Chapter 18
Application of Interactive Technologies in Engineering Education in the Research University

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ABSTRACT

The chapter describes the problem of application of interactive technologies of engineering education in the contemporary world-class research university: National Research Nuclear University "MEPhI" (Moscow Engineering Physics Institute). The results of the ongoing process of transformation of engineering education in compliance with the CDIO (conceive-design-implement-operate) international and Russian federal national educational standards are discussed. The pilot projects on the modernization of engineering educational programs have demonstrated that interactive technologies are effective in fixing sustainable results of developing and monitoring the students' project-implementational and other engineering skills.

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INTRODUCTION

Engineering programs aimed at training qualified bachelors, specialists and masters capable of accomplishing personal goals, should be implemented by nuclear, are-earth and other high-tech industries. On the one hand, since its very establishment, the Moscow Engineering Physics Institute has a long-established tradition of training engineers through combining research and developmental activities. This was reflected in the way the educational process was formed. Along with strong fundamental academic training in Mathematics and Physics, it was obligatory for students to be involved in scientific research and development projects (R&D), carried out by the Institute's departments together with industry leaders. Students were also actively engaged in the designing of high-technology devices, appliances and systems that were well ahead of their time; the development and production of pilot models; the perfomance of technology intensive experiments, including, those in reactor conditions (high temperatures, ionizing radiation, mechanical loads).

BACKGROUND

Science constituted the basis for educational process in the second-generation university model (research university) (Fedorov & Medvedev, 2011, Saprykin, 2012, Vladimirov, 2011). However, nowadays, the practical, innovative activity is becoming the key driver of changes in education. Generally, entrepreneurial universities are the leading trend in the world today (Altbach & Salmi, 2011, Clark, 2004, Delbanco, 2012, Grasso & Burkins, 2010, Simonyants, 2014). Considerable efforts are made in the National Research Nuclear University "MEPhI" to modernize basic educational program on nuclear physics and technologies, based on the international engineering educational standards by the Worldwide CDIO Initiative (CDIO, 2017) and other programs taking into account the project-implementational approach and the active role of innovations in the educational process of a modern research university (MEPhI MA Educational programs, 2017).

According to the requirements of the CDIO international standards (Crawley, 2001), relevant laboratory infrastructure is essential for the high-quality engineering education that provides future engineers with necessary knowledge and skills. The practice-oriented approach applied in engineering education cannot be pursued without developing skills of designing and setting up physical experiments in nuclear, aerospace and medical technologies. Such an approach has been historically pursued in MEPhI. It comprises fundamental training and mastering practical skills of working with technical devices and systems through laboratory works in combination with individual designing and development of constructions, devices, installations and systems (Yakovlev et al., 2015). The Department of Engineering Science and Technology of the National Research Nuclear University "MEPhI" employs the above-described approach too. Furthermore, let us examine the examples of the development of these principles of sustainable practice-oriented engineering education in a modern research university with the help of current interactive technologies.

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