



Conditions and Technologies of Students Ecological Culture Formation

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ABSTRACT

Technical progress is closely connected with the social and everyday comfort of society, with the level of the needs of modern society, but the disruption of production cycles, the low level of environmental management culture, the unintelligible consequences of its power over the surrounding world, destroy the harmony of the environment and human beings. The purpose of the paper is directed to improve the professional training of graduates of higher educational institutions, capable of solving production problems with minimizing environmental risks. The authors revealed pedagogical approaches to environmental education and substantiated the essence of the concept "ecological culture of students". Pedagogical conditions that contribute to the formation of ecological culture of university students are developed, introduced and experimental tested. The paper is intended for teachers, heads of educational organizations, researchers dealing with environmental security issues.

Keywords: higher education, high school, students, ecological culture, ecological education, ecological safety, pedagogical conditions

INTRODUCTION

Acuity of the modern ecological situation, characterized by contradictions in the relationship between society and nature, the complexity of overcoming it in modern society is exacerbated by the problem of the destruction of natural ecosystems and the

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disappearance of a significant number of living organisms. The modern ecological situation causes general anxiety, disputes, and discussions and urgently requires rethinking of the usual views on the nature and place in it of a person. The relationship between nature and society has reached a critical point today, and the environmental problems of their interaction can be solved only by using the entire range of natural, technical and humanitarian knowledge.

Technical progress is closely connected with the social and everyday comfort of society, with the level of development of the spiritual and moral needs of modern society, but the disruption of production cycles, the low level of environmental management culture, the unintelligible consequences of its power over the surrounding world lead to an unfavorable ecological situation that destroys the harmony of the environment and human beings.

Already today one can say that the main problems of society in the environmental sphere are often due to the barbaric behavior of society itself in relation to the environment and the blatant ecological illiteracy of the population. At present, as we see, a special emphasis is placed on the connection of environmental problems with the culture of the individual and the culture of society.

The problem of environmental education has often been the subject of scientific attention of such researchers as Zakhlebny [1], Kozlova [2], Mishatkina [3], Petrov [4], V.I. Sivoglavov [5], Suravegina [6] and others. Most of the works are devoted to the development of ecological literacy of university students, the formation of ecological consciousness and ecological culture of future specialists.

In the studies of Biryukova [7], Gerasimenko [8] and others the features of training future bachelors are studied and it is noted that their future professional activities (engineering, industrial technology and others) is closely related to the ecology of natural systems, with a moral responsibility for preserving the environment and depends on the ability to anticipate the environmental consequences of their activities.

The problem of the formation of reasonable interaction in the ecosystem, the ecological culture of man and society was one of the priorities of modern pedagogical science [9, 10]. Today we are talking about ecological pedagogy, which offers the content of ecological and biological education with the aim of predicting new, environmentally valuable orientations and the formation of ecological culture.

In addition, the ecological and spiritual and moral problems of modern civilization are becoming more active, the issues of the culture of biological and ecological education are being raised within the framework of the humanistic and culturally appropriate paradigm [11, 12].

We in our work emphasize the discrepancy between the orientations of professional training of students and the development of a special way of thinking that provides an understanding of the relationship and dependence of "socially desirable" [13] human activities and possible ecologically dangerous consequences of this activity. This vision is the

basis for the formation of the ecological culture of university students and their further environmental-safe behavior in professional situations.

MATERIALS AND METHODS

The problem of preservation of ecology is the object of attention of representatives of the various sciences (philosophy, pedagogy, psychology, sociology, cultural studies, literature, etc.), so the theoretical analysis of several studies which reveal the essence of the concepts of "ecology," "environmental culture", revealed the key idea of our research: ecology as the science about the relationships of organisms with each other and with the environment, not only reveals the relationship between human activity and the degree of destruction of the biosphere, it is a part of culture and understanding of the world, serving as prevention the looming environmental crisis.

The analysis of the scientific literature made it possible to draw attention to two global conclusions of scientists:

-orientation to the technocratic model of life-making caused the activation of environmental and spiritual-moral problems, therefore, a transition from anthropocentric consciousness to a new eco-anthropocentric public consciousness is inevitable;

- the causes of many environmental crises are simple illiteracy and low level of ecological culture of the population; therefore, a new model of ecological education is needed, where the system of values (life, wildlife, health, people, knowledge) and the ways of conservation of nature and human being as one of the Many species on Earth are singled out.

By organizing their environment, constantly solving important problems for them, human beings spend their mental, emotional and physical energy. At the same time, the "habitat" is by no means reduced to one or another area of activity. All of them ("labor", "life", "leisure", etc.), as well as the well-known "sectors" of public life (ecology, economy, culture) are linked not directly, but "through man", that is why everything that happens with culture affects the economy and the environment; changes in the economy affect the state and level of ecological culture.

Many researchers [1, 2, 3, 4, 5, 6], recognizing the inseparable connection between the concepts of "culture" and "ecology", consider "ecological culture" as the competent use of the environment based on the knowledge of the natural laws of nature development, taking into account the immediate and remote consequences of environmental change under the influence of human activity, optimal and effective norms of human behavior in a given natural environment. On ecological culture as one of the manifestations of culture in general, encompassing the sphere of relations between man, society and nature, presenting it as a method of socio-nature development in their unity, manifested in the spiritual life of man, in his or her actions and life [14].

Ecological culture of university students we consider as a personal construct, which includes a set of ecological knowledge, personal meanings, attitude to nature as a value, an orientation to a constructive transformation of reality from the position of conservation of

nature, as well as motivational readiness for independent actions to protect the natural environment in the professional sphere.

At the same time, ecological culture as a world view of the future specialist rarely becomes the object of purposeful theoretical and empirical study from the standpoint of the level, criteria, and the possibility of representing about the qualitative and quantitative state of the formation of its main components among future graduates of universities.

Agreeing with the conclusions of Prokofieva [15] that environmental educational competency, ecological awareness, and ecological activity are components of ecological culture, we believe that it is important to single out the professional orientation of the ecological culture of the future specialist: mastering the system of properties, abilities and skills that protect the environment and the person himself (Fig. 1).

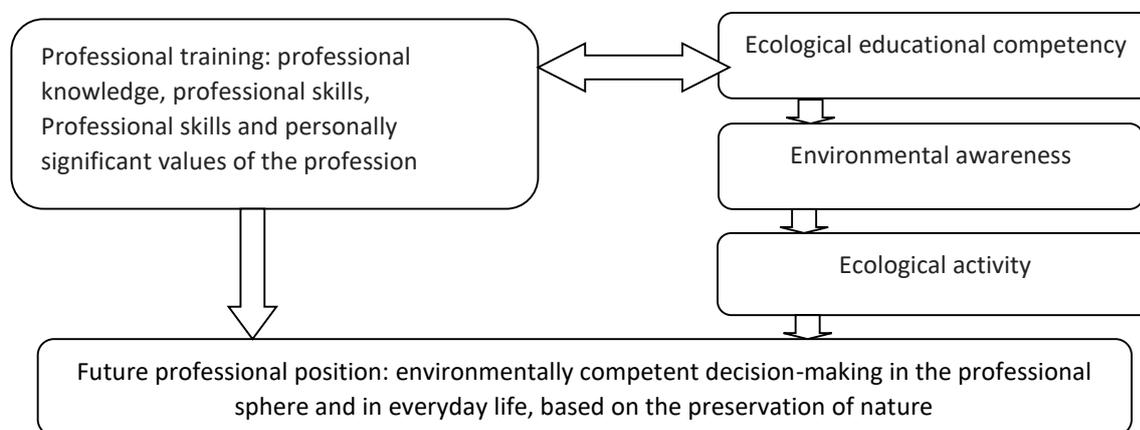


Figure 1. Components of the environmental culture of students

We identify these four components as the basis for the future professional position of the individual, based on environmentally competent decision-making in the professional sphere and in everyday life.

Considering each of the components, we understand the *ecological educational competency* as a system of ecological knowledge, abilities, and skills, which is the basis for further work towards the formation of ecological culture.

Through the environmental educational competency of students, we will be able to come to a qualitatively new stage in the transformation of knowledge into beliefs - environmental consciousness.

We define *environmental consciousness* as the level of development of ideas and attitudes towards nature, the established personal values manifested in the comprehension of the beauty of the surrounding world, its aesthetic, patriotic and cultural significance, and as the ability for a responsible and free choice of environmentally appropriate behavior in nature.

Environmental activities are conscious actions and actions aimed at preserving and protecting the natural environment.

Considering the fourth component of ecological culture - *vocational training*, we allocate professional knowledge, abilities and skills that are a necessary basic element in the formation of a future professional position based on environmentally competent decision-making in the professional sphere and in everyday life.

The presented structure of ecological culture allowed us to identify indicators and levels (high, medium, low) of the formation of the ecological culture of students (see Table 1).

Table 1. Characteristics of the levels of the student's ecological culture.

Level	Ecological educational competence	Ecological consciousness.	Ecological Activities.
Low	Formality of knowledge at the level of general representations and concepts	Pragmatism of the attitude to the nature, the responsibility for behavior in nature is not conscious	Passivity in environmental protection
Average	Knowledge at the level of interest in environmental issues, reasoning about the importance of ecology for humans.	The value of nature is realized at a declarative level.	There is no clear position in motivating of environmental protection activities.
High	Knowledge of the environment as personally significant values	Strong environmental beliefs.	Manifestation of creativity in making environmentally sound decisions.

The search for models of education adequate to the modern type of attitude towards ecology and responding to a new stage in the development of ecological culture constitute one of the topical pedagogical tasks of universities.

Analytical review of research in the field of vocational training has shown that the basic and professional culture of a specialist [16, 17], possessing multifunctional competencies, are recognized as components of the content of education. Thanks to this, the students' individual internal position develop in relation to reality and the chosen profession, future work, surrounding people and themselves. On the basis of this position and simultaneously with it, vital activity is formed, as a condition and a way of self-determination, self-expression and self-assertion of the person in activity, interpersonal relations and communication. But the willingness of a specialist to work with an eco-centric focus (be it a teacher, a technician, an engineer, a kindergarten teacher, etc.), his or her ability to comprehend, change in professional self-manifestation in accordance with the level of his or her ecological culture cannot be rigidly imposed. Readiness can be formed as a personality's quality on the basis of purposeful psychological and pedagogical activity.

RESULTS

We consider the formation of the ecological culture of university students as a process that takes into account the integrity and interrelation of professional knowledge, special ecological knowledge and awareness of readiness for eco-oriented activities in solving professional problems.

When designing the process of forming the ecological culture of university students, we adhered to the basic system-wide principles, such as:

- integrity and integration of disciplines, contributing to the creation of a unified educational environment,
- the active nature of education and social activity of subjects of education,
- emotional and intellectual cooperation between a teacher and a student,
- self-control and positive motivation of the results of active activity.

Totally 228 people were enrolled in the experimental work (114 students in the control group (CG) and 114 students in the experimental group (EG) (students of the Kazan National Research Technical University named after A.N.Tupolev).

At the organizational stage, we conducted a study of the level of ecological literacy, environmental awareness and experience of environmental activities of students. Authors' and modified test diagnostic methods were used to determine the initial level of ecological culture, computer testing was used to assess three components of ecological culture: 1 - ecological (residual) knowledge in ecology, 2 - ecological consciousness, 3 - environmental activity.

As the basis of our technique for assessing the data of the first component of ecological culture (ecological educational competency), we took a test material developed on the basis of the requirements of the state standard of students' training, containing the basic didactic units that are compulsory for study at the university.

The first unit of the test, which characterizes the *students' educational competency* in the field of ecology, is based on the requirements of the educational curriculum. The second unit of the test, which assesses the *students' environmental awareness*, contains questions on identifying students' personal responsibility in the field of ecology and the possible risks of their activities. The third unit of test questions, characterizing *environmental activities*, identified environmental deeds, behavior and participation in environmental activities.

The final control of knowledge also consisted of the same three units, but the first unit of the test was changed, the second and the third were the same.

The results of the entrance control of knowledge revealed both in the control (n = 114) and in the experimental groups (n = 114), low knowledge of the subject, corresponding, on average, to the "satisfactory" estimate. Low results were found in both groups, both in terms of environmental awareness and activity, where test results corresponding to a low level of culture range from 38 to 63%.

Based on the results of the introductory knowledge control, it was concluded that most students had poor knowledge of environmental concepts, did not know how to express their

attitude to the surrounding nature, there were practically no students who took voluntary participation in environmental protection activities.

From the mathematical processing (through the Pearson criterion χ^2), it was concluded that at the beginning of experimental work with students, the degree of ecological culture of the students in the CG and in the EG was evenly distributed (the comparison showed no significant discrepancies in the values at a sufficiently high level of significance $\epsilon = 0,01$). Consequently, the forming experiment after the completion of the study of the discipline should allocate EG from the CG in the case of properly selected and implemented pedagogical conditions

Within the framework of the forming stage of the experiment with the aim of developing the qualities of a specialist capable of understanding responsibility and acting in the light of the preservation of the environment, we carefully studied the boundaries of the discipline "Environmental foundations of nature management", identified topics that come into contact with other disciplines of the curriculum. We excluded the inter-disciplinary duplication of topics related to the study of a safe educational and production environment. This allowed the inclusion of additional material related to environmental activities in the region (Republic of Tatarstan), with protected areas, as well as issues of bioethics. In addition, the notions "ecological culture", "ecological consciousness", "ecological behavior", "nature protection activity". Were introduced. In order to deepen the general idea of students about the specifics of the ontogeny of man's ecological culture, philosophical, religious, folk-traditional, normative, moral-ethical, activity-oriented notions and representations that have developed in the public consciousness for many millennia of human interaction and the environment of its habitat were introduced into the content of the discipline. The above mentioned forms and methods of environmental education in the university were used by us throughout the time allotted for studying the course "Ecological Basics of Nature Management". However, limited by the timeframe of this discipline, we highlighted the strategies of environmentally oriented work with students, which support the awareness of the importance of environmental information in subsequent courses. So, when conducting excursions to the enterprises, students prepared a report that provided for the solution of environmental problems. The students' answers were necessarily assessed by the teacher of the profile discipline. In addition, close cooperation with the teacher of the discipline "Fundamentals of Law" made it possible to highlight the problems of environmental legislation in the relevant sphere of production. Students studied those legal issues that are directly related to the company's environmental policy: the company's environmental passport; Environmental standards, fixed by law, as well as information on maximum permissible emissions and discharges at enterprises of different profiles. The students concluded that enterprises seeking to preserve the ecological status of ecosystems currently occupied a leading position in world markets. This is due to the introduction of not only modern technologies for cleaning and processing, but also with an increase in the consumer rating of these companies, with positive advertising, and, therefore, a more winning position of the manufacturer.

So, we have singled out those basic components of the pedagogical system that allowed to integrate subject (professional) knowledge, super-subject (special ecological)

knowledge and readiness for eco-oriented activity in the professional sphere with the goal of developing the qualities of a specialist capable of understanding responsibility and acting in the light of preserving the environment, that was defined by us as *the first pedagogical condition* for the formation of the ecological culture of university students. It should be noted that the implementation of *the second pedagogical condition* - the provision of methodical maintenance for the formation of ecological culture through the implementation of pedagogical forms, methods and tools that promote the integration of environmental educational competency, consciousness, activity, is reflected in the methodical manual developed by us for university teachers on the formation of ecological culture. It provides lesson by lesson planning with a methodical description of all practical exercises.

Lessons based on the principle "from simple to complex," allowed creating a basis for future work. By activating the activities of students in the classroom and in extracurricular activities, the motivation for solving environmental problems was generally increased and the significance of their solution in the future professional activity was actualized. The activation of students' activities to protect the ecological environment was defined by us as *the third pedagogical condition*.

With the purpose of its implementation, seminars, conferences, business and role plays were practiced, situations were solved where students themselves discovered the problem, formulated it and tried to offer solutions. In such studies, students developed analytical skills, showed interest in discussions, developed a desire to defend their own position. In most cases, new knowledge was acquired on the basis of an independent search for material; Environmental experience was tested through the independent organization by students of environmental actions.

To verify the pedagogical conditions implemented by us in the experimental work, we performed a mathematical processing of the data based on the results of the final testing. The percentage correlation between the results of testing of university students in CG and EG in the final stage of the experiment was presented in Table 2.

Table 2. Levels of formation of ecological culture of students at the final stage of experimental work.

Structural components of Ecological culture	Low level		Average level		High level	
	CG	EG	CG	EG	CG	EG
Ecological educational competence	37	22	49	53	14	25
Ecological awareness	51	26	42	46	7	28
Ecological activity	82	33	18	35	-	32

Comparing the indices of the groups at the final stage of the experiment, we see the same distribution, both in the CG and EG at the average level, while the ecological knowledge with a high level in the experimental group is characterized by big values. This ratio is quite understandable, since the educational curricula, on which usually the subject

"Ecological basics of nature management" is taught, are focused, mainly, on the formation of knowledge among students. Our system of environmental education is aimed at the comprehensive development of students, which simultaneously deepens environmental knowledge, forms the ecological consciousness and develops the students' need for environmentally oriented professional activity.

The values of the levels in the second component of the ecological culture - ecological consciousness - significantly allocate the experimental group at the end of the experiment, where the qualitative increase of the high level is much higher than in the control group. At the same time, the low level indicators, on the other hand, are lower in the experimental group than in the control group.

Ecological activity, being, in our opinion, the most difficultly amenable component to ecological culture, meanwhile, is characterized by a certain positive dynamics. If before the experimental work a high interest in environmental activities was manifested in 20% of the subjects, then at the final stage a high level was found in 35% of the students, the average level of activity in the activities was shown by 50% of the students from the total number of the group.

Subjects in the control group are more likely to exhibit an average and low level of ecological culture.

In the control group, the percentage of ecological culture levels' ratio did not undergo any obvious changes, on average in the sample, the percentage distribution of subjects by levels changed by only 5%, which cannot indicate a significant dynamics of the investigated variable.

Based on the statistical analysis of the Student's t-test method, which allows us to establish the reliability of the changes that occurred, we can conclude that the set of conditions proposed by us provides a positive dynamic for the formation of the ecological culture of university students in the framework of the pedagogical technologies that we are implementing.

DISCUSSIONS

The problem of the formation of reasonable interaction in the ecosystem, the ecological culture of man and society was one of the priorities of modern pedagogical science [1, 2, 3, 4, 5, 13, 18]. Today we are talking about ecological pedagogy, which offers the content of ecological and biological education with the aim of predicting new, environmentally valuable orientations and the formation of ecological culture.

Based on the theoretical generalization of the scientific literature, the concept "ecological culture of student" is concretized, its components are clarified: environmental educational competency, environmental awareness, environmental activities and vocational training, which are closely interrelated.

Since ecology is the science of home, homeland (Greek oikos is a home, homeland), the purpose of modern ecological education is to restore natural connections of man, nature and culture, to realize the idea of a national home, outside of which it is impossible to manifest

the authenticity of humanity. Re-creation in education is carried out through integrated courses, convergence of natural and humanitarian disciplines.

CONCLUSION

The results of the study confirmed the legitimacy of the hypothesis put forward that it is possible to form an ecological culture through a set of author pedagogical conditions that ensures the integration of environmental and professional knowledge with the purpose of developing the qualities of a specialist capable of acting and taking personal responsibility for the preservation of the natural environment.

The authors expanded the theoretical ideas on the features of the process of formation of ecological culture in the conditions of the university by integration of disciplinary (professional knowledge), super-disciplinary (special ecological knowledge) knowledge and readiness for eco-oriented activities in the future professional sphere.

Defining the prospects for research, we believe that further study can be aimed at identifying the level of dependence of ecological culture and the professional well-being of a specialist in various life situations.

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