Approaches to evaluating the development results of a competence-based educational program

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Abstract. The article is devoted to the actual problem of assessing the results of a student's mastery of a competence-oriented educational program, which still does not have a generally accepted solution. A comprehensive interdisciplinary study of interrelated and interdependent processes is proposed: the process of implementation by an educational institution and the process of mastering a competence-based educational program by a student in an electronic information-educational environment of the university. To formalize the goal of the educational program, a new concept – the competence-based image of a future graduate (student) of an institution of higher education – is introduced and discussed. The essence of a competent image is a vector of competencies formed in the process of implementation and mastering of an educational program by a student. A new approach makes it possible to consider in unity three essential aspects of a scientific problem: (1) predicting a goal – a future result of mastering a competence-based educational program; (2) forming competences in accordance with the desired goal; (3) analysis, visual interpretation of results, and assessment of the degree of achievement of the desired goal on the competence-based educational program. The possibility of forming a new research area – neural network recognition of competence-based images of students (graduates) and neural network analysis of the results of education in the space of competencies – is discussed. The perspective of the development of already existing scientific directions in the field of education is shown: foresight forecasting of the future for building a targeted competence-based image of a future graduate; measurement of the levels of manifestation of latent variables on the example of measuring the levels of competence formation. The results of the research carried out by the authors allow to complement the creation of scientific and theoretical foundations and expand the scientific basis of the methodology in the field of social competence-oriented educational systems, can be a contribution to modern didactics, in particular, to the theory of the organization of the educational process.

Keywords: competence-based educational program, approach, paradigm, educational standard, concept

1. Introduction

In accordance with the competence paradigm of education adopted in the Russian Federation, federal state educational standards in the system of higher education provide for the mandatory inclusion of the formed competencies in the set of basic results of the development of the educational program. However, it should be noted that, at present, there is no universal approach and generally accepted methods for forecasting, forming, measuring, monitoring, analyzing and visual interpreting the levels of level of the

claimed competences in the process of implementation by an educational institution and students mastering the educational program.

The relevance of the subject under discussion is due to the need for a theoretical and experimental study of the implementation process of the competence-based educational program in order to develop the theoretical and methodological basis for evaluating the results of its development. This contributes to the resolution of the contradiction between the requirements of modern state educational standards [1] and the state of the scientific-theoretical and methodological bases of the concept and implementation of the competence-oriented educational program. The creation of a scientific-theoretical apparatus, the development of principles and methodology for assessing the results of mastering an educational program in the space of competences is essential for modern Russian education.

The change in the education paradigm entailed a change in the goal setting of the educational program implementation process, which requires scientific understanding of the methods of formalizing and predicting the education goal, building a competence formation model in accordance with the predicted goal, choosing the criterion of goal achievement, and visual interpretation of the results of the competence educational program. The solution of these issues will allow a comparative analysis of the results of mastering a separate educational program implemented by various educational institutions, to assess the quality of training students and graduates, and thus carry out the ranking of universities for this educational program.

The latest version of educational standards indicates the continuation of work to improve and further develop the competence approach at all levels of higher education and the need for further scientific support for the course being implemented. Scientists have an urgent task: the creation of a scientific-theoretical apparatus, the development of a theoretical and methodological basis for evaluating the results of mastering an educational program in the space of competences, without which it would hardly be necessary to regard the evaluation of the results and quality of education as adequate to the implemented paradigm.

The confirmation is an analysis of the content of approved educational standards [1]. We can point out the following innovations, trends and controversies:

- In section V *Requirements for the Results of the Program* ... the requirement is formulated: all competencies that the educational program is focused on are included in the set of required results for the program;
- When developing an educational program, an educational organization independently establishes requirements for the results of training in individual disciplines (modules), practitioners, taking into account the requirements of the corresponding exemplary basic educational programs;
- There is no section on requirements for assessing the quality of mastering basic educational programs in terms of the formation of graduate's declared competencies;
- Reduction in the total number of competencies of the future graduate occurred (compared with the previous version);
- There is a tendency towards greater unification of the goal of the educational program in terms of general cultural, general professional, as well as professional, but common to a specific field of study, competencies;
- In section VII *Requirements for The Conditions of the Program Implementation* ... the requirement is formulated: the organization's electronic information and educational environment should, among other requirements, provide: the recording of the progress of the educational process, the results of interim attestation and the results of the educational program, the procedures for assessing learning outcomes, the formation of the student's electronic portfolio.

It should be noted that not only the state that conducts education reform, which forms the state order and expectations for graduate training for specific types and tasks of professional activity, is interested in a knowledge-based information society and in successfully resolving topical issues of education [2]. The expectations of the academic and professional communities, representatives of employers [3], business circles are also associated primarily with the high results of the development of educational

programs. They should be clearly evaluated and clearly interpreted, including in the graduate's document on education received. Currently, there are new conditions and new requirements for the preparation of a future graduate. However, in the final document on education, the old assessments of the results of mastering the educational program (the level of developed knowledge in certain subjects and types of educational activities) are still used in the Russian Federation. This gives rise to another contradiction between the implemented competence-based concept of training and the display of the results of mastering the educational program. The problem of assessing the results of education is also of a humanitarian nature. The request for a high level of development of educational programs is relevant for the social expectations of society, since the standard of living and well-being of society depends on the level of education and vocational training of graduates. It is also natural that the student's personal expectations are focused on achieving their own high educational results. The opportunity in the process of learning to visually assess the personal results of the development of the educational program - the level of development of the mastered competencies should be the motivation for this.

2. Problem Statement

The scientific problem focuses on evaluating the results of the development of a competence-oriented educational program. This publication is aimed at understanding and solving this problem. Assessment of the degree of achievement of the objective of functioning of the object of study for any systems, including social, which include educational systems, is associated with comprehensive studies of the essence and interrelationships of the object, determines the essence and focus of the educational process being implemented and refers to basic research. Evaluation of the results and quality of education should be based on a consistent assessment of the results of the development of individual educational programs.

The reform of the Russian education system, the transition to the competence-based model of graduate training and a new, verbally formulated, goal-setting process for the implementation of the educational program actualizes the problem, which implies the formation of a given set of competencies of the future graduate. This has intensified a new theoretical and practical research, as well as searching for innovative methods and technologies for the formation of competences.

In the previous version of the federal state educational standards, the section *Assessment of the Quality of Mastering Basic Educational Programs* was present. This section prescribed to educational institutions the creation of funds for assessment tools, allowing to assess the level of acquired competencies. This approach allows each institution of higher education to have its own bank of evaluation tools for measuring the level of manifestation of the same indicators of the main result of the educational program. Such variability in assessing the results of mastering an educational program does not allow for an objective comparative analysis of the results achieved in various educational institutions.

As already noted, an analysis of the content of the latest version of educational standards [1] shows that their new edition has continuity and is aimed at further developing the idea of a competency-based approach. Nevertheless, the adopted educational standards still require updating the goal of educational programs of all levels of education in terms of the formation of competences. Continuing research aimed at finding and developing effective methods of formalizing and building a goal, interpreting and evaluating the degree of achievement of the results of mastering an educational program is necessary. The unsolved problem of evaluating the results of the development of a competence-based educational program in the new conditions of functioning of an electronic information-educational environment of an educational organization remains open and requires further scientific theoretical and experimental research [4-6].

It should be noted that the problem under discussion does not have a universally recognized solution, and traditional pedagogical technologies, tools, and methods do not allow us to obtain comprehensive system answers to emerging questions under new conditions. To study and solve the fundamental problem of evaluating the results of mastering a competence-based educational program, the authors propose a comprehensive and interdisciplinary approach based on the formalization of the goal of the

educational program in the form of a concept of "a competent image of a future graduate." The essence of a competent image is a vector of competencies formed in the process of implementation and mastering of an educational program by a student.

Laconic formulation of the main aspects of the problem under study: forecasting, formation, analysis of the competence-based image of a future graduate. In more detail, these essential aspects involve the deployment of the problem into separate sections and topics for additional research:

- Forecasting and building a target competency image of the future graduate;
- Building a roadmap of the formation of the actual competence of the student (graduate);
- Building a mathematical model of the formation of the actual image of the student (graduate) in accordance with the target and in its relationship with the road map;
- Implementing a model of formation of the actual image of the student (graduate) in the electronic information and educational environment of the educational organization;
- Measuring the levels of competence in the process of implementing the educational program;
- Developing an algorithm for monitoring and dynamic formation of an actual competence-based image of a student (graduate) in an electronic information and educational environment of an educational organization;
- Analyzing and interpreting the results of the development of an educational program in the area of competence; clustering of statistical data, the extraction of new knowledge, classification and pattern recognition;
- Selecting criteria for assessing the degree of achievement of the target competency image of the graduate;
- Comparing the results of mastering the main professional educational program of higher education in the space of competencies implemented in various educational institutions.

In accordance with the formulation of the problem, the working hypothesis is advanced: formalization of the main result of mastering an educational program in the form of a competence-based image of a student (graduate) will allow, in the conditions of the electronic information and educational environment of an educational organization, to implement a model of formation and monitoring of the level of formation of competences, analyzing a variety of competence-based images, visually interpreting the level of achievement of the targeted predicted image of a graduate, and ultimately developing a scientifically based methodology for assessing the results of mastering the basic professional educational program of higher education in the competence space.

3. Research Questions

3.1. The essence and novelty of the approach in assessing the objectives of the educational program based on the competence image of the student

A specific research task within the framework of the designated problem: a comprehensive study of the characteristics and identification of new knowledge in the areas of forecasting, building, analyzing the competence image of the future graduate, and evaluating the results of mastering the basic professional educational program of higher education in the competence space.

The research object is two interrelated processes: the process of implementation by the educational institution of a competence program and, parallel with it, the process of students mastering this educational program in the conditions of the electronic information environment of the university. The essence of the implementation process is to create in the educational institution the necessary conditions and educational environment for achieving the goal of the educational program. The essence of the mastering process is the maximum possible approach of the future graduate to the stated goal. These two processes are interconnected, interdependent, and aimed at achieving the overall goal of a competence-based educational program. The subject of research is the methods of formalizing the goal and evaluating the results of the development of a competence-based educational program.

The fundamental nature of the study, along with the collection of a significant amount of statistical data, provided for the identification and scientific understanding of new knowledge, relationships, and patterns.

The conducted scientific research contains a new look at the interpretation, formation, and analysis of the results on the development of the competence educational program consisting in presenting the results of education in the form of a holistic mathematical object in the competence space – a competence image of a student (graduate), whose components are the levels of competence formation.

With such a formalization of the goal of a competence-oriented educational program, a new scientific and methodological approach is proposed for the first time. It is based on the use of the following: (1) foresight forecasting methods for building a future competence-based image of a future graduate; (2) a neural network analysis methods of education results; and (3) pattern recognition techniques for assessing the degree of achievement of the educational program's goal, methods of latent variable theory for measuring competency levels. The concept of a competence-based image allows to reflect and implement in the electronic information and educational environment of an educational institution a new relationship and unity between the target and the actual graduate competence images of the future graduate in the competence formation model, and also it offers a criterion for assessing the degree of achievement of the educational program goal.

The novelty of the approach lies in the departure from the dominant traditional basis in the national pedagogical science, which implies the study, as a rule, of only one, albeit a very significant area - the study of models and mechanisms for the formation of competences, assessing the level of their development in a graduate. The proposed approach makes it possible to consider in unity three essential aspects of a scientific problem: (1) forecasting goals implies the future result of the development of the educational program; (2) developing competences in accordance with the stated purpose; (3) analysis, visual interpretation of the results and assessment of the degree of achievement of the desired goal of a competence-based educational program.

3.2. Analysis of the current state of research in this area

Reforms in the Russian higher education has stimulated the emergence of a cycle of systemically important methodological developments of the creative team of authors. These methodological developments have become a good guideline and tool for the design of a holistic competence-oriented educational program, the development of passports of formed competencies and a number of other program documents of an integrative and cross-cutting nature within the educational program.

Foreign experience of higher education in the presentation of learning outcomes in the design of educational programs focused on the competence concept is presented and analyzed in the series of applications "The Bologna Process: Learning Outcomes and Competence Approach" under the scientific editorship of Professor V. I. Baidenko.

According to orders of the Ministry of Education and Science of the Russian Federation, from 2004 to 2009 within the framework of the Federal Target Program for the Development of Education in Russia, the analytical departmental program *Development of the Higher School Scientific Potential*, the priority national project *Education* in 2006-2008, a number of exploratory studies were carried out in the implementation of the competence approach in creating a new generation of state educational standards and basic educational programs in higher education. The main research was carried out by the academic community of the higher school under the leadership of the *Research Center for Problems of the Quality of Specialist Training* and *the Coordinating Council of Educational and Methodological Associations and Scientific and Methodological Councils of the Higher School*. In the development of a new education paradigm based on the competence-based approach, the leading role belongs to the creative teams of leading universities of the country and scientific institutions, headed by the coordinator of the group of authors and scientific editor of publications N. A. Selezneva.

A specialized methodological support for solving the main analytical and design tasks of the competence-oriented educational program is being developed in the following works: "Identification of the current composition of competencies and the formation of competence models of preparedness of

university graduates as the cumulative expected result of education: Educational module" by V. I. Baydenko, N. A. Grishanova; "Designing and justifying current social competencies in the composition of the basic educational programs of the new generation of higher professional education" by I. A. Zimnyaya, etc.

The task of focusing the educational process on the final result through the transition from the qualification to the competence-based model of graduate training continues to stimulate the development of research aimed at scientific understanding and development of models and mechanisms for the formation of competencies, assessing the level of their development in graduates.

The study of one of the aspects of the scientific problem under discussion, namely the features, mechanisms and methods of forming competencies, occupies a significant place in the national pedagogical science, it is constantly updated and expanded. As the last examples of the publication one can cite: E.G. Kostenko "Competence-based model of training specialists in high school: resources of students' teaching and research activities"; N. A. Alekseev, N. B. Kutergin, A. N. Kulinichev "Competently-oriented approach to the professional training of a specialist in the educational space of the university"; E.V. Balganova "Principles of building a competence model of a university graduate - a specialist in the field of personnel management"; A. V. Selezneva, L. D. Sirotenko, V. A. Ivanov "Development of the structure of the competency model of a graduate of higher education". Against the background of scientific publications, the following monograph stands out for its fundamental nature: A. E. Fedorov, S. E. Metelev, A. A. Soloviev, E. V. Shlyakova "Competence approach in the educational process".

The study of competence as a latent variable opens up new opportunities for building on the basis of the Rasch probabilistic model test and measurement tools for measuring the levels of competence formation on a linear scale [7-13]. The results of such studies are known [14-16] for socio-economic systems, including the sphere of Russian education. Research based on the theory of measuring latent variables in education has also received support for grants: No. 68427622 "Measurement of latent variables in the field of education" (Fulbright Program, 2003-2004), headed by Prof. Maslak A. A.; No. 05-06-80110 "Development of a measurement procedure on the interval scale of latent variables in socio-economic systems" (RFBR, 2005-2007), headed by Prof. Anisimova T. S., etc. The results obtained and the tools approved for education will be very useful in solving the problems of assessing the results of the development of a competence-based educational program.

It should be noted that much less attention is paid to two other aspects of the scientific problem, such as forecasting and analyzing the results of mastering the main professional educational program of higher education in the space of competencies by the scientific community. A omprehensive study of the problem in terms of the requirements of new educational standards and the availability of electronic information and educational environment of the university is missing.

The idea of using the term "image of a graduate" is met by V. P. Litvinov for designing the concept of a future university, focused on the competence approach and the humanitarian-technological ideal of education. An image of the graduate as a scenario of the future is considered by Dr. Margalit Yosiphon and Professor Miriam Schmid in the new educational paradigm in the Israeli education system. According to the authors, the image of the future graduate is expressed in the curriculum, in the methods and technologies of teaching, in the experience and values that education transmits. The deferred nature of the results of the educational process is a characteristic feature of the higher education system and actualizes the role of prognostic studies in education using the methodology of the Foresight of the future [17-19]. The use of Foresight for solving management problems in education is considered in the works of A.N. Lansky, A.V. Sokolov. Of interest are the expert foresight-methods for constructing a predictable future, in particular, a weighted and coordinated competence-based image of a future graduate. The analytical study performed by the authors [20, 21] allows us to hope for the successful integration of this methodology at the level of the procedure for formulating the goal of the educational program in the form of the desired target competency image of the future graduate.

The analysis of a variety of competence-based images in the competence space and the task of visual interpretation of the degree of achievement of the target predicted image of a graduate can be carried

out using the apparatus of artificial neural networks. The artificial neural networks are an effective tool for the intellectual analysis of multidimensional statistical data and pattern recognition [22-24]. Theoretical foundations, examples of solving practical problems, modeling and computer experiments are fully described in the scientific literature [25], [26].

Thus, it should be noted that in the conditions of the requirements of the federal state educational standards for the results of education and the availability of the electronic information and educational environment of the university, the changed educational paradigm requires an innovative approach. It should be based on a comprehensive interdisciplinary study of the competence-oriented educational process, covering the main aspects of the problem under study, a combination of pedagogical, technical and psychological methods in building models of the processes of this educational system.

4. Purpose of the Study

The purpose of the research: expansion of the scientific and theoretical base and development of a scientifically based methodology for assessing the results of mastering the basic professional educational program of higher education in the space of competencies.

Achieving this goal provides a solution to the problem of a comprehensive interdisciplinary study of the processes of implementation and development of the competence-based educational program, obtaining new knowledge in the field of forecasting, forming and analyzing the competence-based image of a future university graduate.

At the initial stage of the study, the following scientific task is formulated: the development and testing of the scientific and methodological foundations of the foresight forecasting as the expected target competency image of a future graduate. Also, the task is formed by measuring the level of formation of competencies based on the theory of latent variables and neural network analysis of the actual results of education in the space of competencies using the example of a separate educational program implemented by a separate educational institution. In the future, at the next stage, the scientific task should cover a wider field: building a generalized basic competence-based image of the future graduate of a separate educational program, which would allow for a comparative analysis and rating of this educational program implemented by various educational institutions.

5. Research Methods

A comprehensive research and an interdisciplinary approach is used to aproblems using the achievements of pedagogy, information technology, mathematical and computer modeling. The subject of study is studied comprehensively, in its development, with the use of practice as a criterion of truth.

5.1. Methodological principles of research

The research is based on a number of methodological principles. The principle of unity of historical and logical is the logic of knowledge of the object, the phenomenon reproduces the logic of its development, that is, its history. In relation to the problem being studied, the logic of knowing the process of forming the competence-based image of a future graduate reproduces the logic of its formation in the process of implementing the educational program. The dynamics (history) of the formation of a competence-based image can serve as a kind of key to a deeper understanding of the essence of the competence-based image of a particular person, making practical decisions on its upbringing and training.

The principle of consistency is a systematic approach to the objects under study. This method was used by the team of authors when developing the concept of a competence-oriented educational system and the principles of managing its main process. Further consideration of the object of study as a system is assumed: identifying the set of system elements, establishing the classification and ordering the connections between the elements, selecting from the set of systemic links.

The principle of unity of theory and practice is practice as a criterion of the truth of a theoretical position. When organizing a study, not only the achievements of the theory, but also the results of the practice are taken into account. Since a theory that does not rely on practice may turn out to be

speculative and fruitless, as well as practice that is not guided by scientific theory, suffers spontaneity, lack of proper sense of purpose, as well as low efficiency.

The principle of specific historical approach is also to be applied to the problem under study. Our experience convinces us that one cannot deeply investigate one or another problem of preparing future graduates by following only well-known and prescribed ways, following elaborated patterns without attempting to creatively transform them. In our study, we propose to solve the problem of evaluating the results of mastering the main professional educational program of higher education in a new way: based on the competence image of the student (graduate) in the electronic information-educational environment and the requirements of educational standards.

The principle of the objectivity of examining the phenomena under study is to find ways and means of penetrating the essence of the phenomenon, without adding anything external, subjective. Practical actions of researchers, which are social facts, serve as the methodological basis for the concrete implementation of the principle of objectivity in the study of the competence-based image of the person and the measurement of the level of competence.

The principle of comprehensive study is an integrated approach to the study of the processes and phenomena under study. In conducting the study, the two most important essential requirements of an integrated approach are met. The first step is to establish all the interrelations of the phenomenon under study, to take into account all external influences that affect it, to eliminate all random factors that distort the picture of the problem under study. The second step is the use in the course of research of various methods in their various combinations.

5.2. Research methods

The methodological base of the research includes the following methods: a system analysis; a mathematical modeling of processes in social systems; foresight forecasting methods: an expert panel method in conjunction with literature review, a bibliometric analysis, a reference analysis, a SWOT analysis; methods for measuring the level of manifestation of latent variables on a linear scale; methods of graph theory and constructing tree-like dynamic data structures; intelligent neural network methods for feature extraction, clustering and data classification; neural network pattern recognition methods.

5.3. Research tools

The following software packages are used as tools for processing and analyzing statistical data, simulation modeling: the interactive system for measuring latent variables RUMM (Rasch Unidimensional Measurement Models), the package “Statistica Neural Networks”.

6. Findings

According to the authors, the answer to the question “How to evaluate the results of the development of a competence-based educational program?” can be obtained as a result of the step-by-step solution of the following tasks formulated in the article and other publications:

- Formalization of the results of the development of the educational program in the space of competencies.
- Building a formalized predictable desired goal of a competence-based educational program.
- Development of a roadmap for the formation of competences of the future graduate in the process of implementing the educational program in accordance with the stated goal.
- Construction and implementation of the model of the actual formation of student competences in accordance with the roadmap and formalized goal in the information-educational environment of the university.
- Creation of test and measurement materials for measuring the level of formation of competences of a future graduate.
- Ensuring monitoring of the actual measured level of formation of the competencies of the future graduate in the process of mastering the educational program.

- Ensuring the update and visual interpretation of the individual actual level of development of the competencies of the future graduate according to the results of monitoring.
- Analysis, assessment, and visual interpretation of the degree of achievement of the goal of the competence-based educational program.

Based on the conducted research [4-6, 20, 21, 26], we can offer the following answers to the questions posed, allowing us to set guidelines for further planned research in the framework of the problem under discussion:

- To formalize the result of the student's learning of the competence-based educational program in the form of a vector of competencies, obtaining a competence-based image of the future graduate. It is proposed to consider the levels of development of the proposed competencies as components of a mathematical vector image.
- To build with the foresight methods a predicted coordinated goal of the competence-based educational program in the form of a targeted competency vector-image of the future graduate. The method of expert panels in combination with other methods is proposed to be used as the main method: a literature review, a bibliometric analysis, a reference analysis, a SWOT analysis, workshops of the future.
- To develop a roadmap for the formation of student competencies in accordance with the projected goal. Competence-oriented work curriculum for the implementation of an educational program in an educational institution is proposed to be considered as a roadmap. This work curriculum links all types of student training with a competency development plan.
- To build and implement in the electronic information-educational environment of the university a mathematical model of the formation of student competencies. The model is proposed to be created on the basis of a regularly updated dynamic hierarchical data structure – a tree of competences, reflecting the structure of the target competency image, containing in its nodes the individual actual levels of competence formation and the dynamics of their formation in the process of mastering the educational program.
- To create measurement and control materials for objective measurement of the level of formation of the student declared competences. The creation methodology is based on the interpretation of competence as a latent variable, which allows the application of the theory of measurement of latent variables and the Ras probabilistic model for the operational description of competence. Competence is described by means of a set of indicators of its manifestation, further iterative construction and calibration of a measuring instrument, and the final measurement of the actual level of competence formation on a linear scale.
- To develop and implement in the electronic information-educational environment of the university an algorithm for monitoring the periodically measured actual level of formation of competencies in the process of mastering a student's educational program.
- To provide in the monitoring algorithm the actualization and visual interpretation of the individual actual competency tree and the individual competence image of the student.
- To implement in the electronic information-educational environment of the university neural network recognition of competence-based images and analysis of the results of education in the space of competences with assessment and visual interpretation of the degree to which the student (graduate) attains the goal of the educational program. The degree of achievement of the goal is calculated on the basis of the proposed criterion, i.e. the metric (distance) between the competence target and actual vectors-images of a student (who is a future graduate).

The experience of a comprehensive systemic study of the processes in the educational system in their agreement with the results of the development of the educational program in the competence space showed that this approach provides the most important condition for achieving the goal of education: an integrity of the competence-oriented educational program at all stages of its implementation and development.

7. Conclusion

The results of the interdisciplinary research performed by the authors allow to complement the creation of scientific and theoretical foundations and expand the scientific basis of the methodology in the field of social competence-oriented educational systems, can be a contribution to modern didactics, in particular, to the theory of the organization of the educational process.

The opportunity arises when solving the set tasks to obtain a significant amount of new information about the object under study, for example: extracting new features as a result of intelligent neural network analysis of statistical data; a study of the influence of the number of measurable levels of competence development on the measurement accuracy, a quality of neural network analysis of the results of educational program development, a quality of clustering, classification and recognition of competence patterns; a study of the influence of individual components and dimensions of the vector of a competence-based image on the quality of neural network analysis and recognition, a visibility of interpretation of results; an analysis of the influence of the distance metric between the target and the actual competence-based images of the future graduate on the quality of clustering, classification and pattern recognition in the investigated competence space.

The lack of a comprehensive interdisciplinary research of the implementation of a competence-oriented educational program in the context of the electronic information and educational environment and the requirements of federal educational standards allows us to hope that the results would make a significant contribution to solving the problem of assessing the results of mastering the basic professional educational program of higher education in so far generally accepted decision.

The proposed formulation of the problem and the solution of scientific problems covering its three distinguished aspects can create prerequisites: for the formation of a new scientific direction – a neural network analysis of the results of education and recognition of student competence images (graduate). For the development of existing research areas in relation to the field of education, on could apply the foresight forecasting of the future, which implies building a targeted consistent competency image of the future graduate. Measurement of the levels of manifestation of latent variables on a linear scale based on the Rasch model – for building adequate test materials and measuring the levels of competence formation.

The scientific results of the study can be applied not only by theoretical educators in the course of research of the modern educational process, but it also have the potential to contribute to solving applied problems in educational organizations of all types and types whose educational programs are based on the competence approach.

The proposed innovative approach of the integrated interdisciplinary research and solving this fundamental scientific task in the field of education correspond to the strategic direction formulated by the President of the Russian Federation. This is also associated with the development of intelligent systems for creating a digital economy in the modern knowledge society.

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