

FOSTERING ENVIRONMENTAL COMPETENCE IN THE PEDAGOGICAL UNIVERSITY GRADUATES THROUGH RESEARCH ACTIVITIES

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Abstract: This paper describes the teaching practices at the Department of Natural Science and Technology of the Mordovian State Pedagogical University named after M. E. Evseviev for fostering the environmental competence in future teachers of biology, chemistry and geography. The authors have identified the main approaches to solving the problem of fostering the environmental competence in the pedagogical university graduates through research activities: the graduates should have a solid knowledge about ecology and environmental factors, a strong ability to assess the condition of the environment under the anthropogenic impact; university should implement full-scope research activities directed at fostering the environmental competence; communicative and practice-oriented pedagogical activities.

Keywords: ecology, environmental competence, research activities, future teachers, orientation toward nature protection, pedagogical university.

1 Introduction

The imperative of the modern society in the 21st century is that a graduate of pedagogical university must have a developed environmental competence. One of the first priorities of the Department of Natural Science and Technology is to foster the environmental competence in the university graduates.

The modern world is living in difficult environmental conditions, which obliges the younger generation to think about the devastating consequences of the environmentally unfriendly actions. In this connection the society has begun to pay more attention to fostering the environmental competence of younger generation which will predetermine the future of people, the nature and the planet as a whole.

The goal of school education is to raise the future generation having the environmental competence and understanding the negative impact of environmentally unfriendly human intervention in nature, possessing certain environmental knowledge, abilities and skills. It brings a challenge before a pedagogical university to raise of students the future teachers committed to developing the environmental competence in the younger generation.

However, the process of fostering this competence cannot be built on traditional methods of teaching focusing on conveyance of theoretical knowledge, which alone cannot be efficient in solving practical tasks. It is possible to address this problem by introducing research activities in the learning process. Thus, the issue of fostering the environmental competence in pedagogical university graduates through research activities proves to be relevant.

The competence of a prospective teacher is a complex structural formation which requires ongoing improvements, where the environmental competence is among the key competences to be developed in a pedagogical university graduate. The professional growth trajectory of a future teacher depends on the individual capabilities of students and professionalism of teachers.

The environmental competence includes certain combination of environmental action algorithms and criteria for implementing such algorithms in practice.

2 Literature Review

The basic concept in the context of the problem under scrutiny is research activity. Analysis of scientific and methodological literature revealed that the issue of research activity was studied in the works of A. V. Andreeva (2015), E. A. Makarova (2011), A. G. Busygin, E. V. Lizunova (2018), V. A. Slstenin (2006), A. V. Khutorskoy (2013) etc.).

Nowadays the educational process with a research orientation is considered as one of the ways for boosting creative potential and original thinking, and also is one of the main characteristics of the high level of education of modern students (Busygin & Lizunova, 2018).

Highly relevant is the use of research activities in the system of effective fostering environmental competence for the implementation of integration ideas. The incorporation of research activities as a centralized conceptual platform in the educational process will provide future graduates with the opportunity to build an individual learning path. An individual learning trajectory is a personal path of tapping the personal reserve of environmental knowledge of each graduate (Smirnov & Maltsevskaya, 2019).

According to researchers, research activity is a type of action associated with satisfaction of the needs of students in creative, learning, cognitive activity, which final product is the new knowledge acquired in accordance with the goal (Smirnov & Maltsevskaya, 2019).

The high urgency of the need to foster the environmental competence in future teachers is tied to the requirement of Federal State Educational Standard 3++, which states that each graduate should possess the universal competence (UC-8, GPC-8) for developing conscious attitude to the environment (Portal of the Federal State Standards for Higher Education, 2021; Sadykova & Niyazova, 2014; Satueva 2016).

The research format of activities contributes to the proactive development of graduates' readiness for carrying out professional activities in educational institutions (Chigisheva, 2010).

3 Research Methodological Framework

The purpose of this research was to identify techniques for fostering the environmental competence of pedagogical university graduates through research activities.

The research objectives were:

- develop a model of fostering the environmental competence of pedagogical university graduates through research activities;
- test the developed model and assess its effectiveness;
- analyze results of the experimental work aimed to foster the environmental competence in pedagogical university graduates through research activities.

This research employed theoretical methods for reviewing the research and methodology literature, observation, analysis, comparison and synthesis, as well as an empirical method (an experiment). The experiment was conducted in 2019-2021 academic year on the basis of the Mordovian State Pedagogical University named after M. E. Evseviev (MSPU). It included 30 students of the Department of Natural Science and Technology of the Mordovian State Pedagogical University named after M. E. Evseviev (MSPU).

During the experimental research, the environmental questionnaire of S. S. Kashlev and S. N. Glazachev (2000) was used to reveal the level of environmental competence of the pedagogical university graduates through research activities. The

questionnaire consisted of 45 questions divided into three modules: environmental: focusing on the questions about environmental activities at the level of each individual and society as a whole (Questions 1-10), mental: focusing not only on the environmental knowledge, but also the natural sciences exploring the environment, its components and their interactions (Questions 11-24) and behavioral: focusing on the environmental skills and creative abilities of students related to application of the obtained knowledge in practice (Questions 20-45). The levels of environmental competence were revealed based on the following differentiation scale: from 0 to 20% - very low; from 21 to 45% - low; from 45 to 75% - medium; from 76 to 100% - high.

4 Results and Discussion

We would like to present the main approaches to solving the problems of fostering the environmental competence of pedagogical university graduates through research activities. The first approach is revolving around the fact that modern university and, in particular, the Department of Natural Science and Technology should be the powerhouse of protection and preservation of ecology and environment. Future teachers should have a solid knowledge about ecology and environmental factors, as well as proper skills to understand the state of ecology resulting from anthropogenic impact.

The second approach is rooted in the fact that in modern higher education institution the full-fledged work should be performed aimed at fostering the environmental competence. The learning content should include the research projects presenting information and facts about environment and ecology. A special place in the research activities is taken by ecological games, eco-trails, eco-quests, which may be efficiently used both inside and outside the classroom.

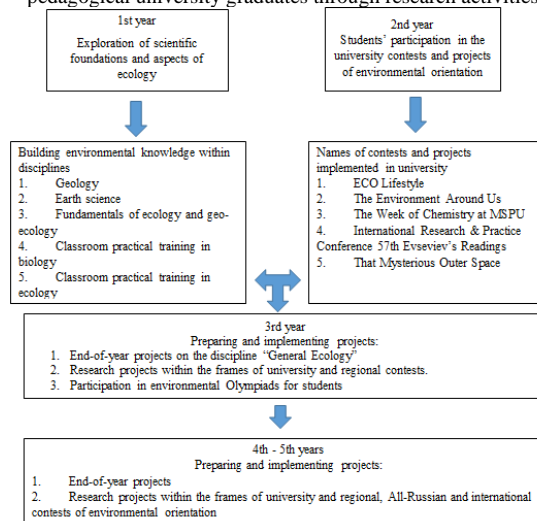
The third approach is hinging on understanding a big role of research activities for the environmental research projects involving cognitive, communicative, practice-oriented pedagogical activities. For implementation of this approach, the biodiversity preservation projects are of great importance.

For accomplishing the purpose of this research, the compound environmental questionnaire was used, which was produced based on several methods of S. S. Kashlev, S. N. Glazachev (2000) in the authors' own interpretation. Two groups, comprised of 30 students each, were organized for the purposes of our experiment. The first group included the graduates who received training under the general education program of higher education without participation in additional research activities, it was the control group. The second group, experimental, included students who, starting from the third year, took an active part in competitions, Olympiads and research projects of environmental orientation.

A large amount of research work is implied for producing end-of-year papers on the disciplines of environmental content and the final qualification paper.

We have developed a model of fostering the environmental competence of pedagogical university graduates through research activities (Figure 1).

Figure 1 A model of fostering the environmental competence of pedagogical university graduates through research activities



Source: developed by the authors

Taking into account the modern trends in the development of global educational space and new requirements of the competence-based approach to the qualification of pedagogical university graduates, the importance of ecological competence cannot be underestimated. The structure of this competence includes the following important components as presented in Table 1.

Table 1 Main criteria, indicators and methods of measuring the effectiveness of efforts aimed at fostering the environmental competence of the pedagogical university graduates

Seq. No.	Criteria & indicators	Measurement methods
Cognitive component		
1.	Acquisition by graduates of a framework of environmental knowledge and necessary skills for modelling environmental relationships and processes.	- Understanding of the holistic ecological picture of the world; - ability of graduates to identify the causes of environmental problems and to foresee their probable consequences.
Professional-activity component		
2.	Readiness of the bachelor's degree holders for environmental action.	- Answers on the methodology of environmental education and propagation of environmental ideas; - performance of creative tasks requiring research activities to solve environmental problems.

Source: compiled by the authors

As concerns the first criterion, graduates performed tasks intended to check their understanding of the holistic ecological picture of the world (Task 1-10) and tasks checking their ability to identify the causes of environmental problems and to foresee their probable consequences (Task 11-24). The conducted research yielded the following results: in the experimental and control groups 11.8% and 10.5% of graduates respectively demonstrated the high level of environmental knowledge and environmental modelling skills. It was revealed that 47% of graduates in the control group and 59% in the experimental group have the medium level of such knowledge and skills. So the number of graduates with a medium and high level of the first and second criteria was: 70.8% of students in the experimental group and 57.5% in the control group. The low level and very low level of the environmental knowledge was

shown by 29.2% in the experimental group and 35% and 7.5% graduates respectively in the control group.

The indicator of the second criterion was the level of the fostered environmental competence of graduates. We used 10 tasks requiring answers regarding methodology of environmental education and propagation of environmental ideas and another 15 creative tasks requiring implementation of research activities to solve environmental problems.

Having analyzed the results obtained in our research, we came to the conclusion that:

- more than half of students from the pedagogical university studying at the Department of Natural Science and Technology in both the experimental and the control groups, showed high and medium results based on the questionnaire results, which is explained by the fact that most students chose the specialty with a natural science orientation and already have the basic knowledge of environmental problems;
- all the graduates have to complete end-of-year projects on the discipline "General Ecology" which by default implies completion of a creative project;
- division of students into groups showed that graduates in the experimental group have the higher ecological competences.

5 Conclusion

The better results of students, the prospective teachers, from the experimental group are explained by their active participation in research activities related to the environmental competence. Research activities are not associated only with the development of cognitive skills, but also the ability to navigate the information and digital space, the ability to compare the stated objectives and the obtained results, the ability to structure obtained knowledge in an intelligent way. The future teachers, when carrying out research projects related to environmental issues, are in some way "challenging the future", and on the basis of the received integrated environmental knowledge they choose the most effective ways to solve problems related to the close socio-natural sphere, facilitating implementation of the principles of sustainable development.

Thus, the findings of pedagogical experiment targeting the cognitive and professional-activity components of environmental competence indicate that systematic involvement of students during their five-year study period to research activities of environmental orientation helps to raise the level of environmental professionalism of graduates.

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