ЕКОЛОГІЧНА ОСВІТА ТА ЕКОЛОГІЧНЕ ВИХОВАННЯ

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THE ISSUES OF TRANSPORT ENVIRONMENTAL IMPACTS PERCEPTION BY STUDENTS OF ENVIRONMENTAL AND OTHER ENGINEERING SPECIALTIES

The issues of environmental consciousness formation among the students of non-environmental specialties are considered. The preconditions of environmental culture formation during secondary education have been analyzed on the example of Ukraine, Canada, Germany and Sweden. The efficiency of environmental impacts understanding among the students was tested and evaluated on the example of the environmental impacts of transport. The major complications and problems of environmental culture formation were formulated.

Keywords: environmental education, environmental impacts, environmental culture, higher education, transport.

У статті розглядаються питання формування екологічної свідомості у студентів неекологічних спеціальностей. Проаналізовано передумови формування екологічної культури під час отримання середньої освіти на прикладі України, Канади, Німеччини та Швеції. Повнота розуміння студентами впливів діяльності людини на навколишнє середовище була перевірена та оцінена шляхом опитування на прикладі впливів на довкілля транспорту. Виявлені основні проблеми формування екологічної культури.

Ключові слова: екологічна освіта, впливи на навколишнє середовище, екологічна культура, вища освіта, транспорт.

Introduction. Reorientation of Ukrainian politics and economy towards the sustainable environmental management development is only the part of the major environmental problem facing the state. The most important key to successf ul transition of the state to the new paradigm of development, which will provide mutually beneficial coexistence of nature and man, is raising public environmental awareness. This will require a combination of the following factors:

- development and distribution of systematic information about the current environment condition, use and protection of natural resources and environment capacity;
- free access of general public to the information on environmental issues at all levels of government;
- active involvement of public into the work on environmental protection and creation of conditions for building a constructive dialogue between citizens and authorities to maintain environmental safety;
- development of environmental component of primary, secondary and higher education in order to raise public awareness of environmental problems.

Pursuant to the first provisions the Ministry of environment protection of Ukraine planned preparation of a package of reports on a regular basis. Thus, according to the Section 6 of the Law of Ukraine "On the Major Principles (Strategy) of the State Environmental Policy of Ukraine for the period till 2020" the reports on environment condition and implementation of the National Environmental Policy of Ukraine must be prepared every year and every five years correspondingly and distributed to the central and local executive bodies for environmental protection, local authorities to be open for review by common public [1].

The last component, namely development of environmental awareness in the process of official education, involves formation and promotion among population of a set of ideas, theories, opinions, motivations, reflecting the environmental aspects of social life, namely the practice of the relationship between man and nature, including regulatory principles and standards of behavior aimed at achieving an optimal state of the system "society-nature".

Problem formulation. The role of high school in building environmental awareness is finalizing and aimed at formation of holistic environmental outlook of students and future professional. Considering the fundamental importance of the ecological way of life it is commonly accepted that all engineering specialties must be provided with equal volume of information on the modern environmental problems and their potential solutions. However, environmental engineers normally get broader perspective of environmental issues. The resulted level of environmental processes understanding must be of different quality. So, the task of the research was to define the range of this difference and efficiency of the non-specific training for the students of other engineering fields. Either, the purpose of the paper is to analyze the current efficiency of training for environmental engineers in terms of modern student-oriented approach accepted in the world educational science and in terms of building their competency.

Analysis of previous research and publications. Theoretical and methodological issues of environmental education as one of the basic components of education for sustainable development are covered in the works by M. Argunova, G. A. Bilyavsky, N. S. Kasimov, Y. L. Mazurov, A. P. Meshchaninov, N. A. Poustovit, N. M. Ridey, T. V. Saenko, S. M. Stepanenko, B. C. Tykunova, S. M. Shmal and others.

The field of competencies formation process is developed by V. P. Simonov, V. P. Bespalko, V. N. Maximova, M. N. Snatkin, O. Ye. Lebedev, V. I. Teslenko, I. Ya. Lerner.

The main tools in raising environmental awareness level are environmental education and environmental culture promotion and behavior improvement.

Environmental education – is a continuous learning process, aimed at assimilation, systematization of knowledge about the environment, methods of its management and protection and development of a common environmental culture.

The system of continuous environmental education, in the context of the current state policy in the field of environmental education is a set of successive environmental education programs that meet state educational standards and are implemented in educational institutions, regardless of their organizational and legal forms. From this point, the most important features of environmental education are openness, multidimensionality, focus on continuous creative search, and formation of an objective picture of the modern world. The structure of environmental education includes learning principles of bioecology, geoecology, chemical ecology; gaining engineering and socio-economic background (sociological and economic faculties).

Ecological culture is inherited experience of human life in its interaction with the environment, promoting healthy lifestyles, sustainable socio-economic development, territory and individual environmental safety. Ecological culture according to V. A. Levin is the ability of people to apply their environmental knowledge and skills on practice [2]. People, having not formed environmental culture, may possess the necessary knowledge, but do not operate them. Ecological culture of a person includes his environmental awareness and environmental behavior.

Environmental consciousness in this relation means the total implementation of ecological and environmental concepts, worldview and attitude to nature, practical activity strategies aimed at natural objects [3].

The concept of ecological education in Ukraine, approved in 2002 by the Ministry of education of Ukraine provides a clear structure for the formation of environmental education, covering all age, social and professional groups of the population. It highlighted two main areas of education – formal and informal. Formal education covers all parts of the education system which exists in Ukraine: pre-school, school, extra-curricular, vocational, higher and postgraduate. The second area is educational in nature and is aimed at formation of ecological

culture of the population through the media, public ecological organizations, parties and the like. Therefore, environmental education and education for all segments of the population is one of the most important and necessary ways that will contribute to the effective solution of an extremely acute environmental and socio-economic problems of modern Ukraine [4].

The system of school education is carried out in two directions: teaching the course "fundamentals of ecological knowledge" and the ecologization of academic disciplines.

In 1993, the Ministry of education of Ukraine introduced to the basic curriculum of the school the elective course "Fundamentals of ecology". Was this program and the textbook "Fundamentals of ecological knowledge". In addition, for schools with advanced study of ecology publications textbooks "Ecology", "Human ecology," but the vast majority of schools the course "Fundamentals of ecology" is not taught [4].

The most common form of ecologization of secondary school education is the saturation of the objects of natural-geographical cycle, in particular biology, geography, chemistry etc. with environmental materials. This approach is not justified in the system of formation of ecological knowledge. As a rule, the subject teacher should reflect the topics of the basic courses of environmental issues [4].

Priority of general secondary environmental education is a personal orientation, involving the creation of an environment in which nature becomes a personal value to each student. This approach is carried out in three stages in accordance with the age of the children, scope and level of their knowledge and experience, psychological characteristics.

Secondary schools of II grade (grades 5-9) are designed to provide students a basic level of environmental education, mastery of the fundamentals of ecological culture. Students should [4]:

- know the essence of ecology as a science and sphere of practical human activities, concepts and regularities that characterize nature as a whole system;
- realize the primacy of nature, the universal and objective character of natural laws, the need for compliance by the person;
- understand the dialectical nature of the influence of scientific-technical progress on the nature and causes of global environmental problems, achieving balanced sustainable development;
- know the ecological rights and duties of citizens of Ukraine;
- be able to evaluate the environment, adjust their own consumption and way of life, to participate in practical conservation actions.

Foreign countries organize environmental education in the similar way,but it includes certain peculiarities. Thus, in Canada the environmental education can occur through formal, non-formal, and informal approaches or settings [5].

Formal environmental education is linked with the formal education system and generally takes place in a school context.

Non-formal environmental education is organized educational activity outside the formal school system, and includes environmental education activities or programs provided by community organizations, youth groups, museums, zoos, and nature/interpretive centers, etc.

Informal environmental education is the provision of information without an organized educational/institutional structure and typically includes learning about the environment through the media, personal reading, everyday experience and interactions with other people.

For the implementation the system of secondary environmental education in Canada children must study such disciplines, which is divided on two main direction: Science and Technology and Social Studies. They include disciplines regarding to the Life Systems, Matter and Materials, Energy and Control, Structures and Mechanisms, Earth and Space Systems, History and Geography.

In Sweden students obtain environmental knowledge in Natural Science Oriented subjects (NO) and Social Science Oriented subjects (SO) in compulsory schools. NO consists of Biology, Physics, Chemistry and Technology in a broader sense. SO consists of Geography,

History, Religion and Civics. Upper secondary schools offer more opportunities to develop environmental awareness, understanding and practical skills [6].

Environmental education in compulsory schools is implemented in comprehensive study and (or) special activity and is carried out for 6 or 7 hours a week. It is also noted that environmental education in Sweden emphasizes the empirical activity such as fieldwork and (or) laboratory work.

The aim of environmental education within Swedish environmental policy is to create a society where present and future generations can live in a guaranteed environment. So, children learn early environmental awareness in pre-school age and continue in compulsory school [6]. The curricula for environmental education are the same in the whole country since 1960s, but teachers have the freedom in deciding interdisciplinary teaching and project work.

Environmental education in Germany also engages with the natural and social environment. Guidelines provide the framework for oriented subjects and consist of five learning areas: Living together in community, Encounter with nature, Orientation in space, Dealing with time, Securing human life [6]. As a result, since the mid-70s environmental issues and problems are included in curricula of all federal states, mostly as a part of geography and history (4 hours a week.

As a general result of comparing the level of implementation of ecological education in the system of secondary education in Ukraine and foreign countries have highlighted the following problems in its implementation:

- limited number of hours allocated for teaching of natural sciences;
- inadequate environmental training of teachers of different subjects;
- limited possibility for introduction of special courses with environmental focus in educational process;
- weak methodological provision of secondary schools with materials of environmental focus;
- lack of motivation of students to obtain environmental knowledge;
- poor coverage of environmental problems of the area and the impossibility to conduct real practice students to familiarize with them, the impossibility of participation of students in practical nature conservation work;
- weak material and technical base of the majority of schools (lack of video materials, laboratory equipment, and modern tourist equipment, etc.).

Research methodology. In order to analyze the existent level of environmental awareness of students of various specialties the following structure of the research was chosen:

1. Definition of the specific environmental problem as a background for the assessment.
2. Determination of the key factors to be considered by students in the questioning.
3. Development of the list of question to be included into the questionnaire.
4. Choice of the target groups of students to be involved into the research.
5. Conduction of the testing.
6. Results processing.

The environmental problem to be chosen for the research had to be as broad as possible and known to people of the widest range of knowledge, both general and applied environmental. It was also necessary to consider the problem with minimum of specific terminology and concepts.

The key factors must refer to the everyday experience of common public to provide the maximum probability of their familiarity to people with various backgrounds.

The list of questions had to be complete enough to reveal the real level of environmental problem comprehension. From the other hand, they had to be understandable to students with different academic results and learning progress.

The groups of student could be different in number (within 5% acceptable statistical difference), but of the different specialties and year of study.

The study was conducted during classes of Fundamentals of Ecology for students of the technical specialties except environmental engineers. For the later the testing was organized during professionally oriented subject classes. The reason for such testing conditions choice was the need to make students perform their best and avoid typical among Slavic people lightweight attitude to social questionings.

The environmental problem most fully corresponding to the above mentioned requirements is the environmental impacts of transport.

Ukraine has developed all major modes of transport and traffic volumes grow each year. However, modern vehicles are major sources of pollution. Emissions of road transport is on average about 5.5 million tons (39% of total emissions in Ukraine) a year. In large cities, air pollution due to transport sometimes reaches 70-90% of the level of contamination. In addition, over 20% of vehicles are currently operating with exceeding standards of harmful substances content in exhaust gases. Also the recent trend in Ukraine is the increasing average age of vehicles, especially cars, in use, due to the crisis of 2009-2010 and unstable social political situation of 2014-2015.

Overall in 2014-2015, transport emissions of pollutants in Ukraine decreased by 0.8% compared to previous years and reached the mark of 195.4 thousand tons a year. However there was a slight increase in carbon dioxide emissions to 5710.6 thousand tons, which is 102% similar to the previous year.

With the aim of reducing negative impacts of transport on the environment, the state government works on development of special environmental programs. The progress in the process of transport environmental impacts mitigation includes reduction of low quality fuels and toxic additives application, development and introduction of advanced techniques and clarified GHG emissions inventory, substitution of old vehicles and equipment of various transport types, reduction of water and power resources consumption and construction, expansion and renovation of anti-erosion, hydraulic, structures to protect against flooding and prevent the development of dangerous geological processes, eliminate or reduce negative impact on the territory and objects of transport to acceptable level. Nevertheless, transport is still among the major sources of technogenic pressure on the environment and needs constant attention from the state authorities.

Thus, the questions offered to the students included testing their knowledge about structure of urban transport system, impacts of various types of transport on components of the environment, factors having influence on the intensity of transport impacts, comparative aggregative effects of transport types, ways of urban traffic problems solution. Students were also offered to name the most important health effects of transport impacts, methods of protection from toxic substances exposure. Questions were in the form of test and others needed open answer.

Results and discussions. The total number of students involved into the interviewing process was 548. Among them, students of environmental engineering included 150 people, others (398) were from non-environmental specialties, but related to transport branch of economy (mechanical engineering, aircraft maintenance, logistics, air navigation) or information technologies field.

The results were obtained during the period of 4 years – 2011-2016 from the students of the 1, 3 and 4 year of study. The first-year students were chosen to participate as they are able to reproduce the understanding of transport impacts on the environment and their health consequences, formed as a result of school education. The second course students were excluded due to dominating non-professional humanities in the curriculum. The third and fourth courses have normally acquired the basic components of their background and their perception of various problems, including environmental is more professional.

The results of the interviews have predictably showed deeper understanding of the problem by environmental engineering students. However, we have managed to establish a range of important issues. First of all, environmental engineering students were able to present a wide

list of potential environmental impacts, produced by transport, while other groups were mostly concentrated on air and noise pollution issues. At the same time a range of mentioned impacts are out of date, meaning their value has already changed over the last decade. This could be conditioned by outdated manuals and training materials used in the study course and lack of knowledge updating due to low interest to the environmental issues. Also it is obvious mostly for scientists that information becomes irrelevant very quickly. The reduction of the necessary volume of knowledge to be acquired, especially technical ones, has led to serious gaps and failure to understand the essence and objective laws of ecosystems functioning.

From the other side, environmental engineers turned to lack purely technical understanding of the process: most of them (62%) failed to give the answers to the questions related to the structure of transport systems. While both groups of students managed to give complete list of factors having influence on the intensity of impacts. Likewise, they have offered similar ways of solving the existing problems. Here is the reflection of an important current problem of the students training, determined in our previous research [7], which is transition from analysis to synthesis in the cognitive process. There is some obstacle in the form of hanging example. In other words, students are inclined to copy the existing examples, provided by professors, and it is only the imitation of synthesis.

The influence of transport on human health is more obvious to environmental engineers and generally it may be concluded that they are more aware about the regularities of environment functioning and able to predict consequences of environment pollution. The other groups of students do not consider the fact of cause-effect relation between environment quality degradation and condition of their health. Although they know that pollution of the environment is hazardous for humans, they do not attribute it to their health, which is a problem and not only in relation to transport impacts perception, but also in relation to understanding consequences of their living activity for the environment and further for their health.

The common problem of environmental impacts perception for both groups of students was inadequate assessment of relative environmental hazard level of different types of transport. General opinion states for complete safety of at least distant influence (environmental effects due to power generating facilities activity) of electric types of transport. Thus, they omit the negative health effects of powerful electro-magnetic fields, accompanying their activity. As a result we may conclude that the presentation of the problem by manuals and trainers is one-sided, leading to future inadequate evaluation of situation, as electric transport is considered to be the transport of future.

But the most urgent issue found in the process of interviews processing is a gap between the understanding and implementation of environment protection principals on the whole. The most prominent example of it is that 97.8% recipients would like to own private car, knowing its nocuous influence on the environment. So, we see the clear problem in the formation of environmental consciousness, culture, education and sustainable development of the country on the whole.

The content of environmental consciousness is revealed through such concepts as environmental views and environmental actions. The ecological views include various kinds of empirical knowledge, attitudes and traditions of a culture, while environmental actions include a system of regulatory principles of moral character.

The structure of environmental consciousness includes rational, sensory-emotional and behavioral components, – and the latest seems to be the most problematic. The main function of environmental consciousness is regulatory. It manifests itself in the regulation of human activity, from the regulatory-stimulating to value-oriented. As a result, major obstacles on the way to implementation of environmental principles in everyday life appear. For the favorable formation of an environmental awareness there are required appropriate laws, public opinion, and environmental education and training since childhood. The research has showed that most of youth haven’t moved from anthropocentric and ecocentric world view. Consequently, they percept natural objects and phenomena of reality, their interconnections as a guarantee for

targeted and creative human activity, they also set clear contrast between man and nature, where the highest value is the man himself, using nature to meet his needs, and does not extend ethical norms and rules to interaction with nature. But the aim of environmental education is to build ecocentric environmental consciousness at students. In this case nature itself is recognized as a value, and relationship with it based on the principles of equality, because of dominance of non-pragmatic motivation and distribution of ethical standards and rules on the world of nature.

So, even under clear communication of environment protection principals to the students, they show only initial form of environmental culture. In other words, young people possess the necessary knowledge, but do not operate them. There may be a few possible reasons of this.

Currently the level of indifference to abstract values and individualism is unusually high and except raising obvious moral issues, it is a serious obstacle for mastering such professions as environmental engineering, which is totally grounded on global good and altruism and is often characterized with delayed payback of the invested efforts. This is additionally complicated due to students aiming at practical activity instead of working on theoretical tasks, necessary to form "green" world view, based on solid knowledge in the field of natural sciences.

At the same time, environmental issues are widely discussed by common public and it results in false certainty about comprehensive knowledge of the subject. Thus, at the first level, when students must be ready to receive new information and experiences, educators face the problem of the need to overcome prejudices and improve delusions. Another difficulty is introduction of professional terminology instead of popular or common names. This is also displayed in the process of giving responses and participation in discussions. As a result, students are able to discuss questions from their field of study, but having faced the inadequacy of their previous knowledge and used terms, trainees desist from expressing their ideas. Therefore, the training process faces big difficulties in terms of building students' attitudes and beliefs and overall perception of environmental science, which will eventually form their personal environmental philosophy – the final level of environmental awareness.

The issue of changing way of life to more sustainable is even more urgent for the students of environmental engineering. It is impossible to be good in this occupation without practicing its in ordinary life, which is quite hard with modern level of cynicism among students of higher courses, but still necessary. In the end, it will give awareness about position and importance of environmental engineering and engineers in human life to graduates and young professionals. Here they will also realize, with the help of educators, the role of environmental science not only in safety provisions, but also in the economy of the country. It is important for them to understand that environmental issues are not only restricting, but also provisional for economy, as they support life of workers and resources for production.

Conclusions. The training in the field of ecology and environment protection is currently going through the problematic period. It includes both objective and subjective issues. First, there is lack of well-developed complex tasks to stimulate creative activity and independent thinking of students. This prevents integration of all obtained knowledge and formation of clear occupational patterns to be applied in professional activity.

The second issue is more subjective: availability of common information on various environmental issues litters perception of students and creates additional complications for training process.

Therefore development of engineering education cannot go the way of simplification, considering the growing volume of information and decisive role of engineering for living conditions and living needs provision. There is also a need to improve the scope of issues to be considered by the students especially in the field of transport impacts on the environment.

References

1 The Law of Ukraine "On the Major Principles (Strategy) of the State Environmental Policy of Ukraine for the period till 2020" of December 21st, 2010 (Закон України «Про основні засади (стратегію)

державної екологічної політики до 2020 року» від 21 грудня 2010 р. № 2818.). Kyiv, 2010. 41 p. (in Ukrainian).

2 S. N. Deryabo, V. A. Levin. Ecological pedagogic and psychology (С.Н. Дерябо С.Д., Левин В.А. Экологическая педагогика и психология). Rostov-na-Donu: Phoenix Publishing house, 1996. 480 p. (in Russian).

3 Kimaryo, Lydia A. Integrating environmental education in primary school education in Tanzania : teachers' perceptions and teaching practices / Lydia A. Kimaryo. – Åbo : Åbo Akademi University Press, 2011. 223 p.

4 Mudrak, O. Nagorniuk. Environmental education for balanced development of Ukraine. Problemy edukacji technicznej i zawodowej. 09.2010. P. 326-331.

5 Environmental education in Canada. Toronto: Canadian Environmental Grantmakers' Network, 2006. 34 p.

6 J. Radeiski. The Implementation of Environmental Education in elementary schools: A Comparative Study between Sweden and Germany. Karlskrona: Blekinge Tekniska Högskola, 2009. 53 p.

7 M. M. Radomska, L. M. Chernyak. The issues of environmental engineers education in terms of Bloom's taxonomy : NAU Proceedings, 2016. 1(66). P.32-39.

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