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Improving the Methodology for Developing Students' Natural and Scientific Worldview (On the Example of Teaching the Subject of "The Doctrine of Evolution")

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Abstract-- *This article reveals to improve the methodology for developing students' natural and scientific worldview in the process of teaching the subject of "The Doctrine of Evolution». The tasks of the research are following: clarifying the component and competency system of developing students' natural and scientific worldview; improving the content of development of students' natural and scientific worldview through a competency-based approach in the process of teaching the subject of "The Doctrine of Evolution"; improving the methodological structure of developing students' natural and scientific worldview based on the integrative system of teaching the subject of "The Doctrine of Evolution"; identifying the didactic possibilities of developing students' natural and scientific worldview in the process of teaching "The Doctrine of Evolution" and the facilitation technologies for preparing students to research activities; developing a set of non-standard educational and test tasks of a reproductive, productive, partly research and creative nature as well as electronic resources and educational and methodological support for developing students' natural and scientific worldview in accordance with requirements of international assessment programs. The object of the research was the process of developing students' natural and scientific worldview. 556 students of the National University of Uzbekistan, Andijan State University, Urgench State University and Karshi State University were involved in the experiments.*

Keywords*--natural and scientific worldview, higher educational institutional students, IT in education, vitagenic technology*

I. INTRODUCTION

The world highly appreciates the importance of the natural sciences in the life and lifestyle of mankind, especially the ability to predict the organic world based on the laws of evolutionary development of biological science. In the development of biological sciences, the material foundations of heredity, nucleic acids, the structure (sequence of nucleotides) and the functions of the human genome, which is a product of the evolutionary process, are determined. It is recognized that the organic world consists of viruses, prokaryotes, fungi, plants, wildlife, and a synthetic theory of evolution has been developed. All this, in turn, involves increasing the effectiveness of teaching these disciplines, the technologization of the educational process in an innovative educational environment, the development of virtual electronic resources related to biological phenomena, and the consistent improvement of its organizational and methodological support.

On a global scale, a scientific search is being conducted in the field of organizing virtual laboratory studies in the teaching of biological sciences, methods and effectiveness of using interactive software, facilitation models, reflective and vitagenic technologies. Among the main tasks of these studies, an important place is occupied by

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improving the quality of preparing students for research activities, developing the natural science worldview, in particular, studying and improving the properties of pedagogical approaches based on the discipline, aimed at increasing motivation in the formation of private competencies related to the direction of “Evolutionary Learning”.

As a result of systemic reforms being carried out in our republic to strengthen the material and technical base of higher educational institutions, to radically update the content of educational and methodical literature and to train teachers, the possibilities have been expanded for introducing into teaching educational technologies, innovative approaches, and multimedia educational resources aimed at developing the natural science worldview of students. However, there is a need to improve methodological support for the development of the natural scientific worldview of students. The priority task is defined in the strategy for the further development of the Republic of Uzbekistan: “improving the quality and efficiency of higher educational institutions, educating young people with solid life views, physically healthy, spiritually and intellectually developed, self-minded, devoted to their homeland” [38]. In this direction, the modernization of the content of biological education, along with all academic disciplines, the improvement of methods, means, forms and technologies of the development of the natural science worldview, is of particular importance.

II. REVIEW OF RESEARCHES

Scientific research in the field of the development of the natural science worldview of students is carried out in leading scientific centers and higher educational institutions of the world, in particular in Leiden University (Germany), Polish Society for Human Evolution Studies (Poland), Leverhulme Center for Human Evolutionary Studies (Great Britain), Laboratory of Human Evolution Studies of Kyoto University (Japan), Center for Cellular and Molecular Biology (Pakistan), Russian Institute for Educational Development Strategy (Russia).

In the world, in the framework of scientific research on the development of the scientific worldview of students, a number of results have been obtained, in particular, interactive educational technologies for teaching evolutionary teachings (Leiden University) have been developed; Interactive software tools for the development of the natural science worldview (Polish Society for Human Evolution Studies) were created; the methodological system of introducing biological, anthropological and archaeological concepts in the development of the scientific and evolutionary worldview of students (Leverhulme Center for Human Evolutionary Studies) has been improved; clarified the priority areas related to the social evolution of man, anthropology and primatology in the teaching of evolutionary studies (Laboratory of Human Evolution Studies of Kyoto University); developed a modular educational system based on the priority of integration and differentiation of educational, educational, methodological, research processes in the development of the natural science worldview (Center for Cellular and Molecular Biology); a methodology has been developed for applying international PISA (Program for International Student Assesment) assessment programs in the development of science literacy (Russian Institute for Educational Development Strategy).

Research is being conducted in the world in the field of the development of the natural science worldview of students, in particular, in the following priority areas: improving methodological conditions for the development of the natural science worldview of students on the basis of electronic software; the formation of a system of natural scientific competencies of students in the process of working with virtual laboratories, ensuring the integration of theoretical and practical lessons in organizing the process of biological education, increasing the role of innovative educational technologies in the development of the natural science worldview of students, improving the methodological support for directing students to research activities [34].

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III. LITERATURE REVIEW

The methodological foundations of teaching biological sciences are reflected in the works of scientists of our republic A. Gafurov[17], Zh. Tolipova [36], S. Fayzullaeva [15] and others; the conceptual foundations of the organization of innovative education, the advantages and possibilities of using information and communication technologies - in the works of A. Abdukodirov [1], U. Begimkulov [5] and others; applied technological aspects of the organization of interactive education - in the works of N. Azizkhodzhaeva [3], R. Dzhuraev [13], Zh. Juldoshev [22], N. Muslimov [26], H. Omonov [29], D. Ruzieva [33], M. Tozhiev [37], U. Tolipov[35] and others.

Scientists of the CIS countries T. Baiborodova [4], S. Beketova [6], N. Galeeva [18], L. Grigorieva [19], E. Demyankov [12], M. Zhuraev [40], O. Naumova [27], I. Ponomarev [31], N. Postnova [32], Yu. Chaikovsky [10] and others conducted research in the field of theoretical foundations and psychological and pedagogical aspects of the development of the natural science worldview of pupils and students in the process of teaching natural disciplines, including biology.

Scientists of developed foreign countries B. Alters [2], M. Berkman [7], B. Bishop [8], E. Burton [9], M. Clores [11], J. Francisco [16], E. Köse [23], J. Miller [25], D. O'Brien [28], E. Sober [14], J. Sapp [20], M.Muehlenbein [24], Pierre Pontarotti [30], D.Wilson [28, 39] studied the issues of improving the organizational and methodological aspects of the development and use of didactic tools to increase the effectiveness of teaching the discipline "Evolutionary Biology".

IV. METHODOLOGY AND DISCUSSION

The purpose of the study is to improve the methodology for the development of the natural science worldview of students in the process of teaching the discipline "Evolutionary Learning".

The objectives of the study: to clarify (specify) the components of the development of the natural science worldview and the student competency system;

to improve the content of the development of the natural science worldview of students in the process of teaching the discipline "Evolutionary Learning" based on a competency-based approach;

to improve the methodological structure of the development of the natural scientific worldview of students on the basis of an integrative system of teaching the discipline "Evolutionary Doctrine";

to determine the didactic opportunities for the development of the natural science worldview of students in the process of teaching the discipline "Evolutionary Learning" and facilitation technologies for preparing students for research activities;

to develop a set of non-standard educational and test tasks of a reproductive, productive, partially search and creative nature and electronic resources, educational and methodological support for the development of students' natural science worldview in accordance with the requirements of international assessment programs.

The object of study is the development process of the natural science worldview of students, 556 students of the National University of Uzbekistan, Andijan State University, Urgench State University, Karshi State University were involved in the experimental work.

The subject of the study is the content, forms, methods and means of developing the natural science worldview of students in the process of teaching the discipline "Evolutionary Doctrine" in higher educational institutions.

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Research Methods. In the process of research, methods of a comparative analysis of political, philosophical, social, psychological, pedagogical and methodological literature on the problem of research and educational and normative acts relating to this field were applied; socio-pedagogical (observation, conversation, questionnaire, survey); pedagogical experiment; monitoring methods of mathematical statistics.

The scientific novelty of the research is as follows:

the essence and content of the term “natural scientific worldview” has been improved on the basis of the integration of the identifying features of the praxiological (practical, effective, rational) direction and didactic (motivational-value, cognitive-activity, personality-reflective) goals of biological education;

the content of teaching the discipline “Evolutionary Learning” has been improved on the basis of the priority of competency requirements for the microevolutionary and macroevolutionary process (structure, means of the “DNA research” technology);

the development process of the students' natural scientific worldview (independent work on information, the formation of a reflective point of view, the formation of vitagenic and subjective experience) is improved on the basis of concretization of integrative features (creative, emotionally stimulating, varied educational tasks) of individual and differentiated educational technologies;

the methodological structure (motivational, cognitive, practical-activity) for the development of the natural-scientific worldview of students based on the approach of phased and targeted design of learning tools, methods and forms of training (case-collection, networking, mastering lessons) was improved;

the structure of criteria (non-standard, creative educational and test tasks) aimed at developing the students' natural science worldview based on the definition of requirements (reflective assessment, application of acquired knowledge in practice, innovative activity) to the assessment of scientific literacy was clarified.

The practical results of the study are as follows:

non-standard test tasks in the discipline “Evolutionary Learning” were turned into adaptive tests through the My test program and put into practice;

a model for designing classes in the discipline "Evolutionary Learning" based on the educational goals of Bloom's taxonomy was developed;

developed a system of innovative technologies for the formation and development of the natural science worldview of students;

created electronic software for the development of the natural science worldview of students in teaching the discipline "Evolutionary doctrine."

The reliability of the research results is determined by the application of approaches, methods and theoretical data obtained from official sources; articles published in materials of republican and international scientific conferences, magazines included in the list of the Higher Attestation Commission, and other foreign journals, a monograph; the validity of the methods of mathematical statistics of analyzes and the effectiveness of pedagogical experimental work; the introduction of conclusions and recommendations on the methodology of conducting classes on the basis of the created printed and electronic teaching aids in practice, the confirmation of the results by the competent authorities.

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Theory. Based on the results of the study, a definition was given on updating the content of education in an innovative educational environment, introducing innovative and information technologies into the educational process, designing the educational process based on B. Bloom's taxonomy, taking into account the psychological characteristics of students, implementing the integration of educational disciplines in teaching, the use of non-standard adaptive tests in assessing the results of educational activities and preparing the soil for the development of natural science full worldview of students in the educational space.

As the stages of the innovative educational environment in training, the creation of a motivational environment, its design and factors relating to the structure of the cultural and educational environment are defined. To create an innovative educational environment, the direction of activating the educational and cognitive activity of students was determined through work in small groups and individually, didactic support was improved, the structure of the cultural and educational environment for putting into practice was determined, taking into account their components, an educational process based on innovative technologies was designed. In the process of the study, the socio-pedagogical and methodological factors of the development of the natural science worldview of students at the stages of creating the conditions of an innovative educational environment are specified.

In the course of the study, the definitions of the concepts “worldview”, “scientific worldview” and the results of searches were analyzed, an attitude was expressed to them and the following definitions were proposed. Worldview - a reflection in the human mind of a picture of the organic world, the totality of a system of philosophical, scientific, socio-political, ethical, aesthetic views, assimilated throughout the life of a person, determining the direction of a person in independent life and future professional activities.

A scientific worldview is a system of a person’s scientific views on the world and a person’s place in it, on the surrounding reality and on himself, a system of beliefs, a person’s motivation for cognition and assimilation of the world. The natural science worldview is a system of competencies related to the awareness and analysis of the place of living organisms in the organic world, the preservation of biodiversity, the relationship of the individual to the surrounding reality and himself, scientific views, bioecological beliefs, and the awareness of the co-evolution of nature - society - man.

The relationship between the constituent parts of a person’s worldview requires the implementation of the integration of disciplines in the formation of students' natural scientific worldview in the educational process. As you know, in the formation and development of the natural science worldview of students, an important place is occupied by the integration of social and humanitarian, natural-mathematical, general professional disciplines included in the curriculum. In this process, the teaching of the discipline "Evolutionary Doctrine" is supposed to be closely related to the innovative fields of biology as an evolutionary development of biology based on the principles of continuity, continuity, science, and logic.

In the process of developing the natural science worldview of students in the classes on the academic discipline “Evolutionary Learning”, the knowledge, skills and abilities of students acquired on the basis of the methodological laws of philosophy, philosophical views were activated, the integration of the object, concepts, theory, methodological, problem integration, activity and practical was used integration. Taking into account the great importance of the integration of disciplines in the formation of the natural science worldview of students, on the example of the academic discipline "Evolutionary Doctrine", ways to implement integration in synchronous (horizontal) and asynchronous (vertical) directions using dialectic categories and laws of philosophy, laws of such natural sciences as physics, chemistry, geography, ecology, in the development of the natural science worldview of students. Mathematical, natural science, general professional and special disciplines of the curriculum of the direction

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of undergraduate education in biology are conventionally allocated to ecology-biology, natural, socio-economic geography, physico-chemical direction, methodological foundations for the use of a block-modular interdisciplinary system based on the integration of disciplines in teaching have been improved biology.

In the process of the study, the literature and legal documentation relating to the teaching of the discipline "Evolutionary Learning" in higher educational institutions of the developed countries of the world were analyzed.

In the curricula of higher educational institutions of developed foreign countries, the discipline "Evolutionary doctrine" is called as follows: in the curriculum of the University of Westwal Wilhelm in Germany - Molecular and Experimental Evolution (Molecular and Experimental Evolution), at the University of Hohenheim - Evolutionary Biology (Evolutionary Biology) , at the National University of Seoul of South Korea - Evolutionary Biology (Evolutionary Biology), at Cambridge University of England - evolution and Behavior (Evolution and Behavior), at the Leningrad State University of Russia - Theory of Evolution.

When teaching the discipline "Evolutionary Doctrine" for the formation and development of the natural science worldview of students, the need is determined, first of all, to get acquainted with the basic laws and concepts of biology, its place in practice, in various areas of the national economy, the formation of a conscious attitude to nature and society, as well as the implementation of the educational process in close connection with the future professional activities of students.

The formation and development of the natural science worldview based on general biological concepts in the process of teaching the discipline "Evolutionary Doctrine" is one of the urgent problems of the methodology of teaching biology.

During the study, clarity was introduced into general biological concepts that are formed and developed during the teaching of biological disciplines.

General biological concepts include a cell - a unit of the structure, structure and life of living organisms; unity of the structure and functions of organs; the interdependence of the organism and the environment; an organism as an integral self-governing system; metabolism and energy; heredity, variability and reproduction of organisms; evolutionary development of the organic world, etc.

During the search, on the basis of the unity of concepts, the system of the formation and development of the students' natural science worldview was improved.

When designing the formation and development of a natural science worldview based on biological concepts as a result of integration of local and private-subject concepts in the content of biological sciences and the formation of general biological concepts, it was supposed to create the foundations for using the knowledge, skills and abilities learned by students in the process of training and education in familiar, new and unexpected situations, the formation of competencies related to this process, continuity to Competencies, on the other hand, allow the formation of the natural science worldview of students.

Based on the results of the study, the possibilities for the development of the natural science worldview of students through the formation of subject competencies in the process of teaching the discipline "Evolutionary Learning" are determined.

As a result of the analysis, it was established that the concepts of the direction of evolution of the organic world are the basis for the formation of the natural science worldview, based on the research problem, the legal

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documents of the direction of biology education in terms of the development of the students' natural science worldview are analyzed.

On the basis of these analyzes, three interrelated areas are generalized in the teaching of academic subjects ("Organism - the biological system", "Ecological systems", "Evolution of the organic world"), scientific conclusions and methodological recommendations for the integration of biological disciplines are developed.

Problematic educational tasks aimed at enhancing through the creation of conditions for applying in new and unexpected situations the knowledge, skills and abilities of students, acquired in the field of consciousness of the integrity of the organic world, its organicity with the inorganic world, understanding of cause and effect dependencies in the development of the organic world and other areas of biological science.

In the research work, on the basis of the directions reflected in the CRP, the inductive and deductive logical orientation of the process of forming the students' natural science worldview is determined. The content of general professional disciplines of the curriculum, such as cytology, botany, histology, zoology, human anatomy, the basics of genetics and selection, microbiology and virology, biochemistry, plant physiology, human and animal physiology, biophysics, biotechnology, bioinformatics, forms the students ’natural worldview in the inductive logical direction, the content of the educational discipline "Evolutionary Learning" - in a deductive logical direction, recommendations were prepared on the implementation of data on ION.

An analysis of the logical structure of the system of the natural science worldview made it possible to understand its essence and content, contributed to a deeper understanding of various problem situations by students, and a generalization of the essence and content of scientific systems and the scientific worldview helped them to understand the areas and boundaries of their application in subsequent professional activities.

Methods and forms.

Teaching the disciplines of the biological cycle involves achieving a conscious and lasting assimilation and practical application by students of certain knowledge, concepts, ideas, theories. This process creates the basis for the integration of science, technology, production and practical experience with the educational process. It was also assumed the formation of skills in applying knowledge in practice, independent and creative thinking through the development of skills of independent work on educational literature. The study identified the place of lectures, practical, seminars, study groups and independent work in the process of teaching the discipline "Evolutionary Learning", as well as ways to implement didactic goals. In the course of the study, it was meant to ensure an organic connection of the integral pedagogical process and its components, such components as the content of general professional disciplines, means, methods and forms of training, joint activities of a teacher and a student, motives, a block-modular system was formed.

As you know, higher educational institutions (HEU) are entrusted with the task of implementing state and public orders for the training of competitive personnel and a harmoniously developed personality. In the dissertation, the content of the discipline "Evolutionary Learning" is determined on the basis of the requirements of this order. The results were analyzed, if necessary, appropriate changes were made. The educational process is a system, and a change in the components, of course, leads to a change in the remaining parts.

With the development of the natural science worldview of students through the improvement of the teaching of academic disciplines of the biological cycle, in particular lectures, seminars and independent education, with the help of effective means and methods, it is necessary to solve the problems associated with the humanization and democratization of the content of education and pedagogical relations; ensuring the unity of training and education;

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organization and management of cognitive activities of students in accordance with educational goals; effective use of information and innovative technologies; paying attention to practical (applied) issues, taking into account the professional orientation of education; a systematic assessment through adaptive test tasks of the current and intermediate control of the rating system of the level of students' acquisition of knowledge, skills and abilities, key and subject-private biological competencies, and the introduction of appropriate changes to the learning process in accordance with the results. Through the solution of the above problems, a model of the process of development of the natural science worldview of students is developed.

The basis of the model is the requirements for the development of the natural science worldview of students, the content of education, the teacher's pedagogical activity in this process, the organization of educational and cognitive activity of students based on a competency-based approach, the unity (organic) methods, means and forms of training, the use of innovative technologies in their implementations, self-control, means of rating control, standard and non-standard training and test tasks, independent and extra-audit content work, allowing to establish the level of development of the scientific worldview of students.

The organizational, technological and methodological component of the model provides:

updating the content of biological disciplines taught in the higher education system on the basis of educational, didactic and handout materials that contribute to the development of the natural science worldview of students;

use in educational process as a methodological system of educational goals, the content of education, effective methods, means, forms of training;

organization of educational and cognitive activities of students at lectures and seminars based on the requirements of innovative and information technologies;

taking the idea of a harmoniously developed person of national ideology as the basis of the educational process through the knowledge, skills, abilities, key and biological competencies normalized by the CRP, and the idea of mastering students’ professional skills, serving the people’s benefit, and contributing to the prosperity of the motherland.

Based on the results of the study, the methodological system for the development of the natural science worldview of students in teaching the discipline "Evolutionary Learning" has been improved.

This methodological system includes the methodological basis, the paradigm of the educational process, didactic goals and principles, the content of education, means, methods and forms of training, applied innovative technologies, standard, as well as non-standard educational and test tasks, which allow to determine the level of formation of the natural science worldview students and the effectiveness of the process.

Such questions of the modern education paradigm in the process of teaching biology have found their solution, such as the use of focusing on the student’s personality, enriching the content of the discipline regarding the natural science worldview, expanding students' ideas about the scientific picture of the organic world, increasing interest in mastering knowledge in the field of natural sciences related to the natural science worldview, satisfaction of the need for self-development and development of research activities, study of objects of the organic and inorganic world, understanding of their interconnection and interrelations, mastery of practical knowledge and skills in the field of environmental competence, nature conservation and its use.

The place and role, possibilities of the academic discipline "Evolutionary Learning", taught in the bachelor's degree of higher educational institutions, in the formation and development of the natural science worldview of the

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individual as a continuation of the biological sciences taught in institutions of general secondary, specialized secondary, vocational education are analyzed.

The students 'knowledge acquired as a result of studying the structure, development, and vital functions of biological objects in the classroom on the subject “Evolutionary doctrine” constitutes a natural-science outlook and students' belief system. The students' natural science worldview considers the laws of evolution from the point of view of the historical development of relations "nature - man - society", and in the work they were based on this position.

Also in this chapter, the methodology of applying the teaching of the discipline "Evolutionary Learning" of two types of technologies - private-methodical and local-innovative.

During the research at the private methodological level, didactic games, problem-based learning, modular instruction, joint learning, design technologies were applied; at the local level - the technology "Insert", "Cluster", "Venn Diagram", "Brainstorming", work in small groups, "Chain of terms", "Sheet of terms." Based on the results of the study, the technology of didactic games "on the steps" and the development of classes, a book for independent work of students, and an electronic manual were created.

The developed electronic manual and a book for independent work of students aimed at increasing the effectiveness of training, orienting students along with the acquisition of knowledge, skills and abilities, private subject and key competencies in the experience of creative activity and through this creating the ground for the development of a natural world outlook.

The book for independent work of the student, formed by a specific academic discipline, is an integral part of the educational complex of this discipline. It reflects the educational tasks performed during lectures, seminars, practical and laboratory studies, in the process of independent work, it is a didactic tool that allows you to individualize, differentiate training, and systematically organize training activities.

The content of the discipline "Evolutionary Learning" is formed on the basis of the requirements of developing and personality-oriented educational technologies, and if the initial educational tasks for small groups set the stage for mastering the knowledge, skills and abilities contained in the topic, then the substantive tasks of a productive, partially search, reproductive levels designed for independent execution (“Venn Diagram”, “Cluster”, “Chain of Terms”), allow to master the private biological competencies of the application of acquired knowledge s and skills in new situations.

The Case Study task and test tasks of the creative (creative) level contained in the book of independent works are oriented toward the development of the natural science worldview through the application of knowledge, skills, and key and subject-specific biological competencies in unexpected situations. In the process of completing these tasks, students form ideas about the volume, content and difficulty level of tasks to the topic, plan educational activities, carry out self-monitoring and self-assessment, and thereby fully achieve their educational goals.

V. EXPERIMENTAL WORK

The effectiveness of the scientific research and experimental work was ensured by the appropriate organization of the pedagogical experiment on the basis of familiarization with the methodological manuals and recommendations created in the field of pedagogy and methods of teaching biology, conducting it on the basis of the developed program, the geographical location of the experimental sites, and the availability of pedagogical conditions. The experimental work was carried out in three stages: substantive, ascertaining, formative (2012–2017). It was attended

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by 144 students of the National University of Uzbekistan, 134 students of Andijan State University, 134 students of Urgench State University, 144 students of Karshi State University, a total of 556 students.

The program of the pedagogical experiment defines high, sufficient, medium and low levels - criteria for diagnosing the development of the natural science worldview of students. The results of the experimental and control groups were compared with the final values at the beginning of the experiment - the primary result (NE) and at the end of the experiment (CE), non-standard test tasks were used as indicators and diagnostic tools, and numerical evaluations were determined that showed their assimilation. In the course of experimental work on the basis of private competencies, the level of achievement of results on the development of the natural science worldview of students was determined using the student criterion of mathematical statistics. Statistical accounting of the obtained experimental results compared with the results of the 2014/15 academic year is compared with the indicators at the beginning and end of the experiment.

Table 1. Results of experimental work at the beginning and in the end of experiment

HEU	Gruops	Number of resp.	Grades							
			High		enough		mid		low	
			At the beginning	At the end	At the beginning	At the end	At the beginning	At the end	At the beginning	At the end
Andijan State University	Experimental	25	2	3	6	14	12	7	5	1
	Control	25	2	2	5	6	15	12	3	5
National University of Uzbekistan	Experimental	28	1	6	6	12	14	9	7	1
	Control	26	1	2	6	5	11	15	8	4
Karshi State University	Experimental	26	1	5	12	13	12	7	1	1
	Control	26	1	2	4	6	6	14	4	4
Urgench State University	Experimental	25	1	3	6	16	12	5	6	1
	Control	25	1	1	7	8	12	14	5	2
Total	Experimental	104	5	17	30	55	50	28	19	4
	Control	102	5	7	22	24	42	58	22	13

Based on the data obtained at the end of the experiment, the following results are presented (Table II):

Table 2. The results obtained at the end of the pedagogical experiment

Group / Criterion	Experimental group (N_e = 25)				Control group (N_c = 25)			
Degrees of development	high	enough	mid	low	high	enough	mid	low
Number of students	3	14	7	1	2	6	12	5
The arithmetic mean of the estimates	$\mathbf{X_E}^*$ =3,76				X_c^* =3,20			
Performance ratio	**η=1,18**							

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Selective dispersion	S_e=0,50	S_c=0,72
Standard error of mean values	S_e=0,71	S_c=0,85
Confidence Interval X *	$3,48<X_e^*<4,04$	$2,87<X_c^*<3,53$
Student statistics	T=2,53	
Statistic Freedom Level	K=46	
Criterion Inference	H_1 Hypothesis accepted	

According to the performance indicators in the table, the results of the experimental group are 1.18 times higher than the results of the control group.

The general results obtained during the pedagogical experiment with students of higher educational institutions showed that the level of the natural science worldview of students in experimental groups is 1.19 times, or 19%, higher than the level of students in the control groups, and a statistical analysis of the results is shown in table. III.

Table 3. Analysis of the results of a pedagogical experiment on HEU

School year	HEU name	The average value of yjeexperimental groups	The average value of the control groups	Efficiencycoefficient
2014/15	AndSU	3,76	3,20	1,18
	NUU	3,82	3,19	1,20
	KarSU	3,85	3,23	1,19
	UrSU	3,84	3,32	1,16
2015/16	AndSU	3,82	3,23	1,18
	NUU	3,72	3,12	1,19
	KarSU	3,77	3,23	1,17
	UrSU	3,82	3,18	1,20
2016/17	AndSU	3,90	3,21	1,22
	NUU	3,75	3,05	1,23
	KarSU	3,85	3,25	1,18
	UrSU	4,00	3,30	1,21

The results of the study confirm the effectiveness of the experimental work to determine the levels of development of the natural science worldview of students in higher educational institutions.

VI. CONCLUSION

1. Justified in the didactic aspect, the need to create conditions for an innovative educational environment in the preparation of highly qualified, with a broad natural science worldview of personnel in one of the main parts of the continuing education system - at the stage of higher education. The conditions of the innovative educational environment are analyzed in comparison with the conditions of the traditional educational environment. On the example of the educational discipline "Evolutionary Learning", the existing shortcomings and errors in the educational process are established, recommendations are developed for improving this process.

2. The creation of an innovative educational environment at the stage of higher education involves the introduction of a competency-based approach into the educational process, the inclusion of key and private subject

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competencies in the educational content, thereby updating the didactic and methodological support for the development of the students' natural world outlook.

3. The philosophical, psychological, and pedagogical literature on the methodology of teaching biology on the research problem is analyzed, based on the principles of independence and worldview ideas, definitions of the concepts “worldview”, “natural-scientific worldview” and “innovative educational environment” are given. During the study, using individual and differential educational technologies, the methodological structure, stages, and methodological system for the development of the students' natural science worldview were improved.

4. In the development of the natural science worldview of students on the basis of the competency-based approach, optimization of vitagenic, reflective, facilitative, and in the educational process information and communication, local and private-subject innovative technologies are of particular importance.

5. Taking into account the inductive and deductive logical direction of the integration of academic disciplines in the educational process of the academic discipline “Evolutionary Doctrine,” the system has been improved, which involves the simultaneous (horizontal) and asynchronous (vertical) application of the laws of philosophy and natural disciplines, the development of the natural science worldview has been achieved students.

6. The preparatory, procedural, evaluative and corrective stages of the formation and development of the students' natural science worldview are defined:

• at the preparatory stage, innovations in science introduced into the content of education on topics, key and subject-specific competencies formed by students are clarified, the methodology for their formation in unity with knowledge, skills and abilities is improved, non-standard educational and test tasks are prepared that provide constant monitoring;

• at the procedural stage, topics included in the curriculum of the discipline "Evolutionary Learning" are divided into modules based on a block-modular training system and designed, implemented in the practice of developing classes on topics based on innovative technologies;

• for the purposeful organization of the assessment and correctional stages, non-standard training and test tasks of a reproductive, productive, partially search and creative nature, non-standard training tasks (Case Study, Cluster, Venn Diagram, problematic were formed in accordance with the international assessment program and logical tasks) are applied in practice. Non-standard test items are changed to adaptive test items through the My test program. Regular and objective assessment of the knowledge, skills and abilities acquired by students in the discipline, the possibility of self-control and self-esteem by students, the correction of gaps that have taken place have paved the way for satisfying their need for self-development and increasing their need for self-development.

7. Dependence (connection) in the substantive aspect of the biological disciplines taught in the bachelor's degree of higher educational institutions with the academic discipline “Evolutionary Doctrine” paves the way for the systematization, generalization of biological ideas, theories, laws, general biological and private concepts, and smart conclusions of students. The need for the development of the natural science worldview of students in the areas of the organism - the biological system, ecological systems, the evolution of the organic world is established.

8. The block-modular system of teaching the discipline "Evolutionary Learning" is substantively enriched on the basis of a competency-based approach, methods, means and forms of training are systematized. Electronic software, which includes standard and non-standard training and test tasks developed for the purpose of regular monitoring of various levels of complexity, made it possible to increase the effectiveness of biological education on the basis of the skills acquired by students, key and private-subject competences of the students' natural science worldview.

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