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STUDYING BIODIVERSITY IN THE PROCESS OF TRAINING FUTURE BIOLOGY TEACHERS

Abstract. This article discusses the issues of studying biological diversity in the process of preparing future teachers of biology. Currently, issues of biodiversity conservation are considered at the global, regional and local levels. The intensification of the use of natural resources, the growing rate of environmental pollution in the 20th century, led to crisis phenomena and in many cases caused environmental disasters. Anxiety for the future of the planet today is recognized by society and today it becomes obvious that it is impossible to ensure the stability of the biosphere with technical solutions, since the current environmental crisis is largely due to the crisis of culture. The interaction of man with nature, the sustainability of life on Earth will be possible if the achievements of science, education and culture as a whole are focused on developing an understanding of nature as a universal and absolute value. The key role in overcoming the crisis and transition to sustainable development belongs to the education system.

Science and education are the core of modern civilization. The unity of the educational and scientific processes is a necessary condition for the development of the individual and the harmonious training of a highly qualified specialist. Determining the scientific foundations and developing a methodology for studying the content of biodiversity in the process of preparing future biology teachers at the university. The study of the content on biodiversity in the process of preparing biology students at a university can contribute to the successful formation of knowledge and skills that contribute to the formation of professional competencies of a biology teacher. The survey of students allowed us to obtain results indicating a low quality of assimilation of basic knowledge, revealing the content and related to the concept of “biodiversity”. At the ascertaining stage of the study, in order to identify the state of the problem of the formation of biological students' knowledge about biodiversity, a control cross-section of knowledge was conducted. The results of the control cross-section of knowledge indicate that the knowledge about the levels of biodiversity and approaches to biodiversity conservation is the weakest among students. The majority of students assimilated knowledge, the control of which was carried out within the framework of the ascertaining experiment, and corresponded to levels II and III, which in turn confirms the relevance of the research problem.

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Болашақ биология мұғалімдерін дайындау процесінде биоәртүрлілікті зерттеу

Аңдатпа. Бұл мақалада болашақ биолог мұғалімдерін дайындау процесінде биологиялық әртүрлілікті зерттеу мәселелері қарастырылады. Қазіргі уақытта биологиялық әртүрлілікті сақтау мәселелері жаһандық, аймақтық және жергілікті деңгейде қарастырылуда. Табиғат ресурстарын пайдаланудың қарқындауы, XX ғасырда қоршаған ортаның ластануының өсу қарқыны дағдарыстық құбылыстарға әкелді және көптеген жағдайларда экологиялық апаттардың себебі болды. Ғаламшардың болашағына алаңдаушылық бүгінде қоғамда мойындалып, биосфераның тұрақтылығын техникалық шешімдермен қамтамасыз ету мүмкін емес екені белгілі болды, өйткені қазіргі экологиялық дағдарыс көп жағдайда мәдениет дағдарысына байланысты. Адамның табиғатпен өзара әрекеттесуі, жер бетіндегі тіршіліктің тұрақтылығы ғылымның, білімнің және жалпы мәдениеттің жетістіктері табиғатты жалпы адамзаттық және абсолютті құндылық ретінде түсінуді дамытуға бағытталған жағдайда мүмкін болады. Дағдарысты еңсеру және тұрақты дамуға көшудегі шешуші рөл білім беру жүйесіне тиесілі.

Ғылым мен білім – қазіргі өркениеттің өзегі. Оқу және ғылыми процестердің бірлігі жеке тұлғаның дамуы мен жоғары білікті маманды үйлесімді дайындаудың қажетті шарты болып табылады. Университетте болашақ биология мұғалімдерін дайындау процесінде биоәртүрлілік мазмұнын зерттеудің ғылыми негіздерін анықталып және әдістемесін жасалды. ЖОО-да биология пәні бойынша студенттерді дайындау процесінде биоәртүрлілік мазмұнын зерделеу биология мұғалімінің кәсіби құзыреттілігін қалыптастыруға ықпал ететін білім мен дағдының табысты қалыптасуына ықпал ете алады. Студенттердің сауалнамасы «биоалуантүрлілік» ұғымымен байланысты негізгі білімді игеру сапасының төмендігін көрсетті. Зерттеудің анықтаушы кезеңінде биология студенттерінде биоалуантүрлілік туралы білімді қалыптастыру проблемасының жай-күйін анықтау мақсатында алған білімдеріне бақылау жұмыстары жүргізілді. Білімді бақылау бөлімінің нәтижелері студенттердің биоалуантүрлілік деңгейлері мен оны сақтау тәсілдері туралы білімдерін нашар меңгергендігін көрсетеді. Студенттердің көпшілігінде білімді меңгеру деңгейі анықтаушы эксперимент аясында жүзеге асырылған және олардың білімді игеруі II, III деңгейлерге сәйкес келетіні анықталды, ал бұл өз кезегінде зерттеу мәселесінің өзектілігін растайды.

Кілт сөздер: биоәртүрлілік, биология мұғалімдері, білім беру, үдеріс, студент, экожүйе.

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Изучение биоразнообразия в процессе подготовки будущих учителей биологии

Аннотация. В данной статье рассмотрены вопросы изучения биологического разнообразия в процессе подготовки будущих учителей биологии. В настоящее время вопросы сохранения биоразнообразия рассматриваются на глобальном, региональном и локальном уровнях. Интенсификация использования природных ресурсов, растущие темпы загрязнения окружающей среды в XX в., привели к кризисным явлениям и во многих случаях стали причиной экологических катастроф. Тревога за будущее планеты сегодня осознается обществом и сегодня становится очевидным, что техническими решениями обеспечить устойчивость биосферы невозможно, поскольку современный экологический кризис во многом обусловлен кризисом культуры. Взаимодействие человека с природой, устойчивость жизни на Земле будут возможными, если достижения науки, образование и культура в целом будут ориентированы на развитие понимания природы как универсальной и абсолютной ценности. Ключевая роль в преодолении кризиса и переходе к устойчивому развитию принадлежит системе образования.

Наука и образование являются стержнем современной цивилизации. Единство учебного и научного процессов является необходимым условием развития личности и гармоничной подготовки специалиста высокой квалификации, определении научных основ и разработке методики изучения содержания о биоразнообразии в процессе подготовки будущих учителей биологии в вузе. Изучение содержания о биоразнообразии в процессе подготовки студентов-биологов в вузе может содействовать успешному формированию знаний и умений, содействующих формированию профессиональных компетенций учителя биологии. Анкетирование студентов позволило получить результаты, свидетельствующие о низком качестве усвоения основных знаний, раскрывающих содержание и связанных с понятием «биоразнообразие». На констатирующем этапе исследования с целью выявления состояния проблемы формирования у студентов-биологов знаний о биоразнообразии был проведен контрольный срез знаний. Результаты контрольного среза знаний свидетельствуют о том, что слабее всего студентами усвоены знания об уровнях биоразнообразия и подходах к сохранению биоразнообразию. У большинства студентов усвоение знаний, контроль которых осуществлялся в рамках констатирующего эксперимента, и соответствовал II и III уровням, что в свою очередь подтверждает актуальность проблемы исследования.

Ключевые слова: биоразнообразие, учителя биологии, образование, процесс, студент, экосистема.

Introduction

Nowadays, the issues of biodiversity conservation are considered at the global, regional and local levels. The intensification of the use of natural resources, the growing rates of environmental pollution in the twentieth century, have led to crisis phenomena and, in many cases, have become the cause of environmental disasters. Anxiety for the future of the planet is currently recognized by society and these days it becomes apparent that it is impossible to ensure the sustainability of the

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biosphere by technical solutions, since the current ecological crisis is mainly due to the crisis of culture. Interaction between man and nature, the sustainability of life on Earth will be possible if the achievements of science, education and culture in general are aimed at developing an understanding of nature as a universal and absolute value. The educational system plays a crucial role in overcoming the crisis and the transition to sustainable development.

Science and education are the backbone of modern civilization. The unity of educational and scientific processes is a necessary condition for the development of personality and harmonious training of a highly skilled specialist. Science classes will help future specialists creatively implement the knowledge and skills they carry in an educational institution, master the methodology of scientific research, and gain research experience. In the process of scientific search, there is an awareness of the need for continuous professional self-education and self-improvement. In the process of studying biology, students often associate their future life with scientific work. Therefore, the ability to form scientific thinking, comprehensively and objectively evaluate a certain scientific problem and determine ways to solve it is important in the educational process. Changes in the field of education, due to the desire for a global educational space, require the development of independence, curiosity, activity and creative abilities of students. Therefore, there is a need for students to improve their mental activity during their studies, to apply knowledge and skills in life. The implementation of these tasks directly depends on the correct organization of creative activity of students [1].

Education is a category of social, philosophical and methodological nature, it is associated with the development of public intelligence. The essential and value characteristics of education are as follows:

- education is an essential characteristic of any state and society and acts as a historical and cultural phenomenon, the result and condition for the development of the culture of a particular nation;
- education represents a fundamental category of modern times, as it performs the function of life, education permeates the daily routine of every person all through his life;
- education can be viewed as a harmony of factors (historical and social, economic, demographic, ecological, ethno-psychological, technical, medical) reflected in the ideology, content and technology of upbringing and education;
- education is a system expanded in time and space, multidimensional and multi-meaning;
- education acts, on the one hand, as one of the spheres of the functioning of science, and on the other, as an intermediate link between science and man;
- education has a social and philosophical-methodological character and is the “main sociogenetic mechanism”.

Analysis of scientific and educational literature has allowed to reveal the foundations of modern pedagogical education:

- development of integrative processes due to the increasingly complex synthesis of scientific knowledge as the leading methodological regularity of the current status of science in general and pedagogy in particular;
- personality formation, improvement and realization of human abilities in new socio-economic and socio-pedagogical conditions; commitment to the creative activity of each student and teacher;
- intensification of the learning process, the introduction of innovations in pedagogical technologies and teaching methods based on new ideas and concepts;
- the unity of the social and moral, common cultural, general scientific and professional development of the teacher’s personality in the context of the broad humanitarization of pedagogical education;

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- humanization of pedagogical education, careful and respectful attitude towards the individual as a subject of communication, knowledge, social creativity;
- democratization of pedagogical education;
- creation of student-centered pedagogical education;
- development and implementation of multilevel pedagogical education system, providing a wider and more informed choice of specialties and specializations, creating real opportunities for competitive selection for obtaining education and qualifications at subsequent stages; allowing to ensure the real continuity and openness of the entire education system;
- continuance of pedagogical education; basic vocational training; continuous improvement of the teacher's professionalism;
- the relationship between fundamentality and practical orientation in the integral process of training of a future teacher;
- openness, flexibility, variability, dynamism of content, forms, methods and means of teacher training in accordance with the requirements of the present and forecasts for the future;
- integration and continuity in the work of pedagogical universities, general education institutions, vocational education institutions, institutes (faculties) for Advanced Training.

In this regard, in the context of a scientific approach to solving current environmental problems, the environmental education of future teachers deserves special attention.

The relevance of the problem of our research – the substantiation of the theoretical and methodological foundations of the study of biodiversity (in the context of Kyzylorda region) in the process of training of future biology teachers is due to the priorities of solving the problems of environmental education and the development of innovative processes in the process of training of future teachers.

The research of many scientists is devoted to solving the problems of environmental education in higher education institutions.

The complexity and comprehensiveness of environmental education is explained by the features of environmental science and its interrelationship between pedagogy, psychology and teaching methods. Ecology combines many aspects of human consciousness and activity, ranging from a specific activity to the formation of a whole worldview and the development of scientific knowledge. Environmental education has become the priority direction of education system development in Kazakhstan. Today, among Chou Y.Y., Wu PF, Schaal S. and others in his scientific works, he emphasizes the formation of students' environmental knowledge and skills, cognitive attitudes [2; 3].

Cultural aspects of environmental problemы studied by Isaev G.I., Hafeez M. and Andreeva N.D. [4; 5; 6]. The relevance of the issue of scientific and methodological foundations of biodiversity research in the process of training future biology teachers is determined by the following: the understanding of the importance of environmental education by future biology teachers; understanding environmental education as a means of personal development, formation of environmental culture and preparation of students for professional activity; with the understanding of the leading role of the professional activity of the biology teacher in the field of environmental education of schoolchildren; with an understanding of the importance of biodiversity education in achieving environmental education goals in higher education institutions and schools.

And the standpoint of the professional-pedagogical approach, the research has been conducted by N.D. Andreeva, E.I. Polyanskaya, I.Yu. Azizova, S.S. Ryabova, V.V. Glazachev, Zh. Childibaev and others [7–12].

Throughout human history, the sphere of interaction between nature and human society as an integral system is being formed. The modern stage of interaction between nature and human society, which began in the middle of the twentieth century, is inseparable from scientific and

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technological progress. The most important feature of this stage is that the interaction between nature and human society at this stage of development in all its manifestations acquires a planetary, global character.

The importance of creating a concept of interaction between nature and human society began to be realized back in the 1980s. This was due to the need for environmental education and awareness, the definition of new values in the relationship between man and nature. Ecology already in those years had a significant impact on education, which manifested itself in the reorientation of the goals of education, and updating its content. Environmental education has become a priority in the development of the education system in Kazakhstan [13].

Nowadays, environmental education is a priority in the development of the education system. It deserves special attention in the context of scientific approach to solving current problems associated with the disruption of ecological balance and solving pedagogical problems.

Environmental education at a higher pedagogical school is a complex process, distinguished by its versatility and multidimensionality, and at the same time, characterized by integrity and unity.

The complexity and versatility of environmental education is explained by the peculiarities of the science of ecology and its interaction with pedagogy, psychology and teaching methods. Ecology brings together many aspects of human consciousness and activity, the range of which extends from a concrete gesture to the formation of a holistic worldview and the development of scientific knowledge.

The science of ecology could arise only at a certain stage of the accumulation of natural-science knowledge about nature. The origination of ecology can be tracked from ancient times. It is known from the history of human development that in addition to the technocratic, anthropocentric model of the world, in which man is considered the crown and owner of nature, there have been other models that, at certain stages of sociogenesis, have influenced the originality of humanism of a particular era.

Awareness of not only scientific, but also moral, legal aspects of interaction between man and nature have been a prerequisite for the development of continuous environmental education. On the one hand, the need to integrate ecology with all natural and social sciences has become more and more obvious; on the other hand, the need for the ecologization of all types of practical human activities has become increasingly apparent.

The historical aspects of the formation of environmental education are interesting. At the end of the 19th century, simultaneously with the awareness of the protection of certain species of plants and animals, the world scientific community begins to understand the need to preserve natural systems for these purposes, since the protection of an individual living object is closely related to the protection of its habitat. So, the first specially protected natural reservations begin to appear – the world's first Yellowstone National Park in the USA (established on March 1, 1872) [14].

As early as the beginning of the 20th century, a network of conservation areas was being designed in many countries of the world and the first international meeting on nature protection was held in 1913 in Bern. Almost all 80 national environmental organizations existing at that time in the world from 18 leading powers of the world took part in it [15].

Russian professor G.A. Kozhevnikov and Academician I.P. Borodin, who by that time had made a significant contribution to the promotion of environmental ideas and to the development of a plan for a network of conservation areas throughout Russia, took part in this meeting. So, I.P. Borodin in 1912 organized the Permanent Environmental Commission under the Russian Geographical Society, the purpose of which was "to arouse interest within the broader population and of the government for the protection of natural monuments in Russia and to actually preserve intact certain areas or entire areas that are botanically and zoo-geographically important, protection of certain species of plants, animals, etc." [15, p. 130]. The first state reserve in Russia "Barguzinsky" was established in 1916 on Lake Baikal at the initiative of the local population

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(hunters) with the purpose of protecting the population of the rare black Barguzin sable. After the October Revolution (1917), the country's natural reserve system expanded at a rapid pace, since after the abolition of private ownership of land, the organization of reserves was simplified.

In the 1940s, a number of international organizations appeared, which subsequently played an important role in the formation of "biospheric" thinking [15]. First of all, it is the United Nations Organization, founded in 1945, and in 1946 – UNESCO – the United Nations Educational, Scientific and Cultural Organization, whose main activity is environmental protection.

In 1966, the International Union for the Conservation of Nature and Natural Resources published the first international Red Book, which lists species on the verge of extinction.

Awareness of the impending ecological catastrophe led to the integration of environmental efforts, and in 1968 the UN General Assembly decided to convene in 1972 in Stockholm the first UN Conference on the Human Environment. It should be noted that in the scientific world, the understanding of the danger to the environment from the increasing anthropogenic impact has been formed on the basis of numerous data on the state of terrestrial and aquatic communities obtained as a result of scientific research within the framework of the International Biological Program (IBP or IBP) [16].

The discussion of the possibility of an International Biological Program was initiated in 1959 by Giuseppe Montalenti, President of the International Union of Biological Sciences. At the 9th General Assembly of the International Council of Scientific Unions in 1961, the IBE Planning Committee was established. The opening of the program was announced in July 1964 in Paris during a meeting of the General Assembly, which was attended by about 150 representatives from scientific academies of the world. The program was implemented from 1964 to 1974 and its main task was to assess the impact on biological communities and changes in the natural environment in order to preserve and develop natural resources for the benefit of man. The scale of this program can be judged not only by the number of working sections (7) and the countries that joined (58), but also by the number of scientific institutes that took part in this program, only in the USSR the number of scientific institutions of the Academy of Sciences was about 300, except universities and branch research institutes [17].

By 1977, the main tasks and methods of environmental (ecological) education were formulated, although they were still local in nature. The Tbilisi Conference discussed and adopted recommendations to members of the international community on the development of environmental education, which are contained in the most succinct form in the final document – the Tbilisi Declaration [18].

Ecologization is one of the trends in the development of modern higher pedagogical education. Ecology as a science influences the education system, which manifests itself in the reorientation of educational goals [19].

The pedagogical prerequisites for the development of the problem we are investigating are associated with the modernization of pedagogical education, conditioned by humanization, integration, informatization and globalization of education, and the creation of a person-centered concept of pedagogical education.

Currently, in the process of professional and personal becoming of a biology teacher and his/her readiness for environmental education of schoolchildren, a number of contradictions have developed: between the increasing level of social demand for a specialist in biological and environmental education and the prevailing mass practice of higher pedagogical education; between the standardization of higher pedagogical education and the individual and creative nature of teaching activities; between the awareness of the relevance of environmental education and the insufficient development of its material resources; between the structural and functional division of the ecological and ecological-pedagogical training of a teacher and the need for the holistic readiness of the biology teacher for environmental education; between the development of

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innovative and mass experience of environmental education and the need for its in-depth theoretical understanding.

In last decades, numerous studies by scientists from many countries, including the Russian Federation and the Republic of Kazakhstan, are devoted to the development of theoretical and applied aspects of environmental education at a pedagogical university. The need to turn again to the study of the environmental education problems of biology students at a pedagogical university is due to the fact that the environmental education problem of students has not yet been resolved on the basis of attracting teaching materials of a regional and local history nature.

In addition, recently, contradictions between the requirements for a teacher in the field of environmental education and the mass practice of training of biology teachers at a university have reappeared. This circumstance, when training biology teachers at a university, actualizes the problems of environmental education in general and the problem of studying the importance of biodiversity as one of the conditions for the stability of the biosphere and the preservation of life on the planet, in particular. Many scientists pay attention to the need to study material about biodiversity when training future biology teachers [13, p. 134].

Research methods

To solve the set tasks and check the hypothesis put forward, the following theoretical methodshave been used: analysis and synthesis; theoretical generalization and modeling; abstraction;methods of empirical research: questioning, observation, pedagogical experiment; quantitative and qualitative analysis of empirical data; statistical methods of mathematical processing of experimental findings.

The survey of students (2020–2021 academic year) made it possible to obtain results testifying to the low quality of mastering basic knowledge related to the concept of “biodiversity” and revealing its content. The results of monitoring the educational departments of the students proved it. In the identification period of the study, a descriptive observation was conducted in order to determine the situation of the problem of formation of knowledge about biodiversity among biology students (2020–2021 academic year). During the identification phase of the research, the formation of skills in applying knowledge about biodiversity in solving problems was checked for mastering levels according to Usova A.V. [12].

Results and discussion

One of the tasks of our research was to determine the current state of the problem of knowledge development about biodiversity in the mass practice of training of biology teachers at the university.

To implement the tasks of the ascertaining experiment, we have used such methods of pedagogical research as: questioning; conversations with professors, students and teachers – former graduates of pedagogical universities, working in a comprehensive school. Also, a control student assessment has been carried out, which made it possible to find out how much the students have knowledge of biodiversity in their training at the university. Taking into account the research tasks, questionnaires have been drawn up, questions of the conversation have beenframed, test and control tasks for students have been developed.

In the course of the ascertaining experiment, 84 students have been questioned when checking theformation of knowledge about biodiversity and 106 students from Korkyt Ata Kyzylorda University and Abai Kazakh National Pedagogical University when checking the formation of skills to apply knowledge about biodiversity in solving problems and issues. The use of the localcomponent in solving the problem of biodiversity of useful plants is due to: the vast territory of Kazakhstan, a wide variety of natural conditions, a great number of species diversity of flora and the presence of preserved undisturbed ecosystems.

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Considering the problem of studying plant biodiversity using the example of South Kazakhstan, Aidarbaeva D.K. and Sholpankulova G.A. emphasize that the use of the local component in solving the problem of biodiversity of useful plants is due to the vast territory of Kazakhstan, a wide variety of natural conditions, a great number of species diversity of flora and the presence of preserved undisturbed ecosystems. At the same time, scientists point out that knowledge of the characteristics of their region makes it possible to take into account the diversity of plant species, interrelations in ecosystems, to concretize general biological concepts with new facts, local examples, to form students' conviction that the conservation of species and biocenosesis possible only as part of natural ecosystems in their typical habitat conditions [13, p. 135].

The works of many famous biologists, ecologists and teachers are devoted to the study of biodiversity. From the standpoint of the value-based approach, biodiversity is conceptualized in the works of I.T. Suravegina, M.M. Tyaptirgyanov and others. Aesthetic value is manifested in the artistic expressiveness of each species, group of species, cenosis and a certain landscape [20; 21]. However, despite the publications devoted to the study of biodiversity at school and university, the problem of developing knowledge about biodiversity in the training of biology teachers at the university is not resolved.

By analyzing the results of a questionnaire survey of professors teaching biological and environmental disciplines at the university, the fact of insufficient attention to the problem of biodiversity and its conservation in the Republic of Kazakhstan have been revealed. For example, only 60% of the professors surveyed pay attention to the issues about biodiversity conservation in the selection of educational content. Most often, it concerns such concepts as "rare species", "endangered species", "Red Book of Kazakhstan" and some others. At the same time, 56% of professors include in the content of their academic disciplines the material on biodiversity at the species level, and only 32.2% (9 people) pay attention to the diversity of biogeocenoses.

To the question of the questionnaire about how the students' work on studying biodiversity, in particular, biodiversity and its conservation in the Republic of Kazakhstan, is organized, professors (48%) have answered that they themselves make a selection of information and introduce students to "prepared" knowledge. This is clearly not enough and does not meet the needs of our time, since today the work of students on independent search for information is very important. At present, the educational activities of students should be aimed at familiarizing themselves with the analysis results and understanding the analytical research data obtained as a result of international and domestic research in the field of study, at the development of reflective experience, citizenship and abilities to solve professional problems and tasks, and the formation of individual and collective responsibility for professional actions.

A questionnaire survey of students in academic year have made it possible to obtain results that indicate the poor quality of acquisition of basic knowledge, revealing the content and associated with the concept of "biodiversity". The same has been confirmed by the results of the control student assessment.

Students' answers to the questionnaire indicate that the concept of biodiversity and the knowledge associated with this concept are incomplete and inaccurate among biology students who completed their studies up to 8th semester. For example, to the question of the questionnaire, which involves the answers of students with self-assessment of their knowledge, students have put 4–5 points. Thus, assessing their own knowledge of measures to promote the conservation of biodiversity, the majority (71.4%) have put 5 points, while when we have conducted the assessment of students' acquisition of knowledge about biodiversity, 84% (71 people) have defined the concept of "biodiversity" as species diversity of living organisms only. At the same time, 35.7% of students generally indicate that "biodiversity is a variety of plant and animal species". This circumstance suggests that students have overestimated their knowledge of biodiversity.

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To the question of the questionnaire "Specify the names of no more than 4 academic disciplines, during the study of which you had the opportunity to familiarize with materials about biodiversity, including the conservation of biodiversity in Kazakhstan", students most often have named such academic disciplines as Vertebrate Zoology, Plant Taxonomy, Animal Ecology, Biological Resources of Kazakhstan.

Answering the question "In what do you see the value of biodiversity (name several aspects of value)?", students most often have noted the resource (economic) value (89.3%), scientific value (39%), and educational value (28.5%). And only 11.9% of students have noted that biodiversity is about ensuring the sustainability of the biosphere, and the sustainability of life on Earth.

An interesting fact is that student srated their knowledge of measures to promote biodiversity conservation by 4 and 5 points (50% and 40.4%, respectively). However, when disclosing the content on measures of biodiversity conservation, including conservation in Kazakhstan, not all students (35.7%) were able to give specific examples of methods and activities aimed at preserving and protecting biodiversity.

When questioning biology teachers - former university graduates, the same questions were applied as in the students' questionnaires. This did not require teachers' self-assessment of their knowledge about biodiversity and questions were added about the study of which educational topics of school biology form pupils' knowledge about biodiversity. The knowledge of teachers practically did not differ from the knowledge of students.

At the ascertaining stage of the research, in order to identify the state of the problem of forming biology students' knowledge about biodiversity, a control student assessment has been carried out (2020–2021 academic year). For this, 4th year students (8th semester) have been involved as a category of those students who are completing their bachelor's degree studies.

The analysis data of the results of the control student assessment are given in the Table 1.

Table 1 – The results of the quality analysis of acquisition of knowledge about biodiversity by 4th year students (the ascertaining stage, in%, of 84 people)

Tested knowledge	Level 0 (no answer, wrong answer)	Level I (knowledge is incomplete, inaccurate)	Level II (knowledge is accurate, not entirely complete)	Level III (knowledge is accurate, complete)
Biodiversity	23.8	34.5	23.8	17.9
Levels of biodiversity	32.1	41.6	23.8	2.4
Factors that affect the biodiversity of the planet	16.6	25.1	42.8	15.5
Approachesto biodiversity conservation	39.3	32.1	22.6	5.9
Specially protected natural reservations	22.6	36.9	25.1	15.4
Specially protected territories of Kazakhstan	13.1	40.5	33.3	13.1

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In answers to the task to give a definition of the concept of "biodiversity", most often (58.3%) there was an understanding of biodiversity as a variety of species of plants, animals and fungi. Less often, students noted that biodiversity was represented not only by species of organisms, but also by different biogeocenoses. And very rarely (17.9%) students supplemented their answer with the fact that biodiversity included a variety of genotypes and genes. Due to such incomplete and inconsistent scientific view, students also showed a lack of knowledge about the levels of biodiversity. The question about the factors influencing biodiversity turned out to be the easiest for the students. They handled this question most successfully. The most difficult question was the question about the approaches to biodiversity conservation. 94.1% of students believe that biodiversity conservation consists in the preservation of species of living organisms. And only 5.1% in their answers indicated the need to protect the habitat (breeding grounds, places of mass migration of birds, fish spawning grounds, etc.) in order to preserve biodiversity.

At the ascertaining stage of the research, the formation of skills to apply knowledge about biodiversity in solving problems have been also checked. The levels of mastering skills according to A.V. Usova [12], where:

Level I (lowest) – characterized by the performance of individual operations by students, their sequence may be incorrect;

Level II (intermediate) – students perform all the required operations, but their sequence is not thought out, the actions are not sufficiently realized;

Level III (highest) – students perform all operations, the sequence is rational and the actions are realized. The analysis results of the formation of skills are given in Table 2.

Table 2 – The analysis results of the formation of skills to apply knowledge about biodiversity in solving problems and issues among students (at the ascertaining stage, by levels, in% of 106 people)

Skills to apply knowledge	Level 0	Level I	Level II	Level III
Definition of concepts and detailing of their content	34.4	48.2	10.3	6.9
Linking biodiversity concepts	37.9	46.5	8.6	6.8
Provide examples of scientific facts to support conclusions and generalizations	34.5	43.1	12.9	9.4
Application of knowledge when choosing a solution to a problem	35.3	41.4	12.9	10.3

The results of the control student assessment indicate that the knowledge about the levels of biodiversity and approaches to biodiversity conservation is the least acquired by students. For the majority of students, the acquisition of knowledge, the control of which has been carried out within the framework of the ascertaining experiment, corresponds to the levels II and III, which in turn confirms the relevance of the problem of our research.

The results of the experiment showed that 34.4% and 48.2% of students correspond to level 1 and 2, and are able to perform separate operations, their sequence may be incorrect. Also, students perform all the required operations, but their sequence is not thought out, the actions are not sufficiently realized. On the problem of establishing links between the concepts of biodiversity, the respondents also showed the correlation of knowledge to level 1 and 2, for example, it was 37.9% and 46.5%, and only a small part of the experimented met level 3 and 4, which approximately amounted to 8.6% and 6.8%. Also, on the issue of the ability to give examples of scientific facts in

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support of conclusions and generalizations, the subjects showed the following picture, 34.5% and 43.1%, also some part corresponded to 12.9% and 9.4%, which also indicates a low level of application of scientific data in everyday life. On the issue of applying knowledge when choosing a solution to the problem, most of the subjects also showed a low and average level, for example, 35.3% and 41.4%, and only 12.9% and 10.3% showed a high level. The results obtained during the experiment indicate the need to study biodiversity in the higher education system.

Assignments and tasks used in order to identify the quality of students' mastery of the skills to apply knowledge about biodiversity were case studies and test assignments. When solving these assignments, the above skills were tested and evaluated. The solution of the tasks offered to the students required the application of theoretical and practical knowledge about biodiversity. Each student was offered 4 tasks, the solution of which, in their totality, required students to demonstrate their skills from all four groups. The analysis of the results obtained shows that the majority of students have skills at levels 0 and I.

Conclusion

The selection of educational content on biodiversity for study by biology students at the university should be carried out taking into account the requirements of evidence-based pedagogical, didactic and methodological principles. In the course of our study, such principles were substantiated, namely: the relationship of biological and environmental training with the methodology of teaching biology, the unity of integration and differentiation, cultural conformity, practical orientation, the principle of “basic discipline”, the principles of manufacturability, the unity of the intellectual and emotional; interrelations of global, regional, local in the study of biodiversity. The principle of the relationship of biological training with the methodology of teaching biology provides for such a construction of the curriculum and the organization of the educational process, which ensures the continuity of the disciplines of biological and methodological training of students in order to develop the professional competence of the future teacher.

The results of students’ acquisition of knowledge about biodiversity and the skills to apply them in solving various kinds of training tasks confirm the urgency of our research.

1. Ecologization, being one of the development trends of modern higher pedagogical education, is manifested in the reorientation of goals and updating the content of education. Environmental training of teachers is becoming one of the most important tasks facing a modern university in connection with the global environmental crisis and the low level of environmental consciousness of the population. Numerous studies of scientists from many countries, including the Republic of Kazakhstan, are devoted to the development of theoretical and applied aspects of environmental education of students. However, again there is a need to turn to the study of the problems of environmental education in the training of future biology teachers at the university due to the importance of attracting teaching materials on biodiversity, taking into account the global, regional and local history aspects.

2. The issue of conservation of biological diversity has become one of the main world priorities, due to the need to conserve biological diversity to ensure the existence and further development of mankind. The main concepts that biology students need to learn while studying at a university are: “biodiversity”, “genetic diversity”, “species diversity”, “ecological diversity”, biodiversity sustainability, “biodiversity assessment”, “biodiversity conservation”, “activities in order to conserve biodiversity”, “values of biodiversity”.

3. A research to identify the state of the problem of the formation of knowledge and skills about biodiversity in the mass practice of teaching students at a university showed the presence of problems associated with understanding the essence of the concept of “biodiversity”, detailing the

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content of concepts about genetic, species and ecological diversity, as well as problems in knowledge, associated with the state of biodiversity and its reduction in Kazakhstan.

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