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Final module certification project as a means of improving the quality of bachelor's training at the universities

Certificación final de estudiantes universitarios a través de módulos como un medio para mejorar su calidad de formación

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Contents

ABSTRACT:

The article reveals an urgent problem of ensuring the quality of teacher training in higher educational institutions. The problem is caused by the existing discrepancy between the content, technologies, search for the ways to improve the professional training of the teacher in Russia and abroad, and modern requirements for the system of pedagogical evaluation of the bachelors' training results. It is established that the student project and its presentation make it possible to implement a new format for the final certification of students by module.

Keywords: educational module; educational product; educational results; project; project assessment criteria

RESUMEN:

El artículo revela un problema urgente para garantizar la calidad de la formación docente en las instituciones de educación superior. El problema es causado por la discrepancia existente entre el contenido, las tecnologías, la búsqueda de formas de mejorar la formación profesional del profesor en Rusia y en el extranjero, y los requisitos modernos para el sistema de evaluación pedagógica de los resultados de formación de los bachilleres. Se establece que el proyecto del alumno y su presentación permiten implementar un nuevo formato para la certificación final de los alumnos por módulo.

Palabras clave: módulo educativo; producto educativo; resultados educativos; proyecto; criterios de evaluación del proyecto

1. Introduction

The existing gap between the content, technologies and educational results of the main professional educational programs for future educators' training, developed on the basis of the current federal state educational standards for higher education (hereinafter referred to as FSES HE) in the field of study "Teacher Education", and the requirements for the competences of graduates, set by the teacher's occupational standard is one of the

prerequisites for the modernization of Russian teacher training education. Work on the modernization of content and educational technologies is carried out in all countries (Jandhyala and Tılak, 2005; Miroshnikova, 2015; Perevoschikova, 2016).

The problems of improving the organization of the educational process in higher education institutions, the introduction of new programs that combine educational disciplines in the interdisciplinary units (modules) become topical. The issues of organizing the project activities that stimulate students' self-realization and proactivity in discussing and solving research tasks, searching for new forms of students' final certification and requirements for a pedagogical evaluation of the professional teacher training results (Bogomolova, 2006; Egupova, 2012).

Thus, the existing discrepancy between the content, technologies and educational results, the search for the ways to improve the professional teacher training and the current requirements for the system of pedagogical evaluation of the results of bachelors' training make this research problem relevant.

The solution of the highlighted problem is multifaceted and multidimensional, affecting the organization of the educational process in the professional training of the future teacher.

The purpose of the study is to justify the need to involve students in the project activities in the process of mastering the training module, and to identify the conditions that allow adequately assess the achieved learning outcomes within the educational module, using a new form of final certification for the educational module in the form of project presentation. To achieve this purpose, it was necessary to solve the following tasks that determine the research logics and strategy:

• to describe the concept of the educational module, highlighting the principles of its design;

• to compare the requirements of the FSES HE for the formation of competences and the labor actions presented in the Teacher's Professional Standard; to formulate the educational results for the educational module and select educational disciplines that ensure the achievement of educational results for the educational module "Fundamentals of Scientific Knowledge";

• to consider approaches to the definition of the term "educational product" and describe this concept as a set of educational results;

• to identify the specifics of the organization of the students' project activities in the process of mastering the educational module and determine the structural components of these activities in the form of project actions;

• to describe the project evaluation system, develop criteria and indicators for project evaluation based on the rating scale for assessing the students' training quality.

1.1. Literature review

The introduction of a teacher's professional standard inevitably entails changing the main components of the educational process in teacher training: goals, content, methods, technologies, forms of learning and control. The formation of professional qualities, including the key ability to learn, which the teachers should be able to demonstrate to their students, is the main guideline in the future teachers' training. For effective performance of labor functions, the future teacher needs to master the systems of fundamental concepts of philosophy, natural and mathematical sciences, the main stages of cognition of the world and research work, be ready to form an educational motivation and achieve meta-problematic learning outcomes, be able to disclose the formation of a natural scientific worldview to the students. In this sense, the module "Fundamentals of Scientific Knowledge" absorbs the entire range of target settings when teaching students at high school.

The analysis of various approaches to the definition of the concept "module" showed that from the point of view of professional training the closest to solving the above problem is the definition of the module given by V.V. Karpov and M.N. Katkhanov (1992: 113).

Relying on this approach, from the standpoint of professionally oriented teacher training the

educational module will be understood as the organizational and methodological interdisciplinary structure of the presentation of educational information built in accordance with the structure of scientific knowledge and the logic of the learner's cognitive activity united by the single task of forming a certain range of competences in accordance with the requirements of FSES HE and Teacher's Professional Standard.

The inclusion of the "Fundamentals of Scientific Knowledge" module in the teacher training program leads to the changes that are primarily related to the orientation of the educational process toward the new educational results formulated on the basis of the synthesis of competencies identified by the FSES HE in the field of study "Teacher Education" (2016), and labor actions determined by the Teacher's Professional Standard (2013)., According to M.V. Egupova (2012), the use project activities in the process of learning will allow revealing the subtleties of the technology to solve specific and common problems, from posing the problem to presenting the final result, for the students.

Some modern authors (Baranenko, 2014; Romanova, 2013; Allan et al.; 2009, Raus and Falkenberg, 2014; Ilisko et al., 2010 and others) consider that project is a method that implies the application of the organization of collaborative learning, and the combination of such methods as exploratory, research, and practical methods in teaching. That is, in their opinion, this method of teaching is universal; it can and should be combined with various forms of teaching and systems of educational process organization. However, in our opinion, the project should be viewed as a result of educational activity, as an educational product in the study of a module.

The analysis of the literature has shown that by now there has not been a single approach to the definition of the term "educational product". Sh.Z. Valiev (2010: 5) suggests understanding the educational product as the knowledge itself, treating it as a specific commodity, for which there is demand in the market. In the works of M.V. Egupova (2012) and V.I. Zagvyazinsky (2008), the educational product is considered as a certain result of the educational activity of the student or the result of scientific and pedagogical work. A.V. Khutorskoy (2016) treats the educational product, on the one hand, as a product of cognition received by the learner in the form of judgments, texts, etc., and, on the other hand, as changes in the personal qualities of the student developing in the learning process.

From the standpoint of the activity- and competence-based approaches, the interpretation of the educational product given by A. Khutorskoy allows considering the educational product as a set of educational results achieved by each student in the process of mastering the module presented in the form of a project. In this sense, the project activity of students aimed at creating an educational product is the leading activity in the process of mastering the module, and it is carried out through the interaction of students in small groups preparing a single project and having distributed tasks. The **project** becomes a **mechanism** for implementing it in the **educational product**, since its creation serves as a basis for achieving the educational results.

Thus, the analysis of the state of the university's practice of involving students in the project activity enables to conclude that the modern higher school does not fully unlock the pedagogical potential of creating the project as an educational product, as a personally oriented learning technology.

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2. Methodology

The study was carried out at the Minin Nizhny Novgorod State Pedagogical University. The study covered 315 students and 72 faculty members of the Faculty of Natural, Mathematical and Computer Sciences of the University.

Theoretical and experimental work was carried out in several stages.

At the *first* exploratory and cognitive *stage* (2016-2017), a targeted analysis of literary sources was carried out, the initial research positions were developed, and the authors' own experience in applying project technologies in the work of university teachers was generalized.

At the *second stage* (2017-2018), the scientific and pedagogical foundations for the

application of new project technologies in the faculty's educational process were clarified, the ways of improving the educational process were determined while teaching the university students within the module "Fundamentals of Scientific Knowledge".

When assessing and generalizing the results of practical research, the methods of theoretical analysis were applied: questionnaire surveying, interviewing, evaluation-prognostic techniques for the purpose of analyzing students' values; experimental methods; diagnostic methods (testing, generalization of independent characteristics); methods of statistical data processing.

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3. Results

The "Fundamentals of Scientific Knowledge" module is an inherent part of the basic professional educational program in the field of study 44.03.05 "Teacher Education (with two educational program specializations)".

Systemic, activity-based, personality-oriented and competence-based approaches are chosen as an important methodological basis for designing the "Fundamentals of Scientific Knowledge" module (Barrie et al., 2005; Dick, 2013; Mclean, 2018). Reliance on the activity-based approach makes it possible to ensure the involvement of students in activities that simulate working conditions in the field of natural and mathematical sciences, assuming the development of philosophical knowledge. To create conditions for the formation of quasi-professional activity in future teachers it is necessary to use project, teaching, academic research and scientific research activities in the process of studying all the disciplines of the module, as well as the practical work of students in the departments and laboratories of the university that have the necessary human, scientific and technical potential.

From the standpoint of the systemic approach, the following principles are the leading ones in building a module: fundamentality, integrity, comprehensiveness, integration, freedom of choice of the variable part of the module disciplines. The integrity principle provides such a degree of interaction of all components of the module with each other, when a change in one component leads to a change in its other components and throughout the module as a whole. In our case, this principle allows treating the educational module as a system and identifying its key components: professional tasks, types of professional activity and axiological meanings of the learned scientific knowledge systems, educational disciplines and events, educational results, educational environment, forms, technologies, methods of teaching and control. The comprehensiveness principle ensures the implementation of the natural-science and humanitarian approaches in teacher training. The principle of integration of scientific research and academic research activities forms the basis for designing various practice-oriented tasks in the academic disciplines of the module, which enables not only to create conditions for mastering the stages and methods of scientific research, but also to prepare students for conducting researches during different types of practices, provided for in other modules of the educational program.

The organization of interdisciplinary interaction is an important condition for the involvement of students in academic and scientific research activities in the different disciplines of the module and prepares them to create their own educational product.

The analysis of FSES HE (2016), Teacher's Professional Standard (2013), and universal competencies presented in the new drafts of educational programs has made it possible to identify the educational results of the "Fundamentals of Scientific Knowledge" module and the set of academic disciplines that ensure the achievement of these results. Comparison of educational results, competencies and labor actions is given in Table 1.

Table 1
Comparison of competencies, labor actions and educational results

FSES HE competencies// Universal competencies	Labor actions	Educational results
OK-1: the ability to use the	V/03.6. TD.1. Formation of general cultural	OR.1. Students

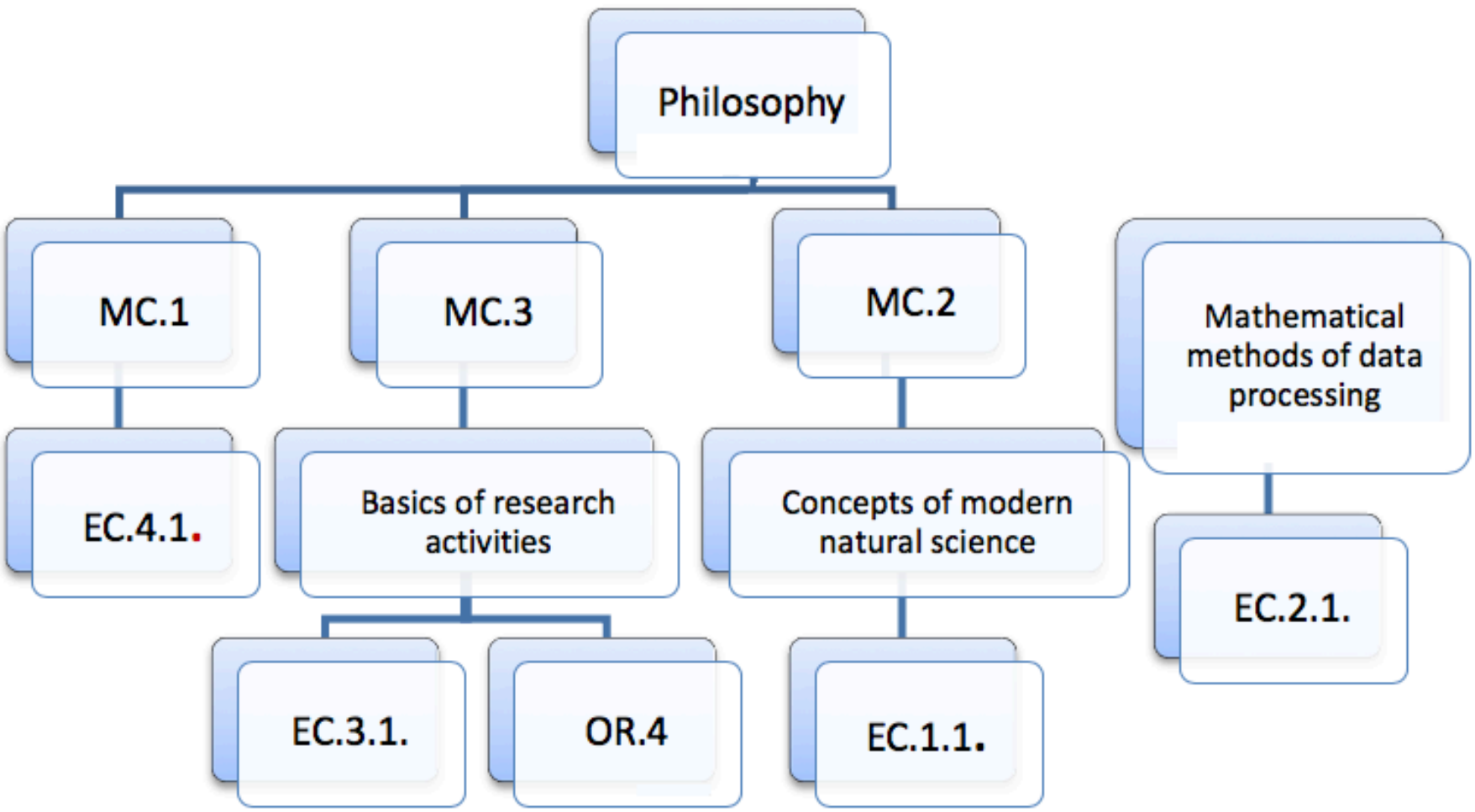
basics of philosophical and socio-humanitarian knowledge for the formation of a scientific worldview // Systemic and critical thinking	competencies and understanding of the place of the subject in the overall worldview. The required abilities: to possess the methods of persuasion, argumentation of one's position	demonstrate the abilities to search for, critically analyze information, relying on a systemic approach based on a scientific worldview for solving the formulated tasks
OK-3: the ability to use natural-science and mathematical knowledge for the orientation in the modern information space // Development and implementation of projects	A.1.TD.8 Formation of skills related to information and communication technologies (hereinafter - ICT). Professional-pedagogical component of ICT: setting and conducting experiments in virtual laboratories of their subject; processing of numeric data using computer statistics and visualization tools; formation and development of educational motivation and the system of universal learning actions A/03.6. 10. Formation and implementation of programs for the development of universal learning actions, patterns and values of social behavior, behavioral skills in the virtual reality world and social networks, formation of tolerance and positive patterns of multicultural communication	OR.2. Students demonstrate the abilities to use natural-science knowledge, mathematical models and methods for orientation in the modern information space and data processing
OK-6: the ability to implement self-organization and self-education // Self-organization and self-development	A/02.6.TD.3. Setting educational goals that promote the development of students, irrespective of their abilities and character A/02.6.TD.5. Designing and implementing educational programs.	OR.3. Students demonstrate the abilities to plan and implement their educational trajectory, to carry out self-development on the basis of the principles of life-long education.
PK-11: readiness to use systematized theoretical and practical knowledge for setting and solving research problems in the field of education // Participation in social interaction and fulfillment of their role in the team	A/02.6 TD.10. Development of students' cognitive activity, independence, initiative, and creative abilities. V/03.6. The required abilities: to organize the independent activity of students, including research; to find the value aspect of educational knowledge and information and to provide its understanding and experience by the students.	OR.4. Students demonstrate the abilities to solve academic research and scientific research tasks in the field of education

The last column of Table 1 presents the educational results of the module, which are subject to evaluation at the stage of final module certification. The analysis of the main components of the table made it possible to determine the totality of the educational disciplines of the module so that the achievement of educational results, and hence the formation of competencies, was ensured by knowledge capture in at least a couple of disciplines. Figure 1 shows the relationship between educational outcomes and academic disciplines.

The reliance on the requirements for the structure and content of the module, presented in the work of the researchers of the Moscow City Teacher Training University (Vesmanov et al., 2015: 8), enabled to determine the following approaches to the construction of the "Fundamentals of Scientific Knowledge" educational module. Firstly, the module content

should be aimed at the formation of a group of competencies, correlated with the types of professional activity, competencies and labor actions (Table 1). Secondly, provision should be made in the module for the disciplines that ensure the formation of the identified competences (Figure 1), which are mandatory for study by all students. The following disciplines are assigned to the mandatory part (MC): Philosophy, Concepts of Modern Natural Science, Mathematical Methods of Data Processing, Fundamentals of Scientific Research. Thirdly, the module provides for Elective courses (EC), which, on the one hand, take into account the training profile of students, and on the other, supplement the content of the basic courses. Thus, the purpose of the "Fundamentals of Scientific Knowledge" module is to create conditions for students to master a comprehensive integrated system of knowledge in the field of Philosophy, Natural and Mathematical Sciences, to acquire the experience of academic research, scientific research and project activities and the formation of professional and pedagogical competencies in the "Teacher Education" field of study, ensuring the competitiveness and academic mobility of university students of the pedagogical profile. To accomplish this purpose, it is necessary to involve all students in the project activities to achieve educational results, the evaluation of the effectiveness of which is possible at the stage of final certification in the form of a project presentation, which is an educational product created by students.

Figure 1
Orientation of disciplines to achieve the educational results of the module



This approach makes it possible to evaluate the effectiveness of the module mastering by the students on the basis of the educational product evaluation, reflecting the level of competence formedness in the process of studying the module.

Themes of the projects on the "Fundamentals of Scientific Knowledge" module are chosen so that the essential, including the quantitative characteristics of the studied object could be described in the form of information (mathematical) models through block diagrams, drawings, formulas, etc. Thus, in the field of physics, information models describe the motion of bodies, in biology – the development of organisms and animal populations, in chemistry – the processes of origin of chemical reactions, etc. (Verzhbitsky, 2002; Aydin, 2016; Jonane, 2015; Makrakis and Kostoulas-Makrakis, 2012; Pipere et al., 2015; Sund and Lysgaard, 2013; Vartiainen and Enkenberg, 2013; Wu and Jessop, 2018; Zenawi et al., 2012).

Table 2
Themes of project assignments

	Project assignment theme	Informational model
1	Describe what will happen to the carp population consisting of 1000 pieces in 20 years, if it is experimentally established that for this type of fish (carp) and under these conditions (good condition of the reservoir, availability of food), the rate of natural increase is 1, the mortality rate is 0.001.	According to the Malthusian Law, the change in the number of fish in one year is calculated by formula: ΔN = k·N1 – q·N2, where ΔN – natural increase, change in number, N1– number of carps at the beginning of the year, N2 – number of carps at the end of the year, k – the rate of natural increase, q – the mortality rate.
2	Ascertain whether it is possible to recognize (and if possible, how) chemical fertilizers in appearance.	Block diagram of the interaction of fertilizers with solutions: 1. Sulfuric acid. 2. Alkalis. 3. Chlorine salts.
3	Describe the way to determine the physical (emotional) state of a person in 10 years. Determine your physical condition after 10 years.	The program for the reflection of human biorhythms for a given time interval Physical cycle: $R_f = \sin\left(\frac{2\pi(t-t_0)}{23}\right)$ Emotional cycle: $R_E = \sin\left(\frac{2\pi(t-t_0)}{28}\right)$
4	Describe the method of determining the most favorable day for passing the exam in mathematics.	The program for the reflection of human biorhythms for a given time interval. Intellectual cycle: $R_i = \sin\left(\frac{2\pi(t-t_0)}{23}\right)$

The system for evaluating the project work is developed in accordance with the purposes, tasks and educational results of the module (Ivashchenko, 2012; Yakovleva, 2014; Soobik, 2014; Wu and Jessop, 2018; Perevoshchikova et al., 2016; Perevoschikova, 2016). This means that the project evaluation in the process of examination and defense should be based on the analysis of the degree of achievement of educational results by the following criteria: "Possession of the methodological apparatus for the project activity" and" Quality of the project work content". Considering that the information and communication competencies should be formed in future bachelors in the Teacher Education field of study constantly in the process of mastering all the modules of the educational program, it is necessary to add the appropriate criteria of the project evaluation to the enumerated ones: "The project presentation quality" and "Reflective-communicative competencies". The latter two criteria serve to evaluate the formation of competencies at the project presentation stage (Table 3). The indicators of achieving educational results and a corresponding five-point grading scale were identified for each criterion to assess the manifestation of the indicator, with 5 points meaning that the educational result is achieved at the optimal level; 4 points are given if the achieved educational result is at an acceptable level, 3 points correspond to the critical level of the achieved educational result. The "Scoring in points" column in Table 3 shows the minimum and maximum points for each indicator.

Table 3
Project assessment criteria for the "Fundamentals of Scientific Knowledge" module

Project assessment criteria	Scoring in points

1. Possessing the methodological apparatus for project activity, 11 – 20	
presentation of the methodological research apparatus	3 – 5
presentation of the formulated problem essence	3 – 5
correct formulation of the project goals and objectives	3 – 5
substantiation of the main provisions of the	2 – 5
2. Quality of the project paper content, 22 – 40	
critical analysis of information, presentation of the analysis of relevant educational and scientific literature	3 – 5
use of mathematical models and methods	3 – 5
data processing	3 – 5
research design logic	3 – 5
degree of solution of the research tasks	3 – 5
substantiation of the theoretical and (or) practical significance of the research results	3 – 5
formulation of conclusions	2 – 5
presentation of conceptual and terminological research apparatus	2 – 5
3.Quality of the project presentation (presentations, handouts, photo-video-reporting), 11 – 20	
the compliance of the presentation content with the project theme and content;	3 – 5
possession of methods of persuasion, argumentation of one's position;	3 – 5
laconism and maximum informative value of the text on the screen	3 – 5
creative approach to the presentation creation.	2 – 5
4. Reflective-communicative competencies (in the process of defense), 11 - 20	
clear, consistent and logical presentation of the project	3 – 5
the ability to communicate and comment in the course of answering questions	3 – 5
self-assessment	3 – 5
demonstration of one's personal position and own attitude to the project activity	2 – 5
Final score for the project	**55 – 100**

As can be seen from Table 3, the total score for the project ranges from 55 to 100 points and corresponds to the minimum and maximum scores of the rating scale of the evaluation adopted at the university. An important principle in the evaluation of the student project is the principle of the evaluation procedure transparency, the essence of which is that students become acquainted with the criteria and evaluation indicators before starting to work on the project task (project)

3.1. Discussion

Let us reveal the specifics of students' project activity organization in the process of mastering the module, the principles of designing project tasks in the context of the academic subjects of the module and formulate the criteria for evaluating the educational product created by the learners.

The main goal of involving students into project activities is to create the conditions under which students:

- independently and willingly acquire missing knowledge from different sources;

- learn to use the acquired knowledge to solve cognitive and practical tasks;

- acquire communication skills by working in different groups;

- develop their own research skills (the ability to identify problems, collect information, observe, conduct an experiment, analyze data, formulate hypotheses, and generalize);

- develop systemic thinking.

At the same time, the main task of the learners involved in the project activity is not so much to acquire knowledge, capacities and skills in the process of mastering the module, but rather to use, develop and enrich their own experience and ideas about the world. Thus, each student should be able to carry out real activities in which they can not only show their individuality, but also enrich it.

The internal structure of the project activity and the appropriate project assignments assumes the availability of the following components: the theme of the research, the relevance of the topic, the object and the subject of the research, the purpose of the project, the tasks, the hypotheses, and the methods used.

Let us briefly describe the key components of the project activity, highlighting the specifics of the organization of the students' project activity in the process of mastering the module.

The analysis of the content lines of the academic disciplines "Philosophy" and "Mathematical methods of data processing", which were included in the "Fundamentals of Scientific Knowledge" module, showed that they are intended to form the ability to search for, critically analyze information for solving problems in the field of philosophy and use mathematical models and methods for data processing. The "Concept of Modern Natural Science" discipline reveals global issues: how the world around us is arranged, what fundamental laws the nature obeys, what life, the mind, man and his place in the Universe are. It presents a holistic description of nature and man (as part of nature) on the basis of scientific achievements, changing methodologies, concepts and paradigms in a general cultural, historical context. The mastering of this discipline ensures broadening of the outlook, forms the scientific interests of students in the field of natural sciences. The analysis of the working program of the "Fundamentals of Research Activities" discipline showed that the research skills formed while studying it can serve as a practical basis for organizing the students' project activity. The above educational results of the module mastering show that the content lines of the "Concepts of Modern Natural Science" discipline can be chosen as the subject area for formulating the themes of the project assignments. Examples of the topics are given in Table 2.

The identification of the research object and the subject in the research problem, the formulation of the goals and objectives of the project, the hypotheses, the methods used is the sequence of design actions that result in getting a practical result by students – the modulus project. In this sense, the formation of a sequence of such actions can serve as a

basis for designing an individual educational route for the student in the work on the project assignment, and then, possibly, on the project.

The analysis of various sources devoted to the problem of the formation of project activities and own experience in organizing such activities within the framework of the educational module made it possible to identify a set of project actions. Mastering of such actions in the process of fulfilling the project tasks serves as a necessary condition for the formation of the project skills that create the basis of the project activity in the students.

The identified set of project actions includes:

1. Understanding the theme of the project task and search for an answer to the questions about the object and sequence of carrying out the research.

2. Identifying the quantitative characteristics of the simulated system that are essential for the problem being solved.

3. Obtaining the mathematics (formulas, equations, systems of equations) linking these characteristics.

4. Determining the method of solving the mathematical problem obtained and implementing it.

5. Solving the formulated problem by carrying out a computational experiment.

As a result of the computational experiment, it is possible to obtain a forecast of the behavior of the system under study; to clarify the question of how the change in some characteristics of the system will affect others.

Practical implementation of the students' project activity in the process of mastering the "Fundamentals of Scientific Knowledge" module enabled to identify the following principles for designing project routes.

1. The *decomposition of the research problem* consists in identifying simple learning tasks as intermediate project solutions. The presentation of a complex problem in the form of simpler project assignments will allow organizing parallel-sequential execution of project procedures by the researcher.

2. *Multistaging* and *iteration* are expressed in the processes of planning and implementing a sequence of actions, in which approaching to the final results is achieved by repeated execution of one and the same procedure with the adjustment of the original data.

3. *Typification and unification of project solutions* are expressed in the reduction of the initial research problem to the project task, to the minimization of the properties of the research object.

Designing the project implementation route by the student affects the form of the educational product presentation. Thus, for example, the project task on the topic "Set whether it is possible to recognize (and if possible, how) chemical fertilizers in appearance" can be accomplished with the defense of an ordinary reference paper, or it can grow into a group project "Atlas for the identification of chemical fertilizers". For example, the project task "Identify natural conditions and means of maintaining the ecological situation of metropolitan cities" can be presented in the form of the project "Environmental program for monitoring and laboratory analysis of drinking water, radiation background and air environment in the municipal district (micro-district)."

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4. Conclusions

Thus, a project as an educational product allows combining various activities of students, making the learning process more fascinating, more challenging and therefore more effective. The discussed approaches to the design of the educational module and the description of the educational results in the form of an educational product enable to consider the project created by the students in the course of mastering the module as a new format for the final certification, on the one hand. On the other hand, the perception of the project as an educational product allows adequately assessing the results achieved in the process of mastering the module. The presented research results enrich the theory and

practice of developing an educational module and the principles of its design, providing a criterial assessment of the results achieved and clarify the features of the students' project activity organization while mastering the module. The ways of developing and evaluating the project on the "Fundamentals of Scientific Knowledge" module proposed in the article are tested in the practice of working with first-year students majoring in "Teacher Education" and can be successfully used in the design of new educational modules in the framework of the module educational program.

The introduction of the project as a form of final certification of learners enables to involve in the process of simulation in scientific cognition. The experience of studying the "Fundamentals of Scientific Knowledge" module by the first year students showed that the fulfillment of project assignments and then the final project significantly changes the learners' attitude to the academic subject, to the learning, makes the learning activity more meaningful and more productive, thereby increasing their desire to learn.

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