FOUNDATIONS OF STEM EDUCATION IN THE CONTEMPORARY CONTEXT

Kovalenko Olena
Candidate of Pedagogical Sciences
Senior Researcher,
Institute of Pedagogy of NAES of Ukraine

Introduction. STEM is an acronym for science, technology, engineering, and mathematics, which was introduced by National Science Foundation of the USA in the 1990s to stress the significance of the four disciplines in the education sphere and society. Nowadays, it is used to identify educational and vocational realms related to science. It is the integration of the science, technology, engineering, and mathematics disciplines aiming at solving practical situations. Typically, the aforementioned subjects are taught separately, but STEM education assumes a cross-disciplinary approach, which blurs their boundaries. This involves integration of the scientific spheres and the scope of knowledge and skills from two or more fields can be applied to real-life challenges.

The aim is the article is to consider the main approaches to the provision of STEM education in the contemporary world.

Materials and methods. STEM education is determined differently by scientists and has become top priority for education, business and authorities. As seen by Breiner, J. [1], the National Science Foundation of the USA defines STEM areas broadly, including not only the mathematics, natural sciences, engineering, computer and information sciences but also social behavioural sciences such as psychology, economics, sociology and political science. According to McDonald, C., STEM education is a teaching field based on constructivism and constructionism [2]. Caparo, R. determines STEM as a teaching composite of any two or more fields of science, technology, engineering and mathematics, which may occur as a result of duplicity of real-life and problem-based learning [3].

Results and discussions. The above-mentioned subjects can be taught either in a traditional and discipline specific manner, or through a multidisciplinary, interconnected and integrative approach. Mitts, C. [4] and Bruce-Davis, M [5] discuss the critical analysis of STEM education in view of two approaches. Thus, the first approach is the integrative approach which is a combination of core disciplines integrated into one. The second is the multidisciplinary approach. This incorporates knowledge and skills from several subjects. The approaches rely upon problem- and project-based learning and inquiry-based learning to gain educational outcomes. Both integrative multidisciplinary approaches are outcome-focused. STEM education creates links between the four subjects by sustaining and promoting technical and scientific education underlining the importance of critical and creative thinking. These skills are essential for success in the contemporary world.

In times past, several industrial revolutions shaped the society and now we are living through the fourth one. It is marked by a fusion of technologies, blurring the lines between the physical, digital and biological spheres. It is characterised by the integration and consolidation of the state-of-the-art technologies such as advanced robotics, artificial intelligence, virtual reality. The fourth industrial revolution influences every sphere of human life.

The response of educational system to the fourth industrial revolution is to re-equip the STEM field and curriculums to provide educational institutions and science programmes in new interdisciplinary fields and to train specialists to promote and enhance the progress of artificial intelligence, biotechnology and nanotechnology.

Contemporary education systems are implementing these new developments, and STEM education has been specified as a new approach to be adopted in the education system worldwide. The impact of the recent industrial revolution on education is two-way. Firstly, it required investigation and effort from researchers and scientists on making intelligence not just an industrial tool but also a direct service to the society. Secondly, it affects the teaching and learning process including the curricula. Taking into account the intensive changes in society, education has to change, and transformations in teaching and learning methodologies are important so

as to adopt a type of learning outcome based on competencies, integrating academic and vocational education to answer the demands of the market. Teaching and learning should now reflect edutech services, lifelong learning pathways, digital fluency, and STEM skills.

The contemporary education system is facing the task of preparing next generations to face the challenges that would change the world, and STEM education is the solution. An interconnection between STEM education and the present-day industrial revolution is to produce scholars with the 21st century skills that will enable the people to solve real-life problems such as collaboration skills, communication skills, critical thinking skills, problem-solving skills and all-round creativity. To accomplish this, STEM education is to be entirely integrated into the school curriculum. Regardless of the course of study, each individual is to be trained to carry out the future work tasks.

The sustained progress and swift transformations give the curriculum an imperative to renew its content to comply with the intensity of scientific and technological advances. Tomorrow's professions extend back to STEM; accordingly, integrated instruction should focus on STEM domains to foster critical thinkers and empower the next generation of innovators.

Conclusions. STEM education should be introduced to primary school pupils to spark their interest and get them curious. This can be achieved through hands-on creative experience. It helps children develop curiosity, critical thinking and problem-solving capacities. In due course, they become interested in STEM fields and are more likely to undertake one of these spheres for the future profession. Encouraging an enquiring mindset and attitude will enable future generations to function adequately in the constantly changing and challenging world.

References

1. Breiner, J., Harkness, S., & Johnson, C. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics*. DOI: 10.1111/j.1949-8594.2011.00109.X

2. McDonald, C. (2016). STEM education: A review of the contribution of the disciplines of science, technology, engineering and mathematics. *Science Education International*. *27*(4), 530-569.

3. Caparo, R., Caparo, M., & Morgan, J. (2014). *STEM Project-Based Learning* (2nd ed.). Rotterdam: Sense Publishers.

4. Mitts, C. (2016). Why STEM? *Technology and Engineering Teacher*. *75*(6).

5. Bruce-Davis, M., Gubbins, E., & Gilson, C. (2014). STEM high school administrators' teachers', and students' perception of curricular and instructional strategies and practices. *Journal of Advanced Academics*. *25*(3), 272-306.