

Real-virtual platforms for organizing events on environmental education of students of technical universities

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Abstract. The problem of environmental conservation is currently one of the most acute for the entire world community, and therefore one of the strategic directions for the development of modern higher technical education in Russia is to increase the level of environmental education of university students. The article discusses the ways of organizing educational work in technical universities using real-virtual platforms, provides a theoretical justification for the need to improve the effectiveness of methods of environmental education of university students, and identifies the specifics of organizing discussion clubs using real-virtual platforms. The paper presents the results of an empirical study of students' participation in an experiment, during which they discussed environmental problems on the site of a real-virtual discussion club. The results of the study prove the high efficiency of conducting environmental educational activities on real-virtual sites.

1 Introduction

The twenty-first century has become a turning point in the life of human society. Introduction of high technologies in modern enterprises, production and use of innovative materials, new methods of processing and production of food products, unfortunately, become not only a factor in improving the living standards of the world's population, they often lead to irreversible consequences for the environment and, as a consequence, human health. It is no coincidence that the issues of preserving the environment today are on a par with the most pressing problems of the entire world community. The Russian government is also making every effort to address these problems. According to the environmental safety of the Russian Federation for the period up to 2025, the country's environmental safety is an integral part of the national safety. Among the goals and objectives aimed at implementing the state policy in the field of environmental safety are such as:

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- 1) activation of fundamental and applied scientific research in the field of environmental protection and nature management, including environmentally friendly technologies;
- 2) development of the system of environmental education and awareness, professional development of personnel in the field of environmental safety. [1]

These problems can be solved only through the competent organization of environmental education and education of the young generation of Russians at all stages of the educational process. However, technical universities play an especially important role in this process, because they train specialists involved in the design and development of machines and technologies, the functioning of which has a direct impact on the natural environment.

In addition, today's students tomorrow will become responsible officials and heads of enterprises, on whose decisions the rational use of the natural resources of our country will depend.

Meanwhile, it is impossible not to agree with B. Nevzorov that modern entrepreneurs and government officials often make decisions that contradict the principles of nature conservation under the influence of the free market laws [2].

Environmental education as an element of general education is associated with the mastery by students of the scientific foundations of interaction between nature and society. Its goal is formation of a system of knowledge, views and beliefs aimed at fostering the moral responsibility of the individual for the state of the environment, awareness of the need for constant care for it in all types of activities [3].

Today, scientists agree that arrangement of environmental education in technical universities requires an integrated approach that provides not only for the acquisition of scientific knowledge in the field of rational environmental management, it shall be aimed at formation of moral convictions in the need to preserve the country's natural resources [4, 5, 6, 7, 8]. Environmental education shall permeate all training courses taught at technical universities, students shall be well aware not only of environmental problems in various regions of Russia, but also of the causes of these problems [2, 4, 7, 8]. It is necessary to teach students to evaluate their projects and developments in terms of their possible consequences for the environment.

Researchers identify the following factors in the dynamics of development of "environmental responsibility of the individual":

- "alienation" and "estrangement" of man from nature;
- the growth of scientific and technological progress that changed the strength of interaction and the nature of relationships in the "man-society-nature" system that led to its instability and the danger of the global ecological crisis;
- the emergence of environmental ethics, the main criterion of which is a high level of development of environmental responsibility of the individual. It is it that becomes the basis for formation of a new ecological ecocentric consciousness that will provide a strategy for transition of civilization to the path of sustainable development;
- determination by the world pedagogical education system of the need to form students' environmental responsibility that shall become the goal and expected result of environmental education both in secondary and higher education [9].

Educational work in technical universities shall also be built considering the need to improve the environmental literacy of students. It is important to arrange various events aimed at increasing the environmental literacy of students. This can be visits to specialized enterprises, participation of students in preparation of projects for restoration of natural objects affected by the irrational activities of industrial enterprises, discussion clubs, where each of the students will have the opportunity to express their point of view on existing environmental problems. In other words, the entire life of the student community must, in one way or another, come into contact with the solution of environmental problems in specific regions of the country.

2 Materials and Methods

Modern information technologies make it possible to use not only real, but also virtual platforms for arranging student discussion clubs. We conducted an experiment on the basis of Moscow Power Engineering Institute in order to find out how effective real-virtual platforms are for arranging discussions among students on environmental topics.

The empirical basis of the study was the results of a questionnaire survey of students conducted within the framework of a real-virtual discussion club "Raising the Environmental Literacy".

Real-virtual discussion platforms imply holding events both online and offline, which is very convenient for participants and organizers, since this form of holding does not require significant financial and time costs. The experiment was attended by 1st year students of technical areas of training in the amount of 58 people. The experiment was carried out in three stages. At the first stage, an offline oral conversation was held with the participants about the fact that after receiving a diploma of higher education, they will have every chance to become the very people on whom decisions will depend considering the problem of preserving natural resources. At the second stage, they were asked to answer the questions of an online questionnaire in order to find out how aware they are of the serious environmental problems that humanity is facing today. At the third stage, an offline conversation was held with them again, during which they were provided with the results of the survey and they had the opportunity to express their own opinion about the sources and possible solutions to the problems raised.

3 Results and Discussion

The results of the survey analysis showed that the majority of first-year students of Moscow Power Engineering Institute are aware of the most pressing environmental problems that is associated with the successful promotion of environmental values among them at school. The results of the survey are provided in the table below.

Table 1. The results of the questionnaire survey of the participants of the real-virtual discussion club "Raising the Environmental Literacy"

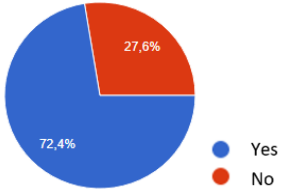
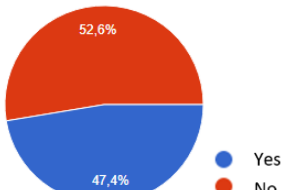
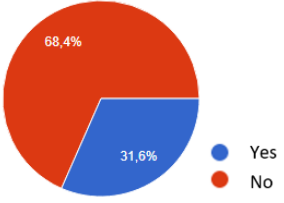
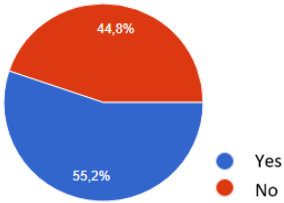
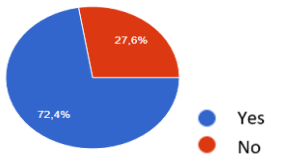
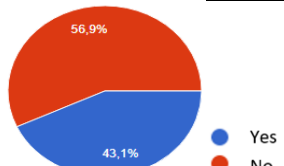
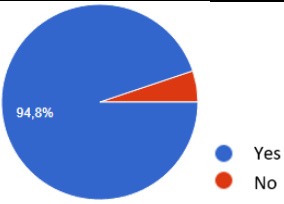
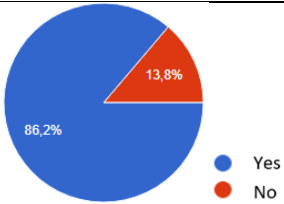
<p>1. Are you familiar with the law of irreversibility of human-biosphere interaction? Renewable natural resources become non-renewable in the case of a profound change in the environment, significant overexploitation, reaching total destruction or extreme depletion, and therefore exceeding the possibilities of their restoration. (https://professia-uc.ru/f/101_osnovnye_ponyatiya_ekologii.pdf)</p>	 <p>58 answers</p>
<p>2. Are you familiar with the law of the indispensability of the biosphere (V.I. Vernadsky, D.P. Marsh, E. Reclus)? There is no reason to hope for construction of artificial communities that stabilize the environment with the same degree of accuracy as natural communities. Therefore, reduction of natural biota in a volume exceeding the threshold value deprives the environment of sustainability, which cannot be restored through creation of treatment facilities and transition to waste-free production. (https://studme.org/260227/ekologiya/osnovnye_zakony_pr_avila_printsipy_ekologii)</p>	 <p>57 answers</p>

Table 1. Continued

<p>3. Do you know the feedback law of interaction in the human-biosphere system (P. Dansero, 1957)? Any change in the environment caused by human economic activity, "back" and has undesirable consequences, affecting the economy, social life and health. (https://studme.org/260227/ekologiya/osnovnye_zakony_pra_vila_printsipy_ekologii)</p>	 <p>57 answers</p>
<p>4. Did you know that in order to keep one tree from being cut down, you have to find 80 kg of recycled paper? (https://sdelatiz.ru/skol-ko-nuzhno-derev-yev-chtoby-sdelat-knigu/)</p>	 <p>58 answers</p>
<p>5. Did you know that 24 trees need to be cut to produce one ton of ordinary office paper? (https://sdelatiz.ru/skol-ko-nuzhno-derev-yev-chtoby-sdelat-knigu/)</p>	 <p>58 answers</p>
<p>6. Did you know that it takes 55 liters of fresh water to make a white cotton T-shirt (https://www.inopressa.ru/article/06Dec2019/bild/tshirt.html)</p>	 <p>58 answers</p>
<p>7. Did you know that the average decomposition time of plastic products created using different technologies ranges from 400 to 700 years? Do plastic bags that people use on a daily basis take 100 to 200 years to decompose in nature? (https://ru.wikipedia.org/wiki/Пластиковое_загрязнение#:~:text=Среднее%20время%20разложения%20пластмассовых%20изделий%2C,прочности%20и%20долговечности%20пластиковых%20изделий)</p>	 <p>58 answers</p>
<p>8. You are aware of the existence of a large garbage patch in the Pacific Ocean, rough estimates of the area of which vary from 700 thousand to 1.5 million km² and more. May there be more than a hundred million tons of garbage on this site? (https://www.independent.co.uk/climate-change/news/the-world-s-rubbish-dump-a-tip-that-stretches-from-hawaii-to-japan-778016.html)</p>	 <p>58 answers</p>

Wherein, less than 50 % of survey participants were familiar with the laws of the Biosphere: only 47.4 % of freshmen answered positively to the question whether they knew the law of the indispensability of the biosphere (V.I. Vernadsky, D.P. Marsh, E. Reclus),

31.6 % of the respondents were familiar with the feedback law of interaction in the human-biosphere system (P. Dansero, 1957), but the law of the irreversibility of human-biosphere interaction was known to 72.4 % of the respondents.

With regard to specific environmental problems, such as pollution with plastic waste, conservation of water resources, here the participants in the experiment showed great awareness: 82.2 % of students knew about the existence of a large garbage patch in the Pacific Ocean, 94.8 % are aware that the average decomposition time plastic products created using different technologies range from 400 to 700 years, 72.4 % know how many trees are required to produce one ton of office paper, but only 43.1 % of respondents knew how much water is required to produce one cotton T-shirt.

Summarizing these results, we can confidently assert that for about half of the participants in the discussion club, the information provided in the questionnaire turned out to be new, which means a high educational potential of arranging such discussion platforms, and if we consider that all this information was provided to the trainees in a new context for them that they will have to make production decisions in the future considering the requirements of respect for nature, then we can talk about the high efficiency of the event. This is also supported by the active participation of freshmen in offline discussions.

4 Conclusions

The topic of environmental education of university students, who in the future will become managers who make important government decisions related to use of natural resources of our country, has acquired national importance today. In this regard, the task of teachers involved in arranging the process of teaching and educating students is to search for new modern pedagogical tools for interacting with students in order to increase the level of environmental education and environmental literacy among them. Real-virtual platforms for arranging educational activities aimed at increasing the environmental literacy of students of technical universities are an effective pedagogical tool. An experiment carried out among students of Moscow Power Engineering Institute proved that about 50 % of students who come to the university from school are not aware of the basic laws of the Biosphere and not all of them are familiar with even the most well-known global environmental problems. Wherein, they are happy to take part in discussions arranged on real-virtual platforms dedicated to environmental problems. An important task for teachers is to convey to their consciousness that in the future they will be responsible for making important environmental decisions. Real-virtual discussion clubs are undoubtedly an effective platform for formation of the ecological culture of future managers.

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