TECNOLOGIA PROBLEMA-DIÁLOGO DE FORTALECER COMPETÊNCIA AMBIENTAL ENTRE ESPECIALISTAS PARA O TRABALHO NAS CONDIÇÕES ARTÍCAS E SUBÁRTICAS DA FEDERAÇÃO DA RÚSSA**PROBLEM-DIALOGUE TECHNOLOGY OF FORMING ENVIRONMENTAL COMPETENCE AMONG SPECIALISTS FOR WORK IN THE ARCTIC AND SUBARCTIC CONDITIONS OF THE RUSSIAN FEDERATION****ПРОБЛЕМНО-ДИАЛОГИЧЕСКАЯ ТЕХНОЛОГИЯ ФОРМИРОВАНИЯ ЭКОЛОГИЧЕСКОЙ КОМПЕТЕНТНОСТИ У СПЕЦИАЛИСТОВ ДЛЯ РАБОТЫ В АРКТИЧЕСКИХ И СУБАРКТИЧЕСКИХ УСЛОВИЯХ РОССИЙСКОЙ ФЕДЕРАЦИИ**PETROV, Sergei A.^{1*}; MAMAEVA, Natali L.^{1,2}; NARUSHKO, Maksim V.¹¹ Tyumen Scientific Centre SB RAS, 86 Malygina Str., zip code 625026, Tyumen – Russian Federation (phone: +73452688787)² Industrial University of Tyumen, 38 Volodarskogo Str., zip code 625000, Tyumen – Russian Federation (phone: +73452283660)** Corresponding author
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RESUMO

O desenvolvimento econômico do Ártico e as perturbações relacionadas no equilíbrio natural dos ecossistemas do norte tornaram-se uma fonte de problemas ambientais que agora se tornaram globais. A esse respeito, a questão urgente é encontrar uma tecnologia de aprendizado acessível e eficaz, voltada para o desenvolvimento de uma educação humanista, voltada para a personalidade. A fim de discutir a tecnologia de educação ambiental, como meio de garantir a segurança, a gestão ambiental e o desenvolvimento sustentável do Ártico, propusemos um questionário para obter informações ambientais e de saúde primárias, o ponto-chave em que a relação de ecologia e saúde. A aprovação do problema-diálogo de tecnologia de aprendizagem permitiu, com base em opiniões e avaliações ambientais esclarecer, orientações de valor, atitudes, disposições e estimular a motivação cognitiva no conteúdo substantivo, para alcançar competências e garantir a segurança ambiental dos ecossistemas do norte durante a realização de economia atividades das empresas do complexo de energia e combustíveis. Isto é especialmente importante nas condições do Extremo Norte com condições climáticas difíceis (fundo geomagnético, mudanças repentinas de temperatura, fortes cargas de vento, presença de gelo permanente, etc.) e o rápido desenvolvimento do complexo de petróleo e gás (em particular, alta taxa de acidentes associada à complexidade de dispositivos técnicos, o uso de condições operacionais extremas, fortes influências ambientais, riscos de inflamabilidade e explosão de produtos minados, fator humano).

Palavras-chave: *Educação ambiental do Ártico, o Extremo Norte, questionário, segurança ambiental.***ABSTRACT**

The economic development of the Arctic and the related disturbances in the natural equilibrium of northern ecosystems have become a source of environmental problems that have now become global. In this regard, the urgent question is about finding an affordable and effective learning technology aimed at developing, humanistic, personality-oriented education. In order to discuss the technology of environmental education, as a means of ensuring environmental safety, environmental management and sustainable development of the Arctic, we proposed a questionnaire for obtaining primary environmental and health information, the key point in which is the relationship of ecology and health. Approbation of the problem-dialogue technology of learning allowed, on the basis of clarifying environmental opinions and assessments, value orientations, attitudes, dispositions and stimulating cognitive motivation on the substantive content, to achieve competences to ensure the environmental safety of northern ecosystems during the economic activities of enterprises of the fuel and energy complex. This is especially important in the conditions of the Far North with difficult climatic conditions (geomagnetic background, sudden temperature changes, strong wind loads, the presence of permafrost, etc.)

and the rapid development of the oil and gas complex (in particular, high accident rate associated with the complexity of technical devices, the use of extreme operating conditions, strong environmental influences, flammability and explosive hazards of mined products, human factor).

Keywords: *Arctic environmental education, the Far North, questionnaire, environmental safety.*

АННОТАЦИЯ

Хозяйственное освоение Арктики и сопутствующие ему нарушения природного равновесия северных экосистем стали источником экологических проблем, которые приобрели на сегодняшний день глобальный характер. В связи с этим актуальным встает вопрос о поиске доступной и эффективной технологии обучения, направленной на развивающее, гуманистическое, личностно ориентированное образование. В порядке обсуждения технологии экологического образования, как средство обеспечения экологической безопасности, рационального природопользования и устойчивого развития Арктики нами предложена анкета для получения первичной экологической и медицинской информации, ключевым моментом в которой является связь экологии и здоровья. Апробация проблемно-диалогической технологии обучения позволила на основе выяснения экологических мнений и оценок, ценностных ориентаций, установок, диспозиций и стимуляции познавательной мотивации на предметном содержании добиться компетенций обеспечения экологической безопасности северных экосистем при хозяйственной деятельности предприятий топливно-энергетического комплекса. Особенно это важно в условиях Крайнего Севера со сложными климатическими условиями (геомагнитным фоном, резкими перепадами температур, сильными ветровыми нагрузками, наличием многолетнемерзлых пород и т.п.) и бурным развитием нефтегазового комплекса (в частности, высокой аварийностью, связанной, со сложностью технических устройств, применением экстремальных режимов эксплуатации, сильными воздействиями внешней среды, горючести и взрывной опасности добываемых продуктов, человеческого фактора и т.п.).

Ключевые слова: *Арктическое экологическое образование, Крайний Север, анкета, экологическая безопасность.*

1. INTRODUCTION

At the present stage, when addressing issues of environmental safety, environmental management, and sustainable development, priority attention is paid to environmental education and education (Environmental Report ..., 2017; Ignatova and Romeiko, 2005; Suravegina and Senkewich, 1995). It is they who form the new ecological outlook and a new way of life of the individual, improving the quality of life and health.

The economic development of the Arctic and the related disturbances in the natural equilibrium of northern ecosystems have become a source of environmental problems that have now become global (Scientific and technical problems of the development of the Arctic, 2015; Tikhonov, 2010). In this regard, the urgent question is about finding an affordable and effective training technology aimed at developing, humanistic, personally oriented education of specialists for work in the Arctic zone of the Russian Federation (Kvashnina *et al.*, 2009; Agranovich, 2017; Khairullina *et al.*, 2019). The problem-dialogical type of training for

environmental specialists will ensure the creative assimilation of knowledge through problem-dialogical methods, and productive tasks will allow for varying the forms and intensively using teaching aids, ensuring the achievement of the subject, meta-subject, and personal results. The dialogue about the problem situation is the most difficult for the implementation of the methods of posing the problem, which explains the significant amount and special logic of its description (Melnikova, 2015). The technology of problem-dialogic training enables students not to be an object of learning, passively perceiving educational information, but to be active subjects of it, to own knowledge and solving cognitive tasks (Karlysheva, 2016; Molchanova, 2016; Shirokikh, 2014). The technology of problem-dialogue education is the most important direction of the implementation of the paradigm of competency-based education in the Arctic environmental education - a scientific direction in ecology and pedagogy, which studies the environmental features of the Arctic, the impact of economic activities of enterprises of the fuel and energy complex on northern ecosystems and ensuring environmental safety (Malchevskiy *et*

al., 2018).

This technology is effective if it is based on subject-analytical material. Only in this case does it ensure high quality of learning, effective development of the intellect and creative abilities of students, development of universal learning activities (Korschikova and Arakelian, 2018). In this case, the methodological tool for obtaining primary environmental and medical information, issued in the form of a set of questions and logically related to the central task of the study, is a questionnaire. However, at present, the organizational-pedagogical conditions and the subject-analytical materials for the implementation of the problem-dialogue technology of forming environmental competence among specialists for work in the Arctic and Subarctic conditions of the Russian Federation are not sufficiently developed.

The aim of this work was the development and testing of a medical and environmental questionnaire in the problem-dialogue technology of environmental education in order to clarify environmental opinions and assessments, value orientations, attitudes, dispositions and stimulate cognitive motivation on subject content.

2. MATERIALS AND METHODS

The problem-dialogic technology was implemented through the medical and environmental questionnaire developed by us (Malchevskiy *et al.*, 2017), which includes 3 training modules: general environmental (21 questions), immuno-ecological (42 questions) and subject-analytical (83 questions). The questionnaire helps, through the assessment and opinion of the student, to evaluate the medical and environmental features of the territories under consideration. In the submitted questionnaire, if necessary, you can make clarifications or generalizations depending on the purpose and nature of training. The questionnaire allows you to conduct monitoring studies of the ecological status of a particular territory in order to assess and forecast changes in the state of the environment and public health, as well as to characterize different areas in order to identify the most or least environmentally friendly conditions for the population.

The object of the analysis of the ecological status of the Arctic territory was the Purovsky District of the Yamalo-Nenets Autonomous District (YNAO). The survey was conducted in December 2015 among students of

the indigenous population living in the area. 46 respondents took part in the survey, whose average age was 26.3 ± 2.6 years. Of those surveyed, 56.5% were women, 43.5% were men.

Qualitative and quantitative characteristics were subjected to statistical processing using the integrated software package "IBM SPSS Statistics 21" (arithmetic mean, variance and its derivative (standard deviation), Spearman's rank correlation coefficient).

3. RESULTS AND DISCUSSION:

The dynamics of respondents' answers to questions related to environmental protection are presented in Table 1. The key point in the questionnaire is the question: "Do you associate your health condition with the environmental situation in this area?", to which $48.8 \pm 7.6\%$ of respondents gave a positive answer ($r = 0.412$; $p = 0.007$). It is known that the immune system primarily reacts to the ecological state with the development of secondary immune deficiency (SID), manifested by the presence of chronic foci of inflammation, the formation of a group of often and long-term illnesses.

Our previous studies (Petrov and Sukhovey, 2007; Sukhovey *et al.*, 2007) showed a significant prevalence among the examined groups of the phenomenon of the frequent incidence of acute respiratory viral diseases (ARVI). Thus, a significant number of respondents among those surveyed report an ARVI disease more than three times a year, which in various regions ranged from 9.2% to 10.2%.

The dynamics of respondents' opinions on population health issues with certain diseases associated with SID are presented in Table 2. Among the respondents, subjectively assess their health status as unsatisfactory, only $2.3 \pm 2.3\%$ of respondents. The correlation analysis showed that, with increasing age, the health condition naturally worsens ($r = 0.323$ with $p = 0.037$) and this is attributed to the frequency ($73.9 \pm 6.5\%$; $r = 0.336$ with $p = 0.024$), severity ($r = 0.497$ with $p = 0.002$) and the course ($r = 0.398$ with $p = 0.012$) of ARVI.

Other signs of SID were also found: herpes infection ($62.2 \pm 7.2\%$), inflammatory skin diseases ($26.2 \pm 6.8\%$), chronic infectious inflammatory diseases ($40.0 \pm 8.3\%$). According to the respondents, the severity and protracted course of acute respiratory viral infections, influenza are associated with climate change ($r =$

0.413 with $p = 0.011$ and $r = 0.348$ with $p = 0.032$, respectively). It was found that active extraction of hydrocarbon raw materials and industrial emissions, discharges, waste are associated with the frequency of spreading ARVI ($r = 0.376$ with $p = 0.012$ and $r = 0.364$ with $p = 0.015$, respectively).

The next block of our questionnaire is a block dedicated to the ecological state of the study region, in particular, the quality of atmospheric air (Table 3). About a third of the respondents are convinced that air quality affects their health ($32.6 \pm 6.9\%$; $r = 0.396$ with $p = 0.009$), although $22.7 \pm 6.3\%$ out of $34.1 \pm 7.1\%$ rated that the air is slightly polluted. Our correlation analysis established direct relationships between the effect of air pollution degree on health ($34.1 \pm 7.1\%$; $r = 0.319$ with $p = 0.042$), in particular, with precipitation, after which adverse changes in the environment are observed ($24.4 \pm 6.4\%$; $r = 0.474$ with $p = 0.002$).

The respondents attributed the deterioration of their health to poor visibility in the atmosphere in the morning hours ($15.4 \pm 5.8\%$; $r = 0.341$ with $p = 0.042$), in particular skin diseases ($r = 0.491$ with $p = 0.002$). As for other diseases associated with SID, the respondents attributed the prolonged course of ARVI and influenza to poor visibility in the atmosphere ($41.9 \pm 7.5\%$; $r = 0.352$ with $p = 0.033$), the prevalence of herpetic eruptions with precipitation, which can partially damage dwellings ($2.3 \pm 2.3\%$; $r = 0.435$ with $p = 0.004$).

Thus, the quality of life both objectively (according to experts) and the opinion of indigenous peoples of the North depends on the quality of atmospheric air, emissions of various chemical compounds into the air, which causes irritation of the respiratory tract mucosa, reduces the body's resistance to adverse factors. Especially hard these pollution endure the elderly people.

Below we give the respondents' opinions on the proposed questions on water quality (Table 4). About half of the respondents are convinced that water quality affects their health ($45.4 \pm 7.5\%$), with $17.8 \pm 5.7\%$ as strong. The state of water quality, respondents evaluated by organoleptic properties. These include smell, taste, color, that is, those properties that can be determined by the human senses. Our correlation analysis established direct relationships between health and the smell of water ($28.9 \pm 6.8\%$; $r = 0.339$ with $p = 0.028$), an unpleasant taste of water ($32.5 \pm 7.4\%$; $r = 0.344$ with $p = 0.037$).

As for certain diseases associated with SID, respondents attributed the frequency and severity of ARVI to the influence of the degree of water pollution ($62.2 \pm 7.2\%$; $r = 0.446$ with $p = 0.002$; $r = 0.333$ with $p = 0.044$, respectively), in particular, with the smell of water ($r = 0.422$ with $p = 0.004$ and $r = 0.444$ with $p = 0.005$). At the same time, the marsh, fish, and earthy smell noted $21.6 \pm 6.8\%$ of students, the smell of oil - $5.4 \pm 3.7\%$. The respondents attributed the frequency of ARVI to the color of water ($29.5 \pm 6.9\%$; $r = 0.326$ with $p = 0.031$), especially a reddish-brown shade with sedimentation of brown particles ($4.8 \pm 3.3\%$; $r = 0.334$ with $p = 0.031$). It was found that the frequency of herpes spread correlates not only with the taste of water ($r = 0.354$ with $p = 0.027$), in particular with a sharply unpleasant ($11.8 \pm 5.5\%$; $r = 0.508$ with $p = 0.003$), but also with red-brown shade of water with sedimentation of brown particles ($r = 0.332$ with $p = 0.034$). They associated the frequency of the spread of chronic infectious and inflammatory diseases with the smell of oil in water ($r = 0.495$ with $p = 0.006$), as well as with the reddish-brown color of water with sedimentation of brown particles ($r = 0.488$ with $p = 0.005$).

In addition to the opinion of respondents on the quality of water and air, we asked respondents questions concerning the state of the soil (Table 5). According to the respondents, $28.2 \pm 6.6\%$ answered that the condition of the soil also affects health, and almost half of the respondents ($48.8 \pm 7.5\%$) noted soil contamination.

Thus, at present time, with the intensive development of the oil and gas complex in the Arctic zone of Russia (a huge macro-region that is essential in the economy of the country), the question arises of finding an accessible and effective technology to train specialists to build their environmental competence by greening the disciplines humanitarian, socio-ecological and natural science cycles and the creation on their basis of interdisciplinary didactic complexes. One of the principles of studying and mastering virtually all disciplines is the problem-dialogue method, which allows us to vary the forms and intensively use teaching aids, ensure the achievement of subject, meta-subject and personal results, which is very important today, since it raises the question of the development and implementation of integrated environmentally sound solutions, activities and technologies that will have a minimally harmful impact on northern ecosystems that are vulnerable to man-made factors, as well as the impact of the latter on the

state and quality of life of people living in these territories.

This is especially important in the conditions of the Far North with difficult climatic conditions (geomagnetic background, sudden temperature changes, strong wind loads, the presence of permafrost, etc.) and the rapid development of the oil and gas complex (in particular, high accident rate associated with the complexity of technical devices, the use of extreme operating conditions, strong environmental influences, flammability and explosive hazards of mined products, human factor, etc.). In many cases, accidents are accompanied by an oil spill, which can lead to large-scale environmental disasters.

In this regard, in order to form ecological competence in the conditions of work in the Arctic and Subarctic zones of Russia, we have developed an environmental and immunological questionnaire and tested it in studying and mastering the humanitarian, socio-ecological and natural science disciplines, the key issue of which is: Does the ecological situation in the area affect the health of the people living here? "

When training specialists for work in the Arctic and Subarctic conditions of the Russian Federation, a special training approach is needed, which can be based on the problem-dialogue technology of forming environmental competence in students. A diagram of the educational process using problem-dialogue technology is presented in Table 6.

Also, one should not forget about the formation of students' ability to work with the bibliographic catalog, own the methodology for finding and using environmental material, skills to work with legal acts in the field of environmental protection, current environmental regulations, and the formation of cryological (regional) component that takes into account the functioning of the oil and gas complex of Western Siberia in conditions of low temperatures and the presence of permafrost.

4. CONCLUSIONS:

Approbation of the problem-dialogue technology of learning allowed, on the basis of clarifying environmental opinions and assessments, value orientations, attitudes, dispositions and stimulation of cognitive motivation on the substantive content, to achieve a competency model as the cumulative expected result of education through general cultural,

general professional and professional competences (Order of the Ministry of Education and Science of Russia dated 12.03.2015 N 227, 2015; Order of the Ministry of Education and Science of Russia dated March 6, 2015 N 162, 2015; Order of the Ministry of Education and Science of Russia dated March 12, 2015 N 226, 2015). The study of environmental, immunological material contributes to the formation of the following competencies in students:

- the ability to apply in practice the principles of rational use of natural resources and environmental protection;
- the ability to take measures to protect the environment and subsoil during the construction, repair, reconstruction and restoration of oil and gas wells, oil and gas production, collection and preparation of well products, transportation and storage of hydrocarbons;
- the ability to organize the work of performers, to find and make management decisions in the field of labor organization and implementation of environmental protection measures;
- willingness to justify specific technical solutions in the development of technical processes;
- choose technical means and technologies aimed at minimizing the anthropogenic impact on the environment;
- have the ability to self-organization and self-education;
- have the ability to use the basics of legal knowledge in various fields of activity;
- have the willingness to apply professional knowledge to minimize negative environmental impacts, ensure safety and improve working conditions in the field of their professional activities;
- be able to participate in the development of organizational measures for the prevention and elimination of the consequences of accidents, catastrophes, natural disasters and other emergency situations as part of a team of performers.

Competence approach in environmental education aims to prepare students with a synthesis of deep theoretical and fundamental knowledge, special skills and highly developed practical skills in the field of environmental safety, especially in the conditions of the Far North, environmental impact assessment of oil and gas facilities. That allows you to find modern

technologies in the field of energy saving and energy efficiency.

Problem-dialogue technology of environmental education contributes to the development and implementation of integrated environmentally sound solutions, activities, and technologies that will have a minimally harmful effect on the biosphere as a whole, in particular, on northern ecosystems. It is obvious that the development of the Arctic requires modern special and unique technical devices capable of ensuring environmental safety in this region, as well as the search for modern resource-saving and health-saving technologies. And this is possible thanks to the development of the Arctic environmental education and the consolidation of all educational, scientific, engineering and technical, production forces and specialists in various branches of knowledge.

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Table 1. Answers to environmental issues, %

Nº	Option question	Indicator
1.	How do you assess the environmental situation in the specified area?	
	good	66,7 ± 7,0
	satisfactory	31,3 ± 6,9
	unsatisfactory	2,2 ± 2,2
2.	In your opinion, has the ecological state of the environment changed in the last 10 years?	62,2 ± 7,2
3.	If "Yes", then it is associated with:	
	increase in motor transport	38,6 ± 7,3
	development of mineral deposits	43,2 ± 7,5
	civil engineering	11,4 ± 4,8
	industrial emissions, discharges and waste	29,5 ± 6,9
	poaching	9,1 ± 4,3
	increase in the number of people	9,1 ± 4,3
	deforestation	18,2 ± 5,8
4.	Has the natural wealth - berries, mushrooms, fish, game, land for grazing in the area over the past 10 years been depleted? Their them:	73,3 ± 6,6
	partially depleted	44,4 ± 7,4
	depleted and polluted	26,7 ± 6,6
	completely depleted and polluted	2,2 ± 2,2
5.	Do you think the winters have become warmer over the last 5-10 years?	68,2 ± 7,0
6.	Do you associate your health with the environmental situation?	48,8 ± 7,6

Table 2. Respondents' answers to questions related to health, %

Nº	Questions dedicated to the health and characteristics of its development	Indicator
1.	How often do you have ARVI? Including the frequency of cases:	73,9 ± 6,5
	Once every few years	30,4 ± 6,8
	1 - 2 times a year	41,3 ± 7,3
	3-4 times a year	2,2 ± 2,2
1.2	Is it hard, with high temperature, do you suffer from ARVI?	25,9 ± 8,4
1.3	Is protracted course of the disease characteristic?	37,9 ± 9,0
2.	Does herpes bother? Including the frequency of cases:	62,2 ± 7,2
	Once every few years	37,8 ± 7,2
	1 - 2 times a year	24,4 ± 6,4
2.1	In the case of "yes", the localization of the hotbed:	
	on lips	79,3 ± 7,5
	in the nose area, on the body	20,7 ± 7,5
2.2	In the case of "yes", the size of the hotbed:	
	pinpoint	60,7 ± 9,2
	about 1 cm in diameter	39,3 ± 9,2
3.	Do you suffer from inflammatory skin diseases? Including:	26,2 ± 6,8
	Once every few years	21,4 ± 6,3
	1 - 2 times a year	4,8 ± 3,3
4.	What are your chronic inflammatory diseases?	
	otitis	27,3 ± 13,4
	sinusitis	9,1 ± 8,7
	tracheitis, laryngitis, bronchitis	63,6 ± 14,5
4.1	The frequency of exacerbations of these diseases:	40,0 ± 8,3
	Once every few years	25,7 ± 7,4
	1 - 2 times a year	11,4 ± 5,4
	more than 3 times a year	2,9 ± 2,8
4.2	Is aggravation sluggish, protracted?	50,0 ± 12,5
5.	How do you rate your health?	
	good	65,1 ± 7,3
	satisfactory	32,6 ± 7,1
	unsatisfactory	2,3 ± 2,3

Table 3. Respondents' answers to questions related to air quality, %

Nº	Option question	Indicator
1.	Do you think air quality affects your health? Of them: partially can cause chronic diseases	32,6 ± 6,9 23,9 ± 6,3 8,7 ± 4,2
2.	Assess air pollution in the area, of them: slightly polluted moderately polluted heavily polluted	34,1 ± 7,1 22,7 ± 6,3 6,8 ± 3,8 4,5 ± 3,1
3.	Do you think that over the past 5–10 years there has been poor visibility in the air, fog, smog in the area you specified?	41,9 ± 7,5
3.1	If "Yes", then what time of day: morning evening during the day at noon	15,4 ± 5,8 20,5 ± 6,5 10,3 ± 4,9 2,6 ± 2,5
4.	Did you observe any changes in the environment over the last 5–10 years after rain (or other precipitation) in the area?	24,4 ± 6,4
4.1	If "Yes", please specify: plant leaves automotive, snowmobile and motor vehicle paints destruction of building materials, monuments your housing	15,9 ± 5,5 4,5 ± 3,1 4,5 ± 3,1 2,3 ± 2,3
5.	Are adverse changes in the air constantly observed?	15,4 ± 10,0

Table 4. Answers to questions related to water quality, %

Nº	Option question	Indicator
1.	Does water quality affect your health? Of them:	45,4 ± 7,5
	partially	40,9 ± 7,4
	can cause chronic diseases	4,5 ± 3,1
2.	Assess water pollution in the area, of them:	62,2 ± 7,2
	slightly polluted	33,3 ± 7,0
	moderately polluted	8,9 ± 4,2
	heavily polluted	17,8 ± 5,7
	greatly polluted	2,2 ± 2,2
3.	Do you smell the peculiar smell of the water you drink?	28,9 ± 6,8
3.1	If "Yes", then specify which:	
	putrefactive	5,4 ± 3,7
	swamp, fishy, earthy	21,6 ± 6,8
	the smell of oil	5,4 ± 3,7
	chemical, chlorine	2,7 ± 2,7
4.	Do you feel a specific taste of water?	32,5 ± 7,4
4.1	If "Yes", then specify which:	
	metallic	17,6 ± 6,5
	sharp unpleasant	11,8 ± 5,5
5.	Do you see changes in water color?	29,5 ± 6,9
5.1	If "Yes", specify which color:	
	yellowish tinge, lime scale, bloom on the kettle	21,4 ± 6,3
	yellow stains on the fabric after washing, dishes	7,1 ± 4,0
	blackish tint	2,4 ± 2,4
	red-brown tint with the sedimentation of brown particles	4,8 ± 3,3
	brown tint of water, no sediment	7,1 ± 4,0
6.	From what source do you use water for drinking and cooking?	
	spring	55,6 ± 7,4
	well	22,2 ± 6,2
	centralized water supply	13,3 ± 5,1
	river, closed reservoir (lake)	13,4 ± 5,0
	draw-well	26,7 ± 6,6

Table 5. Respondents' answers to questions related to the state of the soil, %

Nº	Option question	Indicator
1.	Do you think soil condition affects your health? Of them:	28,2 ± 6,6
	partially	23,9 ± 6,3
	can cause chronic diseases	4,3 ± 3,0
2.	Assess soil contamination in the area, of them:	48,8 ± 7,5
	slightly polluted	33,3 ± 7,0
	moderately polluted	11,1 ± 4,7
	heavily polluted	4,4 ± 3,1
3.	Have you observed soil changes?	22,7 ± 6,3
4.	If "Yes", indicate these changes:	
	damage is observed (bumps, potholes, etc.)	9,3 ± 4,4
	there is a flood of territory	14,0 ± 5,3
	there is a change of one vegetation to another	4,7 ± 3,2
	swamp formation	7,0 ± 3,9
5.	Are adverse changes in soil constantly observed?	8,3 ± 8,0

Table 6. Diagram of the educational process using the problem-dialogic technology

Purpose		
prepare students with a synthesis of knowledge, special skills and practical skills in the field of environmental safety with a cryological (regional) component, assessing the impact on the environment and public health living in areas of oil and gas production, which will find modern health-saving technologies and improve the quality of life in the Arctic zone of Russia		
Learning modules		
general ecological	immuno-ecological	subject-analytical
Submission method		
medical and environmental questionnaire survey		
Educational technology		
problem-dialogue technology in learning		
Result		
training specialists for work in the Arctic and Subarctic conditions of the Russian Federation capable of carrying out integrated environmentally sound decisions, measures that will have a minimally harmful effect on the biosphere as a whole, in particular on northern ecosystems, which will make it possible to find modern technologies in the field of energy saving and energy efficiency, life quality of the population of the Far North		