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The STEAM Approach: Implementation and Educational, Social and Economic Consequences

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Abstract: Nowadays, STEAM-learning as a trend in world education accumulates the educational, developmental and educational potential of science, technology, engineering, creativity and mathematics. This training is based on an interdisciplinary and applied approach that integrates disciplines into a single training scheme and ensures the integration of the maximum number of skills. The context of STEAM education implies a mixed environment and shows how the scientific method can be applied in life. Currently, State programs in the field of using the STEAM educational system are being implemented in a number of highly developed countries. The article deals with the issues based on the content of the STEAM approach, the process of implementation and educational, social and economic consequences.

Keywords: STEAM, integration, educational system, quality of education.

INTRODUCTION

Currently, employers' requirements for the quality of education of employees, the level of their professional training and professional competencies are increasing. Today, the modern labor market needs well-educated, enterprising people who can independently make responsible decisions, predict their possible consequences, be able to work in a team, be mobile, dynamic, constructive and have a developed sense of responsibility for the fate of their country [5]. This is a determining factor in the need to study entrepreneurship from school. If you decipher this abbreviation, you get the following: S - science, T - technology, E - engineering, A - art and M - mathematics. Translated from English, it will sound like this: natural sciences, technology, engineering, creativity, mathematics. Note that these disciplines are becoming the most popular in the modern world. That is why today the STEAM system is developing as one of the main trends. STEAM education is based on the application of an interdisciplinary and applied approach, as well as the integration of all five disciplines into a single learning scheme. But why such a high demand? In many countries, STEAM education is a priority for several reasons:

In the distant future, we will have professions that will be associated with technology and high-tech production at the interface with the natural sciences, in particular there will be a large demand for specialists in bio- and nanotechnologies.

Specialists will require comprehensive training and knowledge from a wide range of areas of technology, natural sciences and engineering.

MATERIALS AND DISCUSSIONS

So, how does this system of education differ from the traditional way of teaching the sciences? STEAM education involves a mixed environment in which students begin to understand how scientific methods can be applied in practice. Students in this program, in addition to mathematics and physics, study robotics, on which they program and design their own robots. In the classroom, special technological equipment is used. Thus,

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the future belongs to technology, and the future of technology belongs to teachers of a new format, who are free from prejudice, do not accept a formal approach and can "blow up the brain" of students with their knowledge and expand their horizons to infinity. Integrated STEM learning may integrate concepts from more than one discipline (for example, math and science or science, technology, and engineering);

STEM learning can link the concept of one subject to the practice of another, such as applying the properties of geometric shapes (mathematics) to engineering design;

STEM can combine two practices such as scientific research (for example, conducting an experiment) and engineering design (which can use data from a scientific experiment);

In integrated STEM education, one of the subjects may play a dominant role, in which case the explicit or implicit goal of the project, program or school is to develop students' knowledge or skills in mainly one area of content;

Including concepts or practices from other STEM subjects may be designed to support or deepen learning and understanding in the target subject [3] etc. On the other hand, due to the predominantly advisory nature of many American educational policy documents, the practice of STEM/STEAM education in the country continues to be heterogeneous and varied.

As for the STEM strategy, along with other options for implementing the integrative idea, it is becoming more and more widespread in the world, is recognized as a promising direction for updating education, and is receiving more and more support and stimulation from the state. So, an important role in this process was played by the installation on the need to develop engineering education. So, among the main ones, A.O.Repin identifies four approaches:

- the first involves expanding the learning experience of students in selected STEM subjects through the use of problem-based learning activities, during which analytical concepts are applied to real problems in order to better understand students of complex concepts;
- the second is focused on integrating knowledge of STEM subjects in order to create a deeper understanding of their content, which should ultimately lead to the expansion of students' opportunities in the future choice of their technical or scientific career direction;
- the third is aimed at using inter activeness in teaching STEM disciplines in the form as it is done in real production conditions (students can apply their knowledge in the conditions of problem-oriented learning activities based on the method of projects, technical design or within a separate school subject that provides a high level of development of STEM subjects);
- the fourth assumes interactivity and such a way of introducing innovations in the methodology of teaching each of the individual STEM subjects, in which the basic concepts of natural science, technology, engineering and mathematics are transferred to one curriculum, called STEM [4].

It seems that the above approaches outline four main promising directions for using the STEM / STEAM strategy and organizing interdisciplinary interaction in school education. Probably, each of these directions is promising and can be successfully implemented by the school. However, in this regard, it is important to note that at present it is still difficult to talk about what the priorities of schools are when choosing the indicated directions. This is due to the fact that the experience of implementing the STEM/STEAM strategy in schools has not yet developed: the implementation of this strategy is only at the very beginning. Nevertheless, it seems possible and extremely important to give some examples of the use of STEM education in schools, since these examples can become a kind of guidelines for organizing interdisciplinary interaction in a mass school, in

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particular, within the framework of integrating the subjects of the natural science cycle, mathematics and computer science. As a result, new conditions of activity require teachers to possess professional skills of a new quality:

- ✓ ability to work in a computer information environment;
- ✓ the ability to build communication on the basis of "horizontal" rather than "vertical" links;
- ✓ pedagogical design skills (ability to independently develop assessment tools, teaching and control materials, etc.).

The STEM-centered approach is dominated by the traditional subject-centered structure of science education; the integrity of the subject content and the structure of education are preserved; the non-traditional - integrated structure of teaching natural science subjects prevails; a model is implemented that differs from the logic of mastering the subject content

STEM education is not a core, but an additional element in education, the goal is to develop skills for the applied use of existing basic knowledge from the subjects of the natural science cycle and mathematics STEM education acts as a backbone element in the structure of natural science education, the goal is through problem and project learning to show the importance of mastering basic knowledge from the subjects of the natural science cycle and mathematics.

In any case, regardless of which approach is chosen by an educational organization, the implementation of an integrative idea and interdisciplinary interaction in a modern school when designing a STEM strategy will require an unconventional approach and “fine tuning” from the teaching staff of the school.

The specialists of the future already today need to be given comprehensive knowledge from various fields of engineering and technology. The introduction of such school disciplines as robotics, programming, information and communication technologies contributes to the development of natural curiosity, research skills of students and directs them to the path of future scientists who can most effectively adapt to the rapidly changing conditions of social development. Israel is an example of a country in which students get a unique opportunity to combine a school entrepreneurship program with university studies and internships in leading high-tech corporations. The formation of an entrepreneurial culture of the younger generation is one of the most important and long-term strategic objectives of the Israeli education system.

An analysis of the state of entrepreneurial education and entrepreneurial culture of the younger generation of schoolchildren and students in Israel indicates that the state education system today meets the needs of the labor market, transforming this direction. Starting from the second half of the 90s of the XX century, in Israel, a direction related to entrepreneurial culture was introduced into the development program of general education and specialized schools. However, not all Israeli schools have such an innovative approach to the learning process. But most of the secondary schools are developing this topical direction as a resource for an active life position of change management and innovation, both in their personal lives and in the surrounding reality. Today, the priority areas in Israel's educational programs are: programming and cybersecurity; business management; robotics; natural sciences (mathematics, physics and chemistry); biotechnology [4].

The advantage of Israeli schools, where entrepreneurial education has been introduced, is a unique opportunity to train in leading Israeli corporations, create business projects under the guidance of leading high-tech specialists. The results of such an innovative approach are not long in coming: pupils of such schools win prizes at international school competitions, spreading fame about the Israeli "factory of geniuses" around the world. At the present stage, the institutions of technical and vocational education in Israel are also trying to develop and improve entry into the high-tech world of work and entrepreneurship. College students,

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mentored by business leaders, work together in teacher-led multidisciplinary teams to identify market needs and then create and bring a product to market. A key aspect of the program is the lack of a school budget or special technical equipment available for product development. Students must independently find sponsorship funding and partners from the outside world and convince enterprises to allow them to use their resources outside of working hours to produce prototype components. This way of learning develops work skills, teamwork, self-confidence, as well as entrepreneurial and innovative thinking [6].

It is important to note that the changes in Israel, which are introduced due to a developed entrepreneurial culture in the education system, are supported, first of all, by the state, which develops the social initiative and entrepreneurial spirit of the younger generation. Our observations and analysis of the literature on entrepreneurial education indicate that Israel's dynamic market development is the right approach to develop entrepreneurship as an active life position for managing change and introducing innovations, both in one's personal life and in the surrounding reality. Studying the experience of the development of entrepreneurial education in the world, it was revealed that in the country the theoretical issues of economics are studied to a greater extent, while the practical component of education is represented rather poorly. The main reason is the lack of basic programs and standards for entrepreneurship education. In this regard, it became necessary to change approaches to the implementation of such courses as "Social Studies", "Economics" and "Technology", through which entrepreneurship is taught. These courses include economic and legal information about entrepreneurial activity, the assimilation of a system of knowledge about human economic activity, the development of economic thinking among schoolchildren, etc.[2] However, the practical involvement of students in entrepreneurship is weak. This approach to entrepreneurial education undoubtedly provides a certain set of knowledge, but at the same time does not form the competencies necessary to create and run a business.

CONCLUSION

In conclusion, we note that at the moment our country is implementing a policy of developing entrepreneurial skills among the country's youth. However, the presented courses in their structure are practically no different from the previously existing programs, focused to a greater extent on the study of theoretical issues of micro- and macroeconomics. The main ideas of STEAM education have something in common with conceptual ideas for schools. The STEAM methodology provides a blended learning environment and shows how the scientific method can be applied to life. STEAM is one of the areas of project and educational and cognitive activities at school and outside it. This work does not provide for the only correct solutions and approaches, the freedom of creativity is cultivated, the generation of ideas and their implementation, the ability to plan one's activities based on the task and available resources is formed. One of the fundamental ideas of STEAM education is the development of cooperation skills as a platform for the formation of teamwork skills, corporate activities and mutual assistance. The existing system is little focused on developing the creative potential of the student, on the development of initiative and other social skills that would allow more graduates to predict their entrepreneurial activity in the future.

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