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Sustainable Development in Engineering Education Tomsk Polytechnic University

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Abstract

The concept of sustainable development influences all processes in social, economic and educational spheres. This issue has become urgent and intensified the scientific research. Since the image of the student has significantly changed recently, the problems contemporary scholars face today are those of the student's consciousness and the way how it integrates the concept of sustainable development. Therefore, educational programmes, methodologies and training projects have to be designed under the sustainable development principles and in terms of education for sustainable development. This involves adjusting curricular and discipline programmes, enhancing the competence of the faculty, establishing relationships with employers. The main goal of education for sustainable development is to transform society values.

Keywords: Sustainable development, ecology, education for sustainable development, strategy, SD;

1. Introduction

The concept of sustainable development implies economic, political, social and cultural progress, maintaining favorable environment and natural resources with due regard to all human rights and fundamental freedoms, including the right for self-development based on spiritual values. The solution of this challenging task mostly depends on the development of intellectual potential of a country. Today, countries, including Russia, face with the lack of qualified personnel, and this problem is becoming more critical.

2. How engineering education is transformed due to the sustainable development at the global level

In recent decades, the term “education for sustainable development (ESD)” is widely used by specialists, dedicated to sustainable development and education issues at all levels. It is important to understand that the concept of ESD is much broader than the concept of environmental education, because it focuses educational efforts on problems of economic and environment development and personality development as well [3]. On October 20, 1987 at the Plenary meeting of the UN General Assembly the basic principle of sustainable development was defined by

Bruntland Commission as follows: “sustainable development is the development that meets the needs of the present times but does not jeopardize the ability of future generations to satisfy their own needs” [6].

The Russian research school for sustainable development represented by V.I. Vernadsky, E.S. Bauer, N.N. Moiseev, P.G. Kuznetsov, B.E. Bolshakov, O.L. Kuznetsov et al. consider the issues of interdisciplinary development, integrated environmental and socio-economic approach to engineering education, thereby forming the demand for engineering education relevant to the principles of sustainable development. The Russian scientist P.G. Kuznetsov emphasized that the best way to save the Earth and the country for future generations is to educate a person who is able of justifying, developing and implementing ideas of sustainable development for the whole life and face global challenges and threats [9]. The care of living generations towards future generations is the education of people capable and realizing their ability for creativity in the name of the development of Life [9]. Therefore, education for sustainable development (ESD), in addition to acquiring knowledge and skills of the activity approach, also contributes to the formation of views, positions, values and consciousness of a person.

It is significant that engineering education focused on sustainable development assumes the ability to adapt to changes quickly and effectively. It is essential that the education of this type meets not only the current demands, but also those of the future in uncertain conditions. This is a particularly challenging point since pedagogical traditions are based on using common knowledge, relations, concerns and approaches reflected in public consciousness. The future is always indefinite, which raises principally new ESD methodological issues [10].

According to N. Mamedov, today there is a need for a look-ahead model of education that can be described in the categories of duty. In other words, designing the educational system in terms of sustainable development is associated with the transition to a model of engineering education based on a holistic approach to a person, society and nature, unity between modern scientific knowledge, and humanistic value-world view installations.

It has already been lasting for three decades, when education aimed to solve these complex problems has been developing. The modern concept of education based on sustainable development goals has been adopted by the majority of countries 20 years ago at International Conference on Ecology and Development held in Rio de Janeiro [7], where in 1992 the heads of all countries unanimously adopted one of the most important documents of the present times - “Agenda 21”. The main steps of humankind towards sustainable development were formulated there. Chapter 36 of Agenda 21, entitled “Education and Enlightenment for Sustainable Development”, emphasized that education is the foundation of sustainable development and the integration of sustainable development elements into the educational system is defined as the most important step towards sustainable development [2].

The ESD was forced during the “Rio+10” World Summit in Johannesburg in 2002. At the Summit, one of the most important issues was the discussion of the problem of transition to a new type of education that can provide everyone with the opportunity to participate, address and prevent social, economic and environmental problems. In accordance with the resolution of the World Summit on Sustainable Development in Johannesburg UN General Assembly (Resolution 57/254) it was announced in December 2002 that 2005-2014 years are the Decade of Education for sustainable development (DESD). Its main goal was the integration of principles and values of sustainable development experience into all aspects of education and enlightenment[4].

New impulse was given to ESD during the “Rio+20” UN World Conference on Sustainable the development in June 2012 in Rio de Janeiro. The final document of the conference - “The future we want” - says: “... promote education for sustainable development and actively include

sustainable development problems into curricula after the Decade of Education for Sustainable Development of the United Nations is finished” (P.233). Within “Rio+20” Summit more than 250 higher educational institutions (including Russian) released a voluntary statement entitled “Obligations of higher education institutions regarding sustainability practices related to United Nations Conference on Sustainable Development ”(June 20-22, 2012 Rio de Janeiro) [8].

Since the importance of ESD was growing, it was realized that engineering education is beyond this context. Due to this fact, in 2005 in Vilnius the “UNECE Strategy of Education for Sustainable Development” was developed by the initiative of the Russian Federation and Sweden. The essence of the strategy is to move from simple knowledge and skills transfer, vital for modern society, to readiness to act and live in rapidly changing conditions, to participate in planning social development, learn to forecast the effects of actions taken, including possible consequences in the field of sustainability of natural ecosystems and social structures. In particular, it was agreed that it is necessary to make changes to engineering programmes that reveal the essence of the concept of sustainable development. In addition to the theoretical foundations, practical ways of how to implement such development should be disclosed [5].

Engineers are always involved into social project design and as a result they are always in close contact with the nature. Engineers should be aware of the fact that the issues of technological development of society and the environment are indivisible and are required to be resolved together. Technicians are required to pre-evaluate environmental and social consequences of their actions, and in case negative consequences are overbalanced, abandon such technical ideas. In other words, engineers should not develop such technologies that could cause nature degradation or increase the level of poverty, because such technologies turn out to be "unsustainable." In their activities engineers should be guided by the following principles: to improve the quality of life; to reduce energy consumption; to ensure equal opportunities of all people to enjoy the benefits of the environment; to provide fair access of the entire population to limited resources; to maintain biodiversity [1].

It is no coincidence that in Russia there are two documents to support the sustainable development initiatives: “On measures to implement public policy in spheres of education and science”; and “On the Presidential Education Programme for engineering personnel in 2012-2014”. The programme indicates that to solve Russia's innovative development problems the following priorities are identified: economic modernization, which includes improving energy efficiency and resource saving; development of nuclear, space, medical and strategic information technologies. These two important documents were preceded by the statement of the President of the Russian Federation “Fundamentals of state policy in the field of environmental development of the Russian Federation for the period until 2030” dated April 30, 2012. The major task of these statements is developing ecological culture and ensuring awareness of environmental issues.

Currently students in Russia are educated in terms of sustainable development along with the transfer to more flexible two-scale education system (bachelor-master degree system). The federal state educational standard of higher professional education (FGOS VPO), approved by the Order of the Ministry of Education and Science of the Russian Federation No. 26 on January 14, 2010, allows implementation of this approach. Since the majority of master educational programmes provide general scientific and professional cycles, each programme comprises a fundamental (compulsory) part and a variable (profile) part designed by the university.

The general scientific cycle provides the consideration of methodological background of sustainable development. The variable (profile) part is aimed at expanding and deepening knowledge, skills, competencies determined by the content of basic disciplines also taking into account sustainable development. This allows students to gain in-depth knowledge, skills and

competencies to successfully perform professional activities in modern conditions. The variable part allows the main educational programme to meet the requirements of sustainable development issues.

In order the approaches of sustainable development are effectively reflected in professional competencies, it is necessary to take into account the opinion of employers in a timely manner; and effectively use internal intellectual and material resources. Evaluating employers' interest in graduate students it is obvious that most employers are interested in those graduates with advanced skills, who have the desire to adapt to the conditions of organizations and who are seeking to learn and develop professionally. Therefore, it is important to attract high-tech enterprises, institutes and consulting organizations.

3. Conclusion

Thus, masters of engineering specialties, especially those related to environmental engineering, are important to be educated in terms of sustainable development principles. Currently, the main challenge for education systems is to adopt components of the educational process according to the principles and approaches of ESD. In order to improve the quality and flexibility of education, it is advisable to engage universities into cooperation with high-tech enterprises, institutes and consulting organizations. The teaching staff and educational methodological associations of educational institutions should use the conceptual categories and terminological apparatus of sustainable development in more effective way. The main goal of education for sustainable development is to transform society values.

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