Robots in Education:
The Latest Developments by Russian Scientists

Bogdan Ershov
http://orcid.org/0000-0002-0544-0350
Voronezh State Technical University, Russia

ABSTRACT

The article discusses the restructuring of the Russian economy for the digital format, which entails radical changes in products, processes, business models, and communication methods. New technologies are not just changing markets, but also the very principles of production. The main emphasis is on the development of "smart" technologies, automation, and robotization. Robotics from a narrow professional sphere becomes an integral component of modern products and technologies. Moreover, robotics becomes a part of modern technological culture and human activity in general. According to the fundamental concept of the content and structure of general education of Academician V. S. Lednev, the social significance of robotics (as well as programming in its time) indicates that it is becoming a necessary element of general education. At the same time, robotics repeats the general pattern of introducing new content: before becoming an element of formal education, it is tested in the framework of non-formal education (clubs, contests, Olympiads, etc.).

INTRODUCTION

According to the estimates of the consulting company McKinsey, the growth of revenues of the global education industry from the introduction of artificial intelligence technologies may reach up to 4% in the next 3 years. According to the review "The Impact of Artificial Intelligence on Education" prepared by ANO Digital Economy, the introduction of AI will lead to significant changes in industries related to intellectual activity, including education. The changes will affect teaching methods and techniques, access to knowledge and teacher training in Russia. Education is among the industries where AI technologies are being implemented at a faster pace. One of the leaders in the use of AI in various spheres of economic activity, including education, is the United States. Technavio estimates that the national AI market in education will grow by $374.3 million from 2021 to 2026, with a compound annual growth rate

DOI: 10.4018/407562

of 48.1% over the period. According to analysts, AI can motivate students, optimize learning timelines, improve the educational environment, and provide students with modern means of acquiring knowledge.

AI technologies are used to analyze the behavior of students, personalize the learning process, and check the level of knowledge and work of students. An important social effect of AI implementation is the increase in the level of accessibility of education, as well as the inclusiveness of the educational environment. The introduction of AI will completely change the understanding of hybrid learning formats, which came into vogue during the coronavirus pandemic.

Robotics in the sphere of education in Russia is predominantly related to natural sciences. New technologies can make a big difference in physics and biology, math and chemistry lessons. Robots will enable better development of what is called hard skills: with them, it is safer to conduct experiments and test theories, gaining knowledge about a specific result. Not everyone would be able to do the same in a factory, and it would most likely lead to losses and accidents.

Soft skills can also be developed in the process of interaction with a robot: from teamwork skills to the ability to find the necessary information. And the ability to "Google" in the XXI-st century is becoming more important than just having information.

Education needs change - and robots can be part of it. Children in schools will not only be able to read about experiments, operations, reactions, but also observe them in a safe format. That artificial intelligence will become part of everyday life is only a matter of time. Therefore, it is necessary to learn how to handle technology today in order to succeed in your work tomorrow.

FOCUS OF THE ARTICLE

Today there are different points of view on the issue of educational robotics. Here is how Arkady Semenovich Yushchenko - Doctor of Technical Sciences, Professor, Head of the Department of the Bauman Moscow State Technical University - reveals this issue: "A robot technician is someone who can connect mechanical, power, computer parts (and the work of these specialists) together. But when I come across robotics at school, for me it's just a type of developmental learning equipment that is used for a schoolchild to better assimilate the knowledge of the school program and get the necessary additional skills."

Vladislav Nikolaevich Khalamov, Director of Educational Robotics Training and Methodological Center: "Robotics is a universal tool for general education. Robotics fits perfectly into additional education, extracurricular activities, and teaching subjects of the school program, and in strict compliance with the requirements of FSES. It is suitable for all ages - from preschoolers to students. And the use of robotic equipment in lessons is both learning and technical creativity at the same time, which contributes to the upbringing of active, enthusiastic people with engineering and design thinking" (Baksansky, 2014).

Until the 60s of the last century, robotics was treated exclusively as a fiction of science fiction writers, which was undoubtedly facilitated by the fact that the term "robot" itself was coined by Karel Čapek and his brother Josef (the term was first used in K. Čapek's play "Rossum Universal Robots", 1921).

The engineering focus of using educational robotics serves as a brilliant opportunity for a child to demonstrate his or her knowledge of engineering and technical thought by quickly (mobile) creating constructors using simple and complex engineering mechanisms and technical solutions. Various robotics kits such as LEGO Education, FischerTechnik, Mechatronics Control Kit, Festo Didactic and others are currently used in education.