

UDC 377.36:004.9

## TRAINING OF MECHANICAL ENGINEERS IN A SINGLE EDUCATIONAL SPACE

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Modern early training of engineers for machine-building industries faces a number of problems, among which we can highlight the main ones associated primarily with the separation of the school from the realities and problems for the creation and implementation of digital technological machines and processes that fully meet the concept of "Industry 4.0", as well as the lack of pupils stable interdisciplinary connections, such as "mathematics-informatics", "mathematics-physics", "physics-informatics".

These challenges are partially addressed through the project activities with wide involvement of the educational community for the final production result; the teaching of one school teacher in a specialized engineering class group of disciplines of mathematical and natural sciences; application of manufacturing tools to design and provision a life cycle of software products in educational process of the school.

An effective solution to the above problems is the convergent training of future engineers in the branches of digital engineering, through the implementation of the scientific and educational project "Digital Engineering School" with additional training of students in applied engineering disciplines within the scientific circles: "Computer mathematics", "Digital electronics", "Software business systems", "Mathematical modeling". Blocks or stages of the project "Digital Engineering School" are aimed at the practical formation of the digital environment.

This approach allows moving to the practical implementation of continuous engineering education "School-University-Enterprise".

The problem of training highly qualified modern engineers is not new, but constructive ways to solve it have not been found yet. Basic meaning of "Industry 4.0" is the creation of digital industries, smart factories, where all devices communicate with each other using the Internet and digital technologies. The main difficulty in the implementation of the concept "Industry 4.0" is not a choice of different modern technologies, but the lack of specialists ready to make this transition. It follows that systematic training for the implementation of this concept have to be carried out from school.

Until now, pupils in the school mastering the educational program, achieved in accordance with it the planned results then moved to the next level



of education at the University. Moreover, as a rule there they were usually told to forget everything they had known before, or worse, the faculty found deep gaps in the knowledge of the school's graduates. The same problem arose when a University graduate was in the enterprise. He had to start his career from the so called "zero level".

The conducted survey and testing of schoolchildren revealed that many of them lack systemic interdisciplinary connections that allow forming a mechanism for the synthesis of various fields of knowledge. The absence of such complex relationships, such as between "mathematics-informatics", "mathematics-physics", "physics-informatics" does not allow to build a successful innovative activity of future engineers, and in fact, there is a certain detachment from the engineering school of the University, from business and from the school. Thus, not formed a single educational space, creates the conditions for a haphazard, uncontrolled and endless educational process. This process shows no results and leads to the complete incompetence of many school leavers in the field of technological, industrial and social knowledge. Thus, it is necessary to understand that to change the situation it is necessary to make drastic decisions.

One of these solutions is the project "Digital Engineering School", which is to create an educational environment that allows implementing educational programs of convergent education and preparing pupils for the branches of digital engineering in both basic and additional education.

It is necessary that all teachers of the school take a direct and active part in the project, as well as undergo training in teaching several disciplines in the fields of mathematical, natural and social sciences. Then such professional activity will become universal and there will be an opportunity to form interdisciplinary connections among students. The opening of additional general development programs, such as "Computer mechanics and mathematics", "Digital electronics", "Software business systems", "Mathematical modeling" will help pupils to form a system thinking in the field of mathematics, physics and computer science. An important condition for the implementation of the project is the teaching of additional education programs by existing, practice-oriented employees of enterprises, who will be able to explain to students aspects of technological and production processes.

The project begins its implementation long before the graduation class of the school. This will help students through project activities and convergence of programs to engage in the development of relevant research under the guidance of both schoolteachers and faculty of universities and employees of enterprises. The project "Digital Engineering School" includes formation of digital AR-environment of educational institution; ICT in research and media activities; Smart navigation; Lean and safe school based on Internet of things (IoT); Mobile assistive robotics; AR/VR/MR and Industrial Internet of things (IIOT) in digital technology environment.



The key moment of formation of the future mechanical engineer will be participation in design conferences and hackathons held at schools, profile universities and engineering enterprises. Such events will help to form the necessary competencies for participation in research activities and improve students' professional level.

It should be noted that the project "Digital Engineering School" will help to improve the results of pupils including the all-Russian and international olympiads in mathematics, physics, computer science, will be able to form interdisciplinary competence and organize a bright in-school digital information educational environment by pupils themselves.

