досить складних явищ чи технологій. Кожна книга містить цікаві факти та експерименти. Так, наприклад, у книжці "Інструменти, роботизація й безці
the STEM approach suggests: as an exciting pastime, not dry and complicated.

Therefore, education based on the STEM approach promotes the development of critical thinking and creative abilities of each student.

Conclusions and research perspectives. The goal of STEM education is the development of scientific and technical competencies of young people, and it is aimed at solving the problem of insufficient engineering personnel. This is one of the leading and promising directions of world education, which involves the integration of various fields of knowledge (natural sciences, technology, engineering, mathematics, etc.), develops interest in research activities, prepares young people for a successful competitive life in a technologically advanced society.

The implementation of the STEM-approach in practice allows students to be taught to think critically, quickly and effectively find the necessary information, solve complex problems, make responsible decisions, cooperate in a team, and creatively present the results of their own research. At the same time, the basis of training is a specific task or problem, which students learn to solve not in theory, but through practical activities built on the implementation of a specific project.

So, it can be argued that the introduction of STEM into the educational process of a modern school allows students to develop the most important characteristics that define a competent specialist. In addition, STEM will contribute to the construction of a fundamentally new model of science and mathematics education, opening up new opportunities for both students and teachers.

However, STEM education involves expanding the range of forms and methods of learning, methods of educational interaction, which a modern teacher should possess. To form the key competencies of students, the teacher
should rely on an interdisciplinary approach, develop a system of integrated tasks aimed at applying knowledge to solve specific problems in practical research situations.

All this actualizes the need for training and retraining of teachers capable of working effectively in the field of STEM education and bringing the process of its implementation to a mass level. It is also necessary to strengthen the material and technical support of educational institutions with the necessary resources (designers, robotics, computers, etc.), as well as to improve approaches to assessment and stimulation of all participants in STEM education.

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