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# Application of the project method in the preparation of students of chemical specialties to improve their environmental competence

Lyudmila Pet'ko<sup>1,\*</sup>, Olha Lebid<sup>2</sup>, Anzhelika Lesyk<sup>3</sup>, Inesa Harkusha<sup>4</sup> and Andrii Kryzhanovskiy<sup>5</sup>

<sup>1</sup> Dragomanov National Pedagogical University, Kyiv, Ukraine

<sup>2</sup> Alfred Nobel University (Dnipro, Ukraine)

<sup>3</sup> Berdyansk State Pedagogical University, Berdyansk, Ukraine

<sup>4</sup> Alfred Nobel University, 18, Naberezhna Sicheslavskya St., Dnipro, Ukraine

<sup>5</sup> Dnipropetrovsk medical academy of the Ministry of Health of Ukraine, Dnipro, Ukraine

\* E-mail: petkoluda2015@gmail.com

**Abstract.** The use of a project methodology based on the solution of environmental projects in the training of modern specialists in the field of chemistry makes it possible for them to form ecological thinking. Working on environmental problems helps to realize the importance of solving them for ensuring sustainable development. The project activity of students helps to expand their horizons, and the process of implementing environmental projects provides an opportunity to acquire skills for solving issues related to solving environmental problems. Modern environmental science is a complex of knowledge that combines elements of social, technical, humanitarian and natural disciplines. Modern specialists in the field of chemistry should have the skills of effective actions in solving various environmental problems. The formation of ecological consciousness and the desire for independent cognitive activity in the field of ecology, in our opinion, should be attributed to the priority tasks of the modern educational process. In conditions of intensive use of natural resources in the framework of economic activity, it is necessary to train specialists with environmental competencies to ensure conditions for sustainable development.

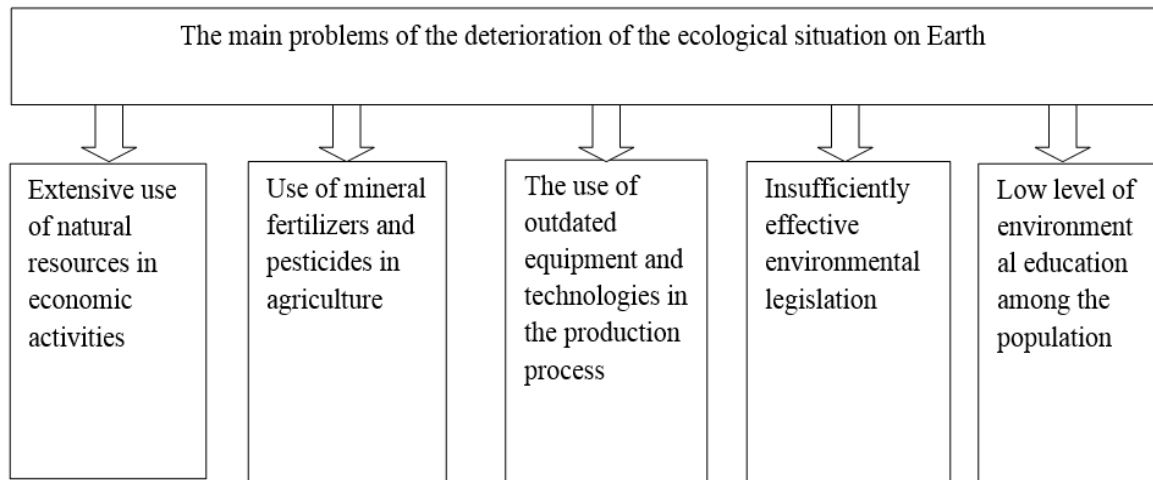
## 1. Introduction

In the modern world, environmental problems are coming to the fore. The dynamic development of the world economy is accompanied by an irresponsible attitude of mankind to the environment. This is accompanied by the death of ecological systems that took thousands of years to create

According to [1], the ecological system of the Earth has turned out to be weakly resistant to the consequences of human economic activity and is currently subject to degradation.

According to [2], the main problems of the deterioration of the ecological situation on Earth can be attributed (Figure 1):





**Figure 1.** The main problems of the deterioration of the ecological situation on Earth.

According to [3], the need for environmental education and education is appropriate for the following reasons:

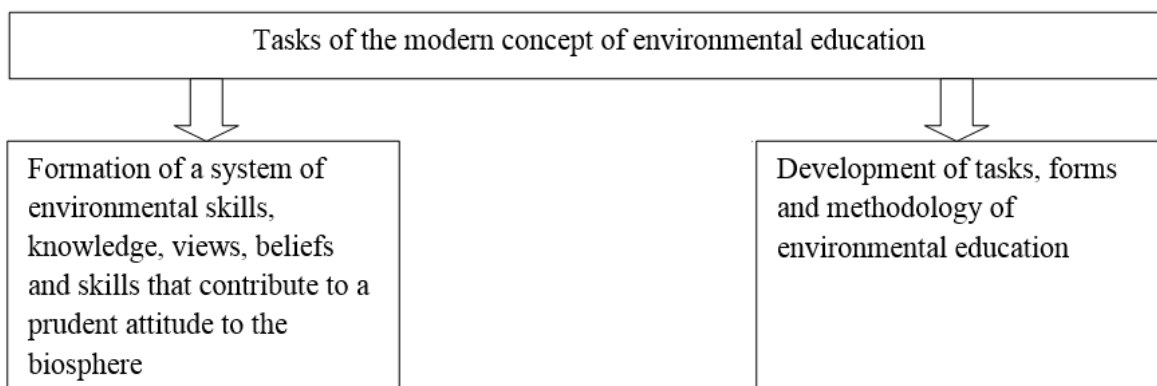
- 1) The modern attitude to environmental problems is largely correlated with the desire to achieve economic benefits
- 2) The lack of environmental knowledge does not allow us to assess the impact on the environment in the course of professional activity.

According to [4], environmental education should contribute to improving the environmental well-being of people in the conditions of changes taking place in the biosphere, as well as assist in the development of human civilization along the path of sustainable development.

In our opinion, only an ecologically educated person can fully realize the importance of protecting the environment and choose the most optimal solutions within the framework of interaction between society and the natural environment.

According to [5], environmental education should contribute to changing the system of environmental values that has developed in society. Environmental education should ensure awareness of human interests in the context of the global environmental crisis, as well as the fact that a person is just a component of the biosphere and his existence is not possible without the biosphere.

According to [6], the modern concept of environmental education should provide (Figure 2):



**Figure 2.** Tasks of the modern concept of environmental education.

According to [7], competence is a set of skills, knowledge, attitudes and skills acquired by individuals in the learning process and on the basis of life experience.

Modern employers are primarily interested in the level of competence of specialists, and not the amount of knowledge they have acquired.

According to [8], competence means the degree of readiness of an individual to use the skills, knowledge and skills at his disposal to solve specific professional tasks, including non-standard tasks.

According to [9], the following main educational competencies of a modern specialist can be distinguished:

- 1) Cognitive and educational competence
- 2) Cultural competence
- 3) Value-semantic competence
- 4) Competence in the field of modern information technologies
- 5) Competence related to the ability to work in a team
- 6) Cognitive and educational competence
- 7) Social competence
- 8) Competence related to the ability to independently improve their professional level
- 9) Competence related to the possession of a foreign language.

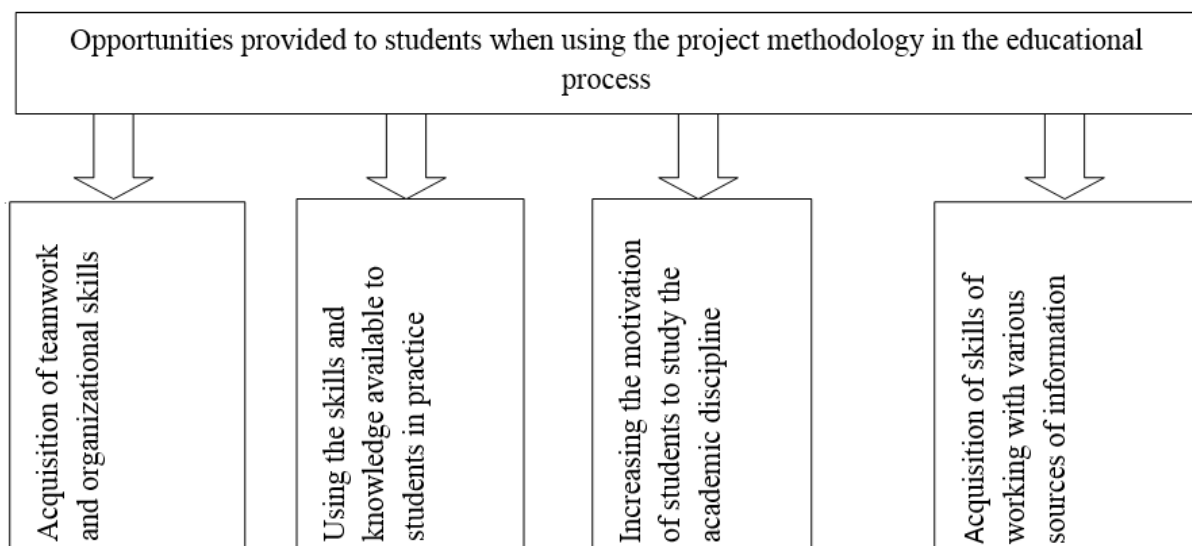
In our opinion, this list should be expanded by adding environmental competence to it.

The authors adhere to the point of view that competence is an indicator that determines the ability of a specialist to solve practical professional tasks, taking into account the environmental problems associated with this.

According to [10], the project method allows students to develop their creative and cognitive abilities, their ability to independently acquire new knowledge and skills, have orientation skills in a complex information space, the ability to independently set tasks and find solutions to them.

According to [11], the project method is aimed at achieving certain didactic goals through creative and detailed development of the problem, as a result of which a certain real practical result should be achieved.

According to [12], the use of projects in the educational process allows (Figure 3):



**Figure 3.** Opportunities provided to students when using the project methodology in the educational process.

According to [13], the main value of the project method is determined by the possibility of applying the knowledge, skills and abilities available to the trainees to solve specific practical problems.

Among the problems faced by the implementation of the project method are the following:

1. The implementation of projects requires additional effort and time from the teacher to choose the topic of the project.
2. The implementation of the project may be difficult to implement within the framework of the classroom
3. The teacher should be able to provide the necessary assistance to the project participants
4. The need to choose objective criteria for evaluating the results achieved as a result of the project implementation.
5. The implementation of the project form of training by the teacher requires that teachers have the skills to use this training technology.

## 2. Methods

When implementing this study, the authors used an analytical method, which provided an opportunity to study the problems considered in the work in their unity and development.

Taking into account the tasks and objectives of this study, the authors of this study used a structural and functional method of scientific cognition.

In the end, this made it possible to study a number of problems related to the use of the project method in the preparation of students of chemical specialties to improve their environmental competence.

## 3. Results

Modern high-tech production is impossible without the use of a large number of different modern materials. Many of these substances are toxic and have a negative impact on the environment. Manufacturers of mobile phones, computers and household appliances are interested in increasing sales. At the same time, consumers often buy another smartphone, just because the design of the new model is more popular with the consumer, although the technical condition of the old phone allows it to be operated for a certain time. Thus, there is a problem of recycling and recycling of equipment that has served its time. Disposal of this equipment as solid household waste does not solve the problem because household appliances contain a certain amount of rare metals and toxic substances. On the one hand, this does not allow the reuse of valuable metals, and on the other hand, valuable metals pollute the environment causing irreparable harm to the environment. The laws of business are primarily focused on making a profit and in many cases environmental issues recede to the second or even third plan.

Within the framework of this study, the authors proposed using the project method to increase the level of environmental culture among fourth-year chemistry students of the Dnipro National University. Students were invited to take part in the project "Save your hometown". The participants of this project were asked to develop measures to solve the problem of waste disposal of computer equipment and mobile phones.

During the implementation of this project, students were engaged in searching for information in specialized scientific publications, as well as on the Internet.

When performing the project work, the students conducted a survey of residents of the city of Dnipro, on the basis of which they found out that only 15% of respondents agree to sort solid household waste without any conditions, 45% of respondents said that they agree to sort solid household waste if the company carrying out their export makes a discount on their services. 10% of respondents reported that they agree to sort solid household waste if they are paid for it.

Based on this, the students came to the conclusion that it is not possible to solve the problem of solid household waste through free voluntary sorting of solid household waste in the near future due to the low ecological culture among the population.

As a solution to the problem of recycling mobile phones and computer equipment, the students proposed to introduce a special recycling fee for each unit of computer equipment and mobile phones sold in the amount of 10% percent of their cost. When buying new equipment, the buyer must, according to the students' plan, pay this recycling dispute in addition to the cost of the gadget. In addition, at the suggestion of students, it is necessary to create reception points for old computer equipment and mobile phones in parallel with the introduction of a 10% recycling fee. When handing over the used equipment at the reception point, according to the students, there should be a refund of the paid recycling fee.

This, according to the students, should be beneficial to enterprises that ensure the functioning of reception points for old computer equipment and mobile phones, as well as to improve the environmental situation in the city of Dnipro.

#### **4. Discussion**

Modern ecology is a complex of knowledge, including elements of technical, social, natural and humanitarian disciplines. Modern specialists should have the skills of effective actions in solving various environmental problems.

The formation of ecological thinking and the desire for independent cognitive activity in the field of ecology using the method of projects providing for the solution of environmental projects in the training of modern specialists in the field of chemistry allows you to form ecological thinking.

Working on environmental problems contributes to understanding the importance of solving them for ensuring sustainable development.

The project activity of the trainees helps to expand their horizons, and the implementation of environmental projects will allow them to acquire skills in solving issues related to solving environmental problems.

In our opinion, it should be attributed to the priority tasks of the modern educational process.

The main principle of the economy of obtaining maximum profit at minimum cost has led to the fact that the costs of environmental protection by large corporations, small and medium-sized enterprises, are often perceived as additional costs affecting the profitability of the business.

Meanwhile, the principles of sustainable development should, in our opinion, provide for the transfer of clean air, fertile land and existing biodiversity to future generations.

In conditions of intensive use of natural resources in economic activity, training of specialists with environmental competencies is required to ensure sustainable development.

The competence of a specialist is determined by the presence of skills, abilities and knowledge for solving specific practical problems.

The competence-based approach in the educational process has been widely used in many countries of the world. Among the pedagogical technologies based on the competence approach, we can distinguish the project method.

The project method allows students to acquire the competencies they need in their further professional activities in the process of its implementation.

#### **5. Conclusions**

The use of the method of projects involving the solution of environmental projects in the training of modern specialists in the field of chemistry allows us to form environmental thinking.

Working on environmental problems contributes to understanding the importance of solving them for ensuring sustainable development.

The project activity of the trainees helps to expand their horizons, and the implementation of environmental projects will allow them to acquire skills in solving issues related to solving environmental problems.

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