



Raising Environmental Awareness of Future Teachers

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This paper provides new and effective modes of professional environmental training for future teachers. We have designed a model of environmental awareness. It was used in the pedagogical experiment to develop a holistic view regarding its significance in the overall structure of professional competence of future ecology experts. We have interviewed 47 students of pedagogical university in order to assess their level of theoretical knowledge and environmental skills. Applying environmental training modes and methods and gaining particular experience allowed effectively organizing the pedagogical process that would promote the development of environmental awareness and attitudes. Our original techniques were used to stimulate intellectual activity of students in this specific field, facilitate the process of identifying personal potential and its activation in the field of nature and resource management, environmental protection.

Keywords: environmental education, professional development, environmental awareness, evaluation criteria, teacher

INTRODUCTION

Humankind has long recognized that its existence depends on the environmental status (Vernadsky, 1991). However, consumer attitude towards nature led to a strong conviction in the primacy of human being in relation to the environment (Nazarenko, 2012; Shorette et al., 2017).

Worldview attitudes determined by upbringing and education can be represented by two models. The first model is characterized by the perception of the world as a set of random events, unconditional causal connections. Consequently, the world is unknowable for the first model. The second model treats the surrounding reality in its unity and integrity, when all natural and social processes and phenomena are interdependent. Such world outlook stimulates cognitive processes and personality development. The second model determines the need for providing younger generations

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with basic knowledge for further self-understanding of the surrounding world (Hayati, 2016; Du Plessis & Brandon, 2015).

Considering the problems of modern humanitarian education, one should pay specific attention to the relevance of environmental education with regard to significant deterioration of environmental quality parameters (Berger, 2002; Glazachev and Kogay, 1999). The environment, in fact, determines life dynamics, public health, spiritual and moral development (Abdrashitova, 2004; Kibbe, Bogner & Kaiser, 2014).

Teachers play an important role in implementing environmental education programs (Bergman, 2016; Stern, Powell & Hill, 2014). More specifically, such factors as positive environmental attitudes, environmental sensitivity, environmental knowledge and skills are important for affecting teacher's decisions on environmental education (Ernst, 2009).

One can note that teachers need to cultivate students' abilities to understand, criticize, and participate rationally in any discourse on controversial, value laden issues of sustainability. This requires a holistic approach addressing social, cultural and ethical aspects (Bergman, 2015). If teachers lack proficiency in environmental knowledge, skills and commitment, it is unlikely that they will be able to effectively lead environmental change in schools (National Environmental Education Advisory Council 2005).

In Russia, environmental education centers are created mainly in pedagogical universities. They have accumulated considerable teaching experience and environmental knowledge. This allows organizing active environmental education more specifically related to the interaction with the environment (Mingazova, 2014).

The key requirement for graduates of the secondary and higher educational institutions implies not only assimilation of specific environmental knowledge, but also their independent deepening, enrichment, systemization and use under varying conditions (Altin et al., 2014; Jefferson, Ciro & María Andrea, 2017). In Russian Federation, higher education is being modernized to train specialists with high level of experience and versatility in the fields of nature/resource preservation and environmental protection (Rogovaya, 2007).

This situation put a school teacher at the forefront of solving one of the most difficult problems, as this very person was entrusted with training new generations. Modern teachers perceive environmental science as applied aspects of nature protection. This attitude does not raise their awareness regarding the harmony with nature and knowledge of relations between man and nature (Liu, 2015; Yevdokimova, 2005).

The teacher as a professional is a link between the generations, a bearer of social and historical experience (Zimnyaya, 2005). As a subject of pedagogical activity, teacher is simultaneously considered as a social and cultural source of knowledge and values. Based on these pedagogical features, teacher is to generate knowledge, beliefs and skills of environmental preservation and nature protection.

Based on the hard information on critical conditions, teacher should be able to analyze, synthesize and evaluate available options related to:

- suspending the rate of destructive environmental processes followed by their complete elimination;
- finding ways to develop new technological approaches to Zero Waste;
- bringing new environmental knowledge to all social strata, groups and categories through one of the main teacher's tasks – developing motivation regarding the correctness of the idea to serve people (Ponomarenko et al., 2016).

Ecologists, educators and psychologists are confident in solving this task by modernizing the education system. This situation is complicated since such this task should be solved by schoolteachers.

Teachers consider the environmental science as an extra, background subject that does not allow reorienting people from consumer to environmental attitude (Littleddyke, 2008; Goldman, Yavetz & Pe'er, 2014). The environmental crisis will not be got over until the State convinces the need for a fundamental solution of this problem. Thus, the subject of this study is relevant.

METHOD

Design

Environmental awareness was assessed on the basis of:

- apparent personal attitudes towards participation in environmental research expedition; scientific and practical conferences on ecology;
- active participation in environmental work days;
- studying the experience of developed countries related to rebuilding the destroyed natural objects;
- search for additional literature on ecology;
- desire to give environmental course and qualifying research on ecology.

We have assessed the following components and elements of raising ecological awareness:

- level of environmental knowledge (*cognitive component*);
- personal attitude to solving environmental problems;
- modality and awareness of personal attitude towards the environment, its status, impact on public health and quality of life (subjective attitudes, readiness to environmental activity);
- environmental behavior, actions, ideas;
- readiness to learn green technologies;
- level of environmental program assessment skills, participation in environmental activity (*activity component*);
- concern about the environmental status, awareness of the need in cardinal measures for its improvement (*emotional component*).

We have carried out a survey before the pedagogical experiment. We have analyzed the revealed specific features of student's perception and attitude towards ecology, its role and place among other academic disciplines. We have also analyzed their beliefs and personal attitudes related to learning ecology in order to provide both theoretical and practical readiness for environmental culture development in schoolchildren.

The environmental awareness and educational background were studied by a properly designed questionnaire (Figure 1). We have used it to assess theoretical knowledge and environmental skills. The attitude towards the environment, awareness of environmental crisis and ways out of it were assessed as well. We have also assessed the demand for an ecological lifestyle in terms of maturity. This involves the knowledge of environmentally aware activity standards and rules. In the poll, students were asked to express their attitude to the current environment, to assess the degree of human influence on the habitat, as well as the deterioration level for environmental parameters. Test results (control and experimental) were analyzed and compared.

Table 1

Content of questionnaire

Task: Carefully read the question, understand its content, think the question over and response by indicating the relevant option.

Questions	Response options		
	Yes	No	Don't know
1. Should ecology be a major subject?			
2. Does this discipline form readiness to active environmental activity?			
3. Do you receive information on environmental status in your area while taking the ecology course?			
4. Do you have a firm belief in the paramount importance of this subject?			
5. Do you know what effect the environment has on the human body?			
6. Are you ready to form the ecological consciousness in schoolchildren after graduating from the pedagogical university?			
7. Do you have thoughts on environmental knowledge improvement?			
8. Do you desire to conduct a scientific research in the field of ecology?			
9. Do you think that environmental knowledge received at the university is sufficient to form student's skills of nature protection?			
10. Do you consider ecology as a vitally important course?			
11. In your opinion, do need deeper study of ecology?			
12. Do you share the opinion that a schoolteacher should form environmental thinking in students (1-11 grades)?			
13. Do you apply effective environmental teaching modes and methods at school?			
14. Do you know how to raise interest in studying ecology in secondary school pupils?			

Methodology for raising the awareness on the significance of ecology as a basic course determining the general educational content takes into account the following:

- raising theoretical and psychological readiness of students to participate in regional environmental research expeditions as assistants and members of the working group;
- participating in environmental work days: site tour, learning the area status; practice; developing ideas and making proposals to improve the efficiency of these work days;

- preparing for participation in scientific and practical conferences based on the results of research expeditions (getting acquainted with the expedition program, measurement technologies used for water and soil sampling; methods for determining populations of animals, birds, insects, etc.);
- analyzing conference proceedings: reports, research papers; identifying and discussing new ideas and approaches to the solution of environmental problems;
- participating in meetings on environmental issues at different levels; forming one's own attitude towards discussed issues; forming attitudes and raising awareness on the significance of ecology for human life;
- designing personal research expedition program under the guidance of experienced professionals;
- organizing a series of excursions to explore environment and to identify potential opportunities of its change for the better.

All these activities allowed involving EG students into active environmental activity and shaping their personal attitudes regarding the fundamental significance of ecology for life preservation.

Participants

We have conducted a pedagogical experiment attended by 47 students of pedagogical university. They were divided into two groups: control group (CG) – 23 students; experimental group (EG) – 24 students. They were 18-20-years-old (second and third grades) students majoring in natural science and geography – future biology and geography teachers – with high cognitive activity characterized by formed discussion skills and personal opinions on the research issues. These students are active citizens engaged in the process of implementing the principles of environmental activity focused on shaping an environmentally friendly attitude to the environment. They have an ecological lifestyle and are interested in scientific work in the field of ecology.

Instruments

Participants of the pedagogical experiment realized its purpose and program. The students wishing to participate in this experiment were included into the experimental group.

We have solved the following problems during the sampling: establishing subject-subject relations between future school teachers and their university teachers; giving knowledge of research activity; forming skills of independent work for personal enrichment.

Survey results showed no significant differences in awareness on the significance of ecology as an integrated, basic course, ($p > 0.05$).

Research reliability and validity are determined by the Student's test that takes into account the dynamics of different indicators.

In the CG, students were taught according to the curriculum approved by the Ministry of Education; in the EG, teachers have applied our method of raising awareness on the

significance of ecology (as part of environmental awareness) as a basic course determining the general educational content.

The methodological framework of this research corresponds to research goals and features. At this point, we face some limitations. Control survey was not performed. Our sample is small and this makes broad generalization difficult. We need a randomized controlled study with long-term follow-up for more complete assessment of environmental awareness among future teachers.

Data analysis

We have applied the following analysis criteria:

5 points—students are participating in one of the regional environmental research expeditions and discussing its results. They should have the proactive attitude maturity manifested in independent consideration of expedition materials; reasoned speech. They should also have a desire to participate in other environmental research expeditions.

4 points—students are interested in scientific and practical conferences based on materials collected at the research expedition. They must participate in discussions on obtained research data, ask questions. They are involved in the environmental work days. Students should be also interested in improving the environmental situation in the city and in the region. They should be expressing ideas about improving the efficiency of environmental work days.

3 points – students are confident that visiting a scientific conference on ecology is sufficient, as well as one-time participation in the environmental work days. They are confident in the opinion of ecology experts. They do not need independent search for ways to improve the environmental situation in the city and region.

2 points— students are lacking of interest and commitment to participate in the environmental research expeditions and/or in scientific and practical conferences. They are confident in their level of environmental knowledge acquired at the university.

1 point—students have little understanding of one's own role in solving environmental problems.

FINDINGS AND DISCUSSION

The questionnaire did not reveal any significant differences in awareness on the significance of ecology as an integrative basic course, ($p > 0.05$).

Level of environmental knowledge is the leading element in raising environmental awareness. It determines how a student understands the reasons standing behind the environmental crisis on a global scale, as well as the leading role of man in disturbing the balance between society and environment. Thus, *cognitive component* is the main component subjected to diagnosis.

The questionnaire has showed that the main reason why students are not aware of the leading role of ecology as an integrative course (83.0% of respondents consider ecology as an additional subject) is that their environmental knowledge is insufficient. Environmental awareness, actions and behavior were assessed according to our methodology. Such components and elements of raising environmental awareness as

readiness to learn green technologies, level of environmental program assessment skills and participation in environmental activity were assessed on the basis of performed creative tasks, scientific conferences on environmental problems, abstracts and reports written by students.

We have developed special criteria to assess the level of environmental awareness.

Table 2

Cognitive component of environmental awareness: formation levels

Level	High	Above average	Average	Below average	Low
Students (%)	0	2.1	11.7	67.5	18.7

We have established the formation levels for other components as well.

Thus, five independent ecology experts have assessed *the degree of awareness on the significance of ecology as a leading course* in the CG – 2.16 ± 0.19 points. At the end of the pedagogical experiment, this figure was 2.71 ± 0.20 points ($p > 0.05$). In the EG, these figures amounted to 2.14 ± 0.13 and 3.87 ± 0.18 points, respectively ($p < 0.05$) (Table 1).

Table 3

Raising environmental awareness during the pedagogical experiment

Indicators	Change in indicators (points)		
	Before the pedagogical experiment	After the pedagogical experiment	Growth, %
1. Belief in the significance of ecology as a leading course	2.16 ± 0.19	2.71 ± 0.20	20.30*
2. Readiness to convince the audience in the correctness of particular views and ideas	2.31 ± 0.18	2.85 ± 0.16	18.95*
3. Ability to provide solid evidence of attractive proposals for improving environmental teaching methods	2.37 ± 0.20	3.81 ± 0.11	37.80*
4. Raised awareness on the need to introduce scientific ecology papers to university students	2.09 ± 0.15	2.21 ± 0.19	5.43
5. Applying the compelling examples confirming the importance of mastering skills of environmental self-education	2.16 ± 0.11	3.44 ± 0.24	37.21*
	2.29 ± 0.16	2.45 ± 0.21	6.54
	2.24 ± 0.15	3.66 ± 0.25	38.80*
	2.17 ± 0.15	2.38 ± 0.14	8.83
	2.23 ± 0.13	3.72 ± 0.21	40.06*

Note: numerator – CG performance, denominator – EG performance, * - value reliability at $p < 0.05$.

The value for *readiness to convince the audience in the correctness of particular views and ideas* was 2.31 ± 0.18 points in the CG before the pedagogical experiment. At the end of the experiment, this figure was 2.85 ± 0.16 points. In the EG, these figures were 2.37 ± 0.20 points and 3.81 ± 0.11 points, respectively. Similar tendency was identified with regard to other indicators.

Designing an environmental awareness model and applying it during the experiment allowed shaping a holistic vision of the significance of this component in the overall structure of professional competence of future ecology experts (Figure 1). We consider environmental awareness as confidence in ideas proposed according to irrefutable

evidence. This personal quality was formed with regard to the main principles of education. The logic of raising environmental awareness involves a certain sequence of actions.

The first stage of environmental competence development requires the ecological worldview formation. The latter has determined the objective consideration of man in relation to nature. In this case, teacher has to provide the necessary prerequisites for raising environmental awareness that could make the student understand that man is part of the surrounding nature that him/her consciousness, but not the right to consider himself (herself) as the king of nature.

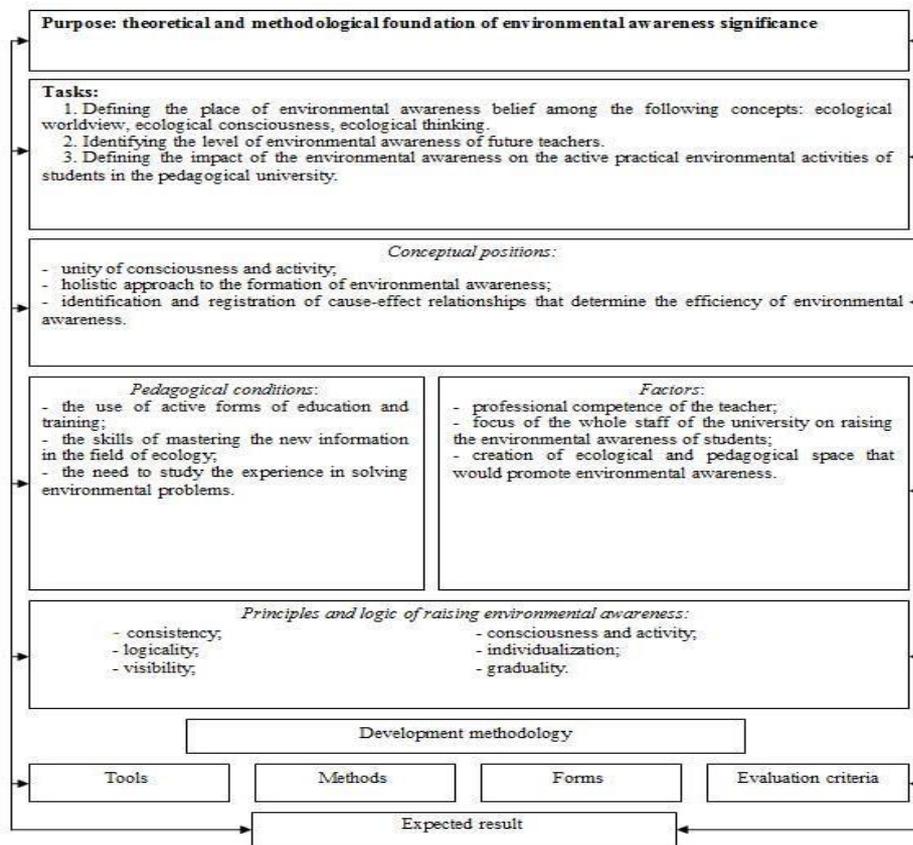


Figure 1
The model of raising environmental awareness

The next stage involves ecological thinking development that should result in understanding the laws of nature, as well as the importance of harmony between society and the environment.

Environmental awareness is a follow-up to environmental competence development based on the system, student-centered, ecological humanist and co-evolutionary approach.

Ecological thinking development is largely determined by the nature and amount of information about the environmental status. Governmental decisions on restricting information related to environmental problems caused by large industrial and agricultural complexes entail the mistrust to environmental information. This situation is determined by the fact that each environmental disaster entails serious negative changes in the environment. People, however, face the facts that significantly differ from the official versions announced by public authorities. Incomplete or incorrect information about the harmful impact of industrial and agricultural enterprises, transport and energy sector on the fundamental environmental parameters (water, air, food) has determined stable rejection of official viewpoint. Such a situation has also led to misunderstandings when it comes to the scale of environmental crisis that became evident not only for the country, but also for the entire world community.

The process of raising environmental awareness is also determined by human impact on the sensual sphere that disturbs the human psycho-emotional balance. The latter is crucial when it comes to accepting the state of nature as suitable for normal life. Ecological thinking requires striving for human moral and spiritual transformation. This requires targeted therapy providing psychological transformation towards personal responsibility for the quality of environment. Clear problem statement is the main factor when it comes to raising environmental awareness. One has to think *on track*, analyze each situation and generalize the available data.

The lack of environmental awareness is a serious obstacle for effective environmental education and environmental culture development. This problem can be solved by providing hard information about natural disasters, which perception creates prerequisites for a deeper understanding of the human role in the relevant events. At this point, one will shape a strong belief regarding the need to raise environmental awareness as a prerequisite for developing environmental culture.

The process of raising environmental awareness has the following algorithm:

- **first stage** – considering the task as a single unit;
- **second stage** – identifying specific elements and features of their interrelation. Each element requires a certain amount of time for finding relevant solution and relevant mental processing rates;
- **third stage** – combining these elements into a single, integrated process; clarifying the ideas related to problem solutions.

Mental efficiency was determined by the following factors:

- assimilating the required system of knowledge providing effective achievement of relevant tasks;

- developing skills related to mental operations: analysis, comparison, generalization;
- developing motivation to assimilate new information required for solving the problem;
- developing and applying criteria of mental activity assessment;
- creating conditions that could allow shaping a creative approach towards mental activity based on emotional and sensual sphere.

As the mental activity is improved, future teacher more consciously perceives the reality that is caused by socio-economic and environmental crisis, and has a significant impact on environmental, professional and pedagogical training. This allows raising environmental awareness to environmentally educate different population groups, form ecological consciousness, ecological worldview and ecological thinking.

The results of our pedagogical experiment show that our method of raising environmental awareness of future schoolteachers is effective, as it solves the problem of improving the quality of professional environmental training.

The proposed modes and methods of environmental training contribute to the development of personal attitudes towards the significance of ecology for civilization development and preservation that are transformed over time into strong convictions. These modes and methods involve participating in ecological research expeditions, scientific and practical conferences held; studying nature with ecologists involved in the expedition, their reports, scientific articles, video records; participating in environmental work days; environmental excursions and hikes, as well as other activities.

Teacher's conviction in a particular behavior or in own attitude towards the particular problem is formed in direct interaction with a particular object or a natural phenomenon. In this regard, one should consider convictions and beliefs as significant elements of personality integration that are formed in throughout life as a result of personal experience. They are developed under the impact of psycho-emotional experiences that reflect personal attitudes to various problems that cause either positive or negative reaction to their appearance (Amelchenko, 2008; Amend & Salamat, 2003; Leontiev, 1983). Regularly affecting external factors accompanied by various emotions, as well as the sense of changes that occur in the existing worldview under one or more factors, promote the development of social attitudes regulating the general approach to nature (Ilyasova, 2005; Nazarenko, 2013; Zimnyaya, 2005). This allows considering intrapersonal attitudes as a base for human behavior in the environment.

There are two basic types of attitudes:

- maintaining and strengthening one's personal health (clean water and air, food, forest, land, etc.) to improve both physical and mental characteristics of the body;
- participating in environmental activity. This raises awareness on the integrative function of ecology as an academic course.

These intrapersonal attitudes defining teacher's convictions are interdependent as there is a need in hard information related to the major environmental parameters that requires immediate and active study. Such information can be collected by applying effective methods for affecting teacher's consciousness (Leontiev, 1983).

Scientific and practical conferences based on the results of ecological expedition are also very important. Students taking part in conferences view video records showing the degree of environmental destruction. They also analyze and discuss the water and soil samples, monitor animals, birds, fish and other inhabitants in the research area, as well as further changes in the environment and their impact on the quality of human life in specific regions. Therefore, such events provide decisive information for teachers that has a strong effect on their consciousness and personal attitudes versus the traditional methods of environmental culture development: lectures, seminars and workshops (Kydd, Crawford & Richers, 1997; Levina, 2002; Geesteranus & Smith, 1994).

Raising environmental awareness and developing ecological thinking is impossible without re-thinking the nature of relations with the environment while preserving previous attitudes naturally entails environmental destruction. Forming the ability to predict the consequences of human actions in relation to nature is one of the important steps in raising environmental awareness. Another one is the assignment of responsibility for air pollution and industrial waste between major industrial and agricultural enterprises. In relation to environmental awareness, people realize the need in reorienting their consumer attitude towards nature to the attitude based on environmental protection.

Students with high environmental awareness understand the significance of shaping relevant attitude towards nature through the focused development of environmental philosophy and environmental culture.

This approach determines the possibility of improving environmental competence of future teachers by identifying types of activity that are the most effective for particular environmental situation. Environmental awareness maturity requires logical and creative, strategic and operational thinking. The optimal mental level provides successful management when it comes to solving environmental problems.

CONCLUSION

Summarizing the above, shaping intrapersonal attitudes determining strong convictions is a long and complex process. Traditional teaching modes and methods (lectures, seminars and workshops) are currently insufficient for shaping a proactive attitude towards assessing and solving environmental problems. Raising awareness on the leading role of ecology as a basis of the entire educational system requires new, more efficient teaching methods for involving future teachers into active environmental activity.

Methods introduced in the research have stimulated the mental activity of ecology students, promoted identification of personal potential that was unlocked in the fields of resource management and environmental protection. Applying our modes and methods

for environmental training and gaining specific experience has allowed effectively organizing the pedagogical process, raising environmental awareness and developing environmental thinking. This has also allowed raising future teacher's awareness on the significance of ecology as an integrative basic course.

The primary research objective was to introduce the environmental components of the general professional competence of university students – future teachers, whose task is to train the younger generation in the spirit of harmony with nature. However, environmental education problems, as well as problems of raising environmental awareness, significance of ecology as an academic course and the problem of interaction between man and nature are still not adequately reflected.

A central problem of environmental education, therefore, is how to encourage and develop in children a sense of relationship with the environment that may transform into pro-environmental behavior.

In teacher education, environmental competence formation methodology is based on the regularities that suggest that educational and professional activity is ongoing. This could be achieved by focusing one's cognitive activity on ecology and teaching carrier. The cognitive activity, in fact, determines the preparation for subsequent actions. This could be also achieved by forming ecological thinking and shaping scientific worldview as a basis for success in a complicated environmental situation and for effective solutions. Another way to achieve the ongoing learning activity is to promote the conviction regarding the need in ongoing environmental self-education and self-improvement, as well as to raise environmental awareness and improve environmental culture.

Raising environmental awareness as a basis of ecological thinking and environmental culture becomes a social requirement of each country keeping in mind the fact that proper teacher education will determine his/her readiness to teach ecology for all groups and categories of population and. Developing and strengthening the interest in environmental activity are one of the most important educational tasks.

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