

Training of chemistry teachers for sustainable development

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Abstract. Proposed and piloted teacher training plan containing elements of the concept of sustainable development. teacher training plan includes the development of general and specialized courses in chemical disciplines, organization of activities, taking into account the principles of Green Chemistry.

1. Introduction

The concept of sustainable development of society in recent decades has become a fundamental principle of human development. Sustainable development understands how meeting the needs of the present does not undermine the ability of future generations to meet their own needs [1]. An important role in the development of this concept belongs to the quality of education and the formation of civil responsibility in the younger generation, so that in the future, based on the knowledge gained, they could form a society functioning on a sustainable basis [2]. The solution of this task is impossible without teachers, and, therefore, the training of teachers committed to the idea of sustainable development is becoming particularly relevant.

2. The basic part

Training of teachers of chemistry at the Kazan Federal University is carried out at the Kh. A.M. Butlerova. Particular attention is paid to the innovative component in the preparation of bachelors and masters [3]. A purposeful work is being carried out to teach the scientific explanation of natural phenomena [4], the formation of professional thinking in students [5], the value-semantic competence [6], the skills of career-oriented work [7]. However, since the concept of sustainable development involves obtaining new energy-efficient materials [8] and optimizing waste utilization [9, 10], these aspects should be reflected in curricula and the organization of training sessions in the process of preparing students of the university.

Consequently, the success of forming future chemistry teachers' understanding of the concept of sustainable development is related to the need to carry out work in three areas. First, to develop a curriculum that allows you to form a solid knowledge of classical chemistry, the methodology of its teaching and the concept of "green" chemistry. Secondly, when carrying out laboratory and practical exercises, regularly demonstrate the importance of waste recycling and non-waste production, and third, systematically carry out work on the formation of the ecological and chemical culture of students.

Let us briefly review the activities of the Department of Chemical Education for each of the indicated areas.



The curriculum developed by the Department of Chemical Education includes classical chemical disciplines such as inorganic chemistry, organic chemistry, analytical chemistry, physical chemistry, colloid chemistry, chemistry of macromolecular compounds, and a number of methodological disciplines on the theory and methodology of teaching chemistry at school. Disciplines "Applied chemistry", "Methods of synthesis of substances" are offered for understanding of the features of technological processes. A modern chemistry teacher should well represent environmental problems and ways to solve them. Such disciplines as "Chemical phenomena in the environment", "Chemistry of soils", "Chemical bases of ecology" form the knowledge of students about the peculiarities of the behavior of chemicals in the environment, the discipline "Problems of environmental and analytical monitoring of environmental pollution", "Fundamentals of chemical safety" Complement the courses of classical chemistry, introducing the properties and methods of determining pollutants in nature. The course "Modern problems of chemistry", which not only reveals and refines the problems of chemistry, but also reveals the features of a new chemical philosophy - "green" chemistry, is conclusive and generalizing. All of the above courses are accompanied by a laboratory workshop in addition to lectures.

Organization of training sessions for future teachers of chemistry is aimed at the formation of professional competencies, education of their ecological and chemical culture, ecological literacy, a sense of responsibility for their actions when dealing with chemicals. The formation of theoretical knowledge among students is supported by the development of practical skills in working with chemicals, the need to follow the basic principles of "green" chemistry in the planning and implementation of a chemical experiment. The importance of working with small quantities of substances in a chemical experiment is suggested and explained, and the need for proper disposal of chemical waste is indicated.

The plan of laboratory works is composed in such a way that some of the substances synthesized by students are used in related disciplines. For example, in a laboratory workshop on the chemistry of coordination compounds, students are asked to obtain sodium hexanitrocobaltate (III), which is then used in laboratory work on analytical chemistry as a reagent for potassium cations. Similarly, in laboratory classes on organic chemistry, when studying the chemical properties of compounds, students receive substances of new classes, which in turn are used in the study of the relevant topic. For example, when studying the chemical properties of alcohols, the corresponding aldehydes and ketones (oxidation reactions) are obtained, which are used in the study of the corresponding classes of organic substances. This approach allows to partially or completely reduce the needs of the department in reagents and follow the philosophy of "green" chemistry. Students - future teachers, performing a laboratory workshop, involuntarily accept the philosophy of both lean chemistry and "green" chemistry. Later, working in school, teachers will be able to convey the principles of "green" chemistry and sustainable development of society to their students.

Educational work with students, as can be seen from the examples given, is conducted continuously throughout the entire educational process. However, the concept of sustainable development covers the most diverse aspects of human and social life and can be viewed from three perspectives: economic (consumption restriction, production optimization), social (harmonization of relations in society) and environmental (philosophy of "green" chemistry). In order to broaden the understanding of sustainable development concepts, students are encouraged to participate in environmental events organized at the university. During pedagogical practice, students develop skills of conducting chemistry lessons, hold conversations with schoolchildren on various topics, touching on issues of sustainable development. As the entire population of the country passes through the school, there is a hope that over time the issues of ecological and chemical culture will be resolved.

Conclusion. The specifics of training teachers of chemistry for the sustainable development of society are revealed. It is related to the activities of teachers in three areas - developing a curriculum, organizing training sessions, educational work with students - future teachers. It is established that the curriculum should include, along with classical chemical and methodological disciplines, environmental and chemical disciplines and disciplines that form and develop a philosophy of "green"

chemistry. The organization of the laboratory workshop should contribute to the formation not only of narrowly professional competencies, but also the education of students in the ecological and chemical culture of the individual.

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