Application of Case-study for solving problems of measuring the level of phenol pollution of the Orel River in the training of future ecologists

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Abstract. In the modern world, rapid changes are taking place in many areas of human activity. The processes of globalization and the acceleration of scientific and technological progress require the search and introduction of new educational teaching technologies in the educational process. The requirements for teaching methods and their quality are steadily increasing. The methods of professional training used in the 20th century cannot provide the necessary level of quality in the new conditions, this creates the need for a constant search for even more effective approaches to the professional training of future specialists, including environmentalists. Motivating students to actively participate in the educational process, increasing their creative activity is important for them to gain new knowledge and skills. The most important condition for the formation of motivation is a close correlation between the educational process and the professional activities of future specialists. Case-study is, in our opinion, one of the most effective tools for improving the quality of training of modern specialists. Its functional capabilities largely meet the requirements that society imposes on the modern education system.

1. Introduction

In the modern world, rapid changes are taking place in many areas of human activity. The processes of globalization and the acceleration of scientific and technological progress require the search and introduction of new teaching technologies in the educational process. The requirements for training methods and their quality are increasing. Traditional methods of professional training can not provide
the necessary level of quality in the new conditions, this requires a constant search for more effective approaches for the professional training of future specialists, including environmentalists.

According to [1] the teaching method is a method of joint educational activity of a student and a teacher aimed at achieving certain educational goals.

According to [2] form of organization of educational activities is a set of tools with which the teacher reaches the participation of students in the learning process.

According to [3] currently, teachers should pay attention to the search for new and more productive forms and methods of education and training. At the same time, special attention should be paid to increasing the motivation of students for creative activity and self-education. This will help to improve the quality of professional training of students for the upcoming work.

In the opinion of [4] the choice of teaching methods used largely depends on: the topic being studied, the degree of training of students and the qualifications of the teacher.

According to [5] professional training is characterized by the main aspects of the learning process. However, there is some inherent specificity of professional training related to the formulation of the content, methods, goals and forms of this type of training.

In the opinion [6] in professional training, it is important to increase the level of professional skills of students in accordance with the chosen specialty or profession.

According to [7] the main goal of professional training is to form the appropriate level of professional skills, creative attitude to work, responsible approach to the performance of professional duties.

In the opinion of [8] increasing the motivation of students to participate in educational activities is one of the most effective tools that increase the level of professional training.

According to [9] providing a number of didactic conditions helps to increase the degree of motivation of students to acquire new knowledge:

- Participation of trainees in solving specific production tasks, including research areas.
- Formation of students' need to independently acquire new skills, abilities and knowledge.
- Satisfaction of personal needs helps to increase motivation.
- The organization of the educational process should encourage students to take a creative approach to solving tasks.
- Formation of students' skills of self-assessment and self-control, the ability to plan their activities.
- Students' solution of didactic problems in teams.

In our opinion, in order to fulfill these conditions, teachers, in addition to general professional pedagogical training, also need to know the techniques and methods of motivating the activities of students, the possession and use of self-reflection skills, the ability to carry out self-analysis. The level of professional competence of teachers largely depends on their ability to motivate students. The use of motivational elements in the educational process increases the desire of students to solve the tasks provided for in the curriculum, contributes to increasing the degree of satisfaction of students from participating in educational activities. This, in our opinion, will contribute to improving the effectiveness of the didactic process.

Modern methods of education allow teachers the freedom of their pedagogical creativity. In recent years, among teachers the broad distribution of active methods in the educational activity. This is largely due to the departure from the traditional educational paradigm according to which the student is a passive subject of the educational process to pedagogy based on the cooperation of the teacher and the student.

In the opinion [10] a person-centered learning process puts the student's personality, aspirations, goals, and aspirations first.

2. Methods

In this study, an analytical method was used, with the help of which the studied problems were studied in their unity and development. Taking into account the goals and objectives of the study, the functional-
structural method of scientific research was used. This allowed us to study some problems concerning the use of the case method for training future specialists in the field of ecology.

In our opinion, in didactic tasks focused on professional training, it is necessary to focus on the formation of active cognitive and creative activity of students, expanding their professional horizons, improving the skills required for the upcoming professional activity. It is very important that students can apply the acquired knowledge and skills to solve practical problems, including non-standard ones. Active educational methods encourage students to think logically and analytically. Working as part of a team creates a sense of responsibility for their actions, as well as the actions of other team members, contributes to the development of skills to defend their position and find a compromise solution in problem situations. We hold the view that the use in educational process of active methods contributes to the development of trainees’ number of cognitive components: attention, the ability to express their thoughts, logical and creative thinking provides support for the full realization of creative potential of students, their self-realization and self-expression. In addition, teamwork allows you to acquire skills to control your emotional and psychological state.

3. Results
Among the active methods of the educational process, in our opinion, the most effective are the problem method of a specific situation and the project method of a specific situation. Using the method of a specific situation allows you to solve a wide range of didactic tasks. Among its advantages is the development of the ability to work independently and as part of a team, contributes to the development of students’ thinking competencies, activates cognitive activity, forms the skills of collecting and processing information. The most commonly used type of situation-specific method is case-study. Case-study is a business game for which a certain time limit is set. Case-study has proven itself well for solving problems related to the economy [11]. In this study, we decided to use it to solve environmental problems. An important feature of this method is the consideration of a problem situation, the solution of which is offered to students. Real material taken from everyday life is used to model problem situations.

In the opinion of [12] the case-study should include questions that would assist in solving the problems posed.

According to [13] the case must meet the following requirements: have a clearly defined goal, the level of difficulty must correspond to the level of training of students, be relevant, contribute to the development of an analytical way of thinking, and also have several possible solutions.

Author [14] distinguish two types of Case-study (figure 1).

![Figure 1. Two types of Case-study.](image)

According to [15] it can combine gaming and professional components.
In this study, we offered students of the Dnipro Polytechnic School of Environmental Protection to measure the level of phenol in the Orel River in the basin of which there are several large industrial enterprises during the summer industrial practice.

Toxicant monitoring behavior is an important tool for determining the measures needed to develop and implement measures to protect river basins. The increased content of phenols is one of the most common types of pollution of water resources of rivers and lakes. Industrial waste water containing phenols pollutes watercourses and reservoirs, significantly worsening their sanitary condition, negatively affecting living creatures with its level of toxicity. As a result of the interaction of phenols with gases dissolved in water, dioxins with a high level of toxicity are formed. The maximum permissible concentration of phenols in the composition of drinking water, as well as in rivers, should not exceed 1 mcg/l. When drinking water is treated with chlorine, phenol is converted to pentachlorophenol, a very toxic and carcinogenic substance.

With this in mind, environmental monitoring of rivers to control the content of phenols is of great practical importance.

As part of the solution of this Case-study, students were asked to take water samples in the Orel River in different places of its flow and at different depths. Determine the degree of contamination with phenols and justify the results obtained.

Polyurethane foams were used as sorbents. These foamed synthetic materials have a mesh structure with numerous pores. This method makes it possible to effectively isolate various sorbents from water bodies.

As a result of the work carried out, the students found that the degree of phenol contamination of the Orel River in some places is 2.7 times higher than the permissible value.

As we approached the mouth of the river, the content of phenols increased, the students, after a long discussion among themselves, justified this phenomenon by the insufficient ability of the Orel River to self-purify from phenol impurities.

Thus, as a result of the Case-study solution, students not only learned how to use measuring devices, but together they were able to justify the results obtained.

4. Discussion

Training of highly qualified specialists, whose skills and knowledge meet the requirements that modern society imposes on them, requires an appropriate approach to the educational process. If earlier the main thing for graduates was to get the baggage of knowledge, then for modern graduates of higher educational institutions this is no longer enough. For modern graduates, in addition to the possession of professional knowledge, team work skills, the ability to independently acquire new knowledge and skills, and communication skills are also required. The task of higher education institutions is to assist students to obtain the necessary competencies that they will need in their professional activities.

Figure 2. Requirements for trainees in problem-based learning.
In order to increase the interest of students in obtaining new knowledge, in our opinion, it is advisable to set them tasks that will be important for their subsequent professional activities. Solving a problem stimulates students’ creative activity, as well as increases the degree of assimilation of educational material.

Active methods of educational activity allow students to solve practical problems related to real production and life situations, and students get the role of a researcher.

In our opinion problem-based learning should require trainees to (figure 2).

5. Conclusions
Motivating students to actively participate in the educational process, increasing their creative activity is important for them to gain new knowledge and skills. The most important condition for the formation of motivation is the connection of educational activities with the professional activities of future specialists.

Case-study is, in our opinion, an effective tool for improving the quality of training of modern specialists. Its functional capabilities meet the requirements that society imposes on the modern education system.

In our opinion, Case-study, along with cognitive it also has elements of training and can be successfully applied in the preparation of students of environmental specialties.

The implementation of Case-study allows students to form skills of team professional activity, responsibility for making their own decisions.

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