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VECTOR MODELING OF A PERSONIFIED INFORMATIONAL AND EDUCATIONAL ENVIRONMENT: PROFESSIONAL SELF-EFFICIENCY REGULATIONS

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Abstract

To present vector modeling as a tool in the design of a personified informational and educational environment. To identify the regulations of professional self-efficacy of a specialist and to mark their capabilities in building optimal educational learning strategies, taking into account the individual needs of students. Within the framework of the system-multidimensional, subject-activity and subject-environmental approaches, the professional self-efficacy of a future specialist is examined. The leading research method is the modeling using multidimensional vectors. The components of the vectors describe the capabilities, actions and results that are comparable with such components of a personified informational and educational environment as information, process, conditions. A vector modeling method has been developed for a qualitative and quantitative assessment of the process of formation of an individual educational trajectory in the conditions of the personified educational environment. The regulators of professional and personal development of the subject of educational activity, based on the principles of the invariance of didactic bases, binary, macro- and micronavigation, which is carried out by logical-semantic modeling, are grounded. The system-multidimensional, subject-activity and subject-environmental approaches procedurally describe the level transition - from personization and personification to personalization of the subject of activity. Vector modeling assesses the qualitative and quantitative relationships in the level transition "personization - personification - personalization".

Keywords: Diagnostics, regulations, individual educational trajectory, professional self-efficacy of a specialist, personalized information and educational environment, vector modelling. .

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1. Introduction

At present, education is characterized by changes taking place in accordance with post-industrial trends in science and culture. This is due to the requirements of the information society. Attitudes, values, learning technologies and methods for diagnosing educational results are being changed. The key conditions for the existence of a specialist in the modern world are his personal qualities, among which self-determination, independence and responsibility in decision-making are especially significant. Education is “self-value and the sphere of production of the highest value and main capital - a person in the fullness of his properties and qualities as a harmoniously and comprehensively developed personality, and not just a specialist” (Ilinsky, 2012, p. 6). Already at the stages of professional education, a student should be ready to plan activities to achieve his goals and design the trajectory of his professional development. Accordingly, the issues of identifying the tools of the educational process for the implementation of the individual educational trajectory of each student and the regulations for building his development strategy are being updated.

Each subject has the right to personified education, implemented in a special personified informational and educational environment. An individually-oriented educational process is based on the principles of multidimensionality, non-linearity and variability. On the one hand, each student has a wide choice of individual educational trajectories. On the other hand, the requirements for the implementation of the trajectory of educational activity, taking into account the personal interests of the student, are quite difficult to structure. Therefore, in pedagogical research, a significant role is assigned to modeling the informational and educational environment, taking into account the personal interests of students.

The modeling method is aimed at explaining, studying and refining the object which is under the study. Modeling is exactly the tool that allows you to influence the construction and functioning of the pedagogical object based on the analysis of the model representation (Yadrovskaya, 2013). Pedagogical modeling has a "partner term", often accompanying it in scientific texts - this is design. Design is aimed at creating models of planned (future) processes and phenomena, while modeling can extend to past experience - with the goal of deeper understanding. Specific models and modules — as functional units that combine the complex of the elements of the educational system — can be components of project activities (Dakhin, 2003, p. 21). The interpenetration of modeling and design is permissible in an isomorphic way to continue both in depth and in breadth. Modeling and design mutually enrich each other: a project, as a result of design, can be a subsystem of a certain model, and, conversely, design can consist of smaller models. Design involves the creation of partial models, and modeling - analysis of the complex of elements.

It is rational to carry out modeling of a personified educationally informational environment and its diagnosis on the basis of multidimensional vectors. The concept of a vector and corresponding operations with it makes it possible to take into account the principles of multidimensionality, nonlinearity, and variability in the best way. The vector description gives us an opportunity to quantify not only the current state of the subject and the environment, but also the prospects for their change - as a transition to the next state.

The vector method, as a means of constructing a model, is presented in (Yasvin, 2000). The author realizes the scientific analysis of the educational environment as a complex and multidimensional social reality through a vector model consisting of a coordinate system with two axes - the axis “freedom -

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dependence" and the axis "activity - passivity". To construct in this coordinate system a vector corresponding to a particular type of educational environment, psychological and pedagogical analysis is needed, which is connected with answers to six diagnostic questions. The first three questions identify the possibilities of the studied environment for the free development of the student, and the next - the opportunities for the development of his activity. The answer to each question is fixed by one point on the corresponding scales of "activity", "passivity", "freedom" and "dependence". Based on the answers to the questions, the educational environment can be interpreted by the corresponding vector in the coordinate system. So, through the simplest mathematical construction, we get one of twelve theoretically possible vectors (three in each of the four sectors of the coordinate system) that model a certain type of educational environment (Yasvin, 2000, p. 80). The purpose of the model is to visualize the predominance of specific signs of the educational environment where the subject is developing. Using coordinates on axes to display a scale of answers to questions formulated in everyday language is a representation of a vector not only as a visual image, but also as a means of translating qualitative characteristics into quantitative indicators.

In the design of individual educational trajectories by means of vector modeling, a correlation of social and individual principles in the structure of the personality is provided for the interaction of the processes of personization, personification and personalization. And this makes it possible to form and develop professionally significant subjective qualities of a person to effectively fulfill social and professional roles. The subject, satisfying the need to "Be yourself" according to his "I-concept", freely displays individual personal and professional qualities (Dorofeev, Chirkina, Gagloev, & Savina, 2018, p. 1617). Individualization in developmental education is the organization of the educational process, which is aimed at developing cognitive abilities and needs of the learner by means level differentiation of the content, tasks and methods of educational activity, as well as its relevant abilities based on the zone of proximal development (Vakhidova, Gabitova, & Ivanov, 2018). While training of specialists it is advisable to operate with the concept of "professional self-efficacy» (Muddy, 2002).

The phenomenon of self-efficacy is still being studied and realized in terms of revealing a person's desire to be a personality not only in terms of self-realization, but also self-actualization, individuation, authentication and personification (Sitarov & Grachev, 2010). So far, the concept of self-efficacy has not been fully developed. Considerable attention in the works of domestic and foreign authors is given to issues of general self-efficacy. Research distinguishes between self-efficacy in activities and self-efficacy in communication. If in the process of personalization the need and ability of a person are to be an individual, then in the process of personification - his need and ability are to be himself. The role and importance of personality in these processes are different. Achieving success by a specific person in a given situation depends on his own competence and other factors. Bandura (2000) hypothesizes that self-efficacy is cognitive, and expectations manifesting in it affect the motor behavior of the person. For example, does a stressful situation stimulate attempts to master it, how intensive these attempts are, and how long they will last. Self-efficacy influences the characteristics of the environment and the subsequent behavior of the person.

Self-efficacy is the core of many aspects of life, including the professional and personal qualities of a specialist. Professional self-efficacy can be interpreted as a vector for the formation of key competencies of a specialist in the educational process. The technologies for their formation have not yet been fully

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developed, and this topic is open - both in theoretical and in technological aspects. The problem of professional self-efficacy is studied from different approaches. We rely on system-multidimensional, instrumental-activity and subject-environmental approaches. The leading principles are the invariance of didactic bases, binary and macro-micronavigation based on logical-semantic modeling (Vakhidova, Gabitova, & Ivanov, 2018).

The problem of the formation of professional self-efficacy is becoming increasingly relevant in the system of training specialists. The organizational and pedagogical conditions for its implementation are quite important. The solution to the problem of creating an appropriate environment that maximally refers the subject of the educational process. The purpose of personality-oriented learning in the conditions of a competency-based approach to education is to provide the conditions for becoming a student interested in self-improvement of the subject of educational activity. Significant potential for achieving the goal lies in the diagnostic activities carried out in close interaction between the teacher and the student. Student initiatives, starting with setting a goal and determining the development prospects ending with the choice of tactics for achieving goals when performing specific educational activities, contribute to the development of qualities that are necessary for a modern specialist and a realized personality. The theory of personality-oriented learning is feasible through building an individual educational trajectory - a personal way of realization of the personal potential of each student in education through the implementation of relevant activities (Khutorskoy, 2003).

More particularly, the individual trajectory of the professional development of a future specialist should be considered as a personal strategy for the student's professional growth, improvement of personal qualities and the formation of his competencies. The strategy is built on the basis of awareness and subjectivation of professional goals, values and norms (Berezhnaya, 2012). The invariant and variable components of the individual trajectory of the professional development of a future specialist can be emphasized. The invariant component is focused on the specialist model, which includes the professional competencies which are necessary for the successful implementation of professional activities, basic professional knowledge, professional skills, professionally significant personal qualities (Steinberg & Manko, 2017). The variable component is aimed at the student's personality, individual characteristics, needs, motives, interests and their further development, which is especially significant in his future professional activity.

2. Problem Statement

A graduate of the profesional education system must possess the qualities of a high-tech specialist, such as competitiveness, professional mobility and the ability to self-study. Changes in the training system are in need. The leading research problem is the issues of designing professional self-efficacy of a specialist and revealing the reserves of a personified informational and educational environment for the future becoming.

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3. Research Questions

The research questions - vector modeling of the formation of the individual student environment. Modeling involves: 1) an understanding of the individual needs of the subjects of the educational process; 2) level differentiation of students, determined by their readiness for independent professional activity; 3) the logic of building the educational process in accordance with the organizational and pedagogical conditions of the information and educational environment for the development of personal and professional qualities.

4. Purpose of the Study

The purpose of the study are to present the possibilities of vector modeling as a tool in the designing of a personified informational and educational environment and to identify the regulations of professional self-efficacy of a specialist and to identify their capabilities in building optimal educational learning strategies taking into account the individual needs of students.

5. Research Methods

The self-efficacy of a specialist combines private self-efficiencies from the most diverse areas of human activity. A person's ability to achieve success in a given situation depends on his own competence and many other factors. Objective results are not so important as their interpretation and the expectation of success from the positive results of own actions. Professional qualities that determine the self-efficacy of a specialist are consistently formed in the process of personisation, personification and personalization (Asmolov, 2007; Shadrikov, 2009). This triad is a kind of result of the student's identification, his individualization and "development in many spheres" in a personified informational and educational environment.

Professional self-efficacy is both a concept and a specialist development technology. It is characterized from several complementary positions. Firstly, it is the student's promotion on the levels of "personization", "personification" and "personalization". At these levels, the subject gradually improves professional actions that are implemented in a micro-, macro- and mega-environment and correspond to the functions of "Trainee", "Craftsman" and "Master". Secondly, such components of the informational and educational environment as the invariant part, logical-semantic modeling, visual micro- and macro navigation, are characterized by changes due to the nature of the interaction based on the methods of auto-dialogue, direct polylogue and translational polylogue. And, in accordance with the types of interaction being implemented, thirdly, the control and reflection of level display are carried out (Vakhidova, Gabitova, & Ivanov, 2018, p. 1546). The process is based on causal factors containing logically semantic modeling, sensuously figurative, verbally logical and modeling reflection mechanisms and cognitive visualization through which the subject is associated with visual means.

A significant component of professional self-efficacy is a personified informational and educational environment, i.e. new pedagogical reality which is based on the principles of autodialogue, didactic multidimensional technology and didactic multidimensional tools. The key elements of the environment are information and a complex of organizational, psychological, pedagogical and didactic conditions. The

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environment suggests a specially organized process of positive change of the subject through its activity of a certain structure to transform the content of the environment itself in accordance with specified indicators and using information technologies implemented through macro and micro navigation, interactive cooperation and subagent approach (Vakhidova, Gabitova, & Ivanov, 2018).

The next component of professional self-efficacy is the level differentiation of the movement of the subject of the educational process. Modern education is represented by different environments: informational, educational, instrumental, institutional environment. As a rule, the appeal to the subject of the educational process is not clearly developed in them. Therefore, we consider the problem of designing a personified educational informational environment taking into account the regulations of professional and personal development of the subject in theoretical and specifically visual cognition.

The main feature of the methodological approach is that individualization is implemented in a single hierarchical triad of "personization - personification - personalization" at the appropriate levels of personal development. The environment sets certain patterns of appearance, patterns and stereotypes of behavior, therefore, qualitative and quantitative relationships between these levels are especially significant. A person, comprehending himself, his abilities and capabilities through comparison and reflection, makes an independent choice. In a successive change of levels, the logic of the development of the subject of the educational process is observed: personization is, first of all, perception, personification is the understanding and manifestation of the subject position in addition to the process of perception, personalization is the creation of subject frames and conditions for changing the educational situation. Consistently and qualitatively, the personality functional changes like “Trainee - Craftsman - Master” (Vakhidova, Gabitova, & Ivanov, 2018). Thus, a hierarchical system is being built in which levels of human resource use such as environment, information and education are detailed and justified on an implementation basis. The first level is personization. The level when a subject of activity is endowed with certain properties. The level which is higher is personification, when through conditions and tasks changes and transformation of the subject in the environment occur. The basis of the process of exteriorization or modification, of course, is the subject himself. His personal characteristics and individual preferences are important. The task of the teacher is to regulate changes in the environment, the conditions of its existence and the behavioral strategies of the subject in a joint activity with him. The next level is personalization, on which the subject is a creative leader. He independently sets the conditions for other participants in the environment, determining the types of activities and modifying the environment. A significant component of the professional self-efficacy of a specialist we mark as "opportunities - actions - results." The peculiarity of the informational and educational environment is that the transformation of the subject from a person to an individual is accompanied by the formation of his personal competencies. This approach, along with components, criteria and process indicators, also includes the regulatory framework for changing the subject. The idea of professional self-efficacy as a pedagogical phenomenon is in personal potential and didactic multidimensional technology. And this means that professional self-efficacy can be considered as a technological phenomenon. The structure of professional self-efficacy of a specialist is presented on the Figure 1:

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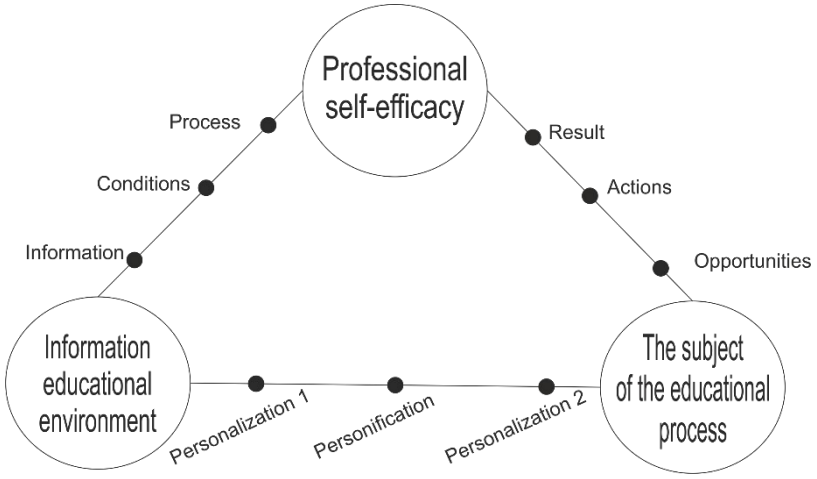

Figure 01. The structure of professional self-efficacy of a specialist

A competency approach to the design of professional education points to the achievement of quality indicators (Berezin, Miroshnikov, & Sokolova, 2011). But designing the future of complex open systems is problematic, so that is why requires constant management of their development through modeling and research (Schedrovitskiy, 2007) .The educational process is characterized by social, informative and organizationally technological content. The leading method is vector modeling (Dorofeev, Chirkina, Gagloev, & Savina, 2018) Qualitatively and quantitatively, the process of forming professional self-efficacy is evaluated on three bases:

1) the potential abilities of the educational environment in the formation of professional self-efficacy of a student (V axis);

2) the severity of the motivationally emotional, cognitive and operationally active consistuents of the discipline in the formation of professional competencies of the student (axis D);

3) student's achievement of education results (R axis).

The potential opportunities of the educational environment are determined by the axiological (goal-setting), cognitive (meaningful content) and methodological (modeling of educational activities) opportunities of the information educational environment. The social context of professional self-efficacy is expressed through the V axis.

The actions implemented by the student are connected with the vector D, the components of which characterize the motivationally emotional, cognitive and operationally active components of the educational activity. Self-development of a person is closely connected with the process of professional development. Professional development is influenced by external conditions created by certain positions and relationships, and internal abilities, which can be shown in goals, actions, means, needs for self-improvement and updating of the knowledge. Vector D diagnoses the professional orientation of training in the field of student actions.

For assessment the achievement of quality indicators of professional education, such characteristics as the student's desire to achieve the results of educational activities and the integrated application of professionally significant knowledge and skills were introduced. The components of the vector R in the field of student achievement are: 1) the coefficient of acquirement of professionally significant skills connected with perception, logical operation, heuristic processing and creative transformation of

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educational material; 2) the coefficient of desire to achieve the results of educational activities; 3) the coefficient of compliance of educational activities with the development of professional student self-efficacy.

The allocation of three fields is consistent with the task of becoming a free person who is capable of creative self-realization in professional activities. The professional self-efficacy of a future specialist is the integration of his theoretical knowledge, ability and readiness for professional self-realization. Vectorization characterizes the movement of the subject. The macro- and micronavigation regulations introduced by us are aimed at optimizing the process of building an individual educational trajectory in order to effectively influence the triad of "opportunities - actions - results" on the dynamics of the subject's progress in a personified educational information environment (Fig. 2):

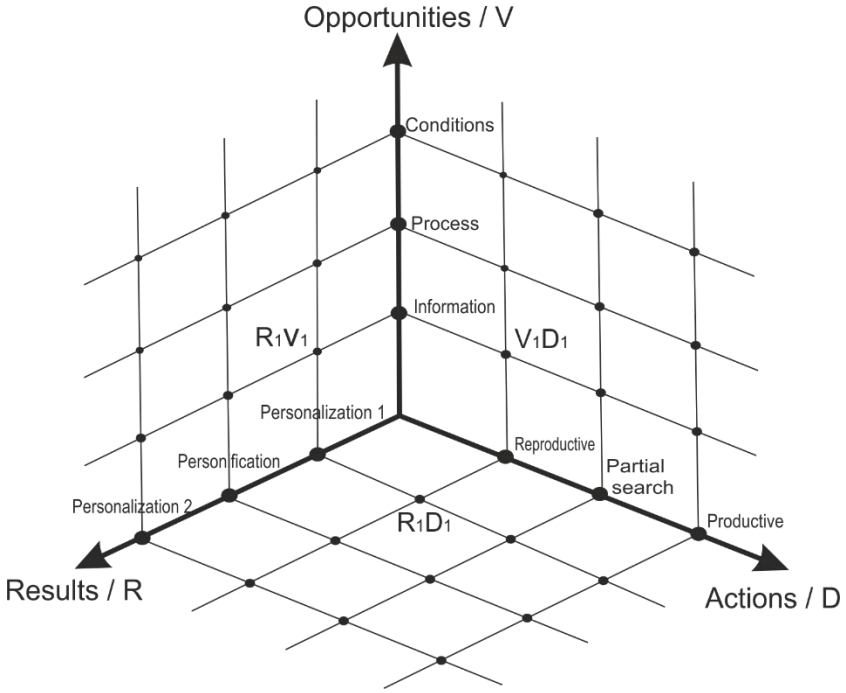

Figure 02. Vector modeling of the process of constructing an individual educational trajectory

Now let us describe the approaches to modeling the process of formation of an individual educational trajectory, carried out in three quadrants of the vector model in Figure 02. The purpose of the VD quadrant is to determine the levels of professional actions in the work process with information in the appropriate educational environment. Here, the subject of the educational process moves from reproductive forms of activity to productive. The RD quadrant indicates the student's fulfillment of professional actions in accordance with the dynamics of his growth at the levels of "personization" - "personification" - "personalization". The growth of professional self-efficacy of a subject temps from executive functions. And then the student transforms the environment "for himself" and proceeds to fulfillment of generating functions that depend on the external and internal factors of the educational environment. The purpose of the RV quadrant is to determine, taking into account environmental conditions, the level gradation of

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professional effectiveness, depending on the content and the degree of subject's participation in the educational process.

A quantitative description of the individual educational trajectory of each student is carried out by out by the method of vector modeling through the coordinates of the vectors in the quadrants of the model. model. We use design tasks, differentiated by level and type of professional activity (Dorofeev, Chirkina, Chirkina, Gagloev, & Savina, 2018). An individual trajectory will be ideal with a diagonal vector in the coordinate system “opportunities - activity - result”. The end of such a vector is the point R3V3-V3D3-R3D3. Taking into account the individual characteristics of students, the vector modeling of the internal conditions of the educational environment and the functional of educational activities, you can get different variations of individual educational trajectories.

Vector modeling evaluates not only the desire of the subject to achieve the results of educational activities, but also the complex use of acquired knowledge and skills in the conditions of the information and educational environment. Thus, the design of an individual educational trajectory is the definition of a strategy and tactics for mastering a student's competencies formed by means of a particular discipline. The student, together with the teacher, formulates the goal of studying the subject (strategy) and determines the steps to achieve this goal (tactics). During the progress, the student’s final and intermediate goals can be adjusted based on the diagnostic results.

6. Findings

Design, like any activity, takes place in stages. The main stages of design are: search-modeling, operationally active and controlling. At the search-modeling stage, diagnostics are carried out in order to determine the initial current state. The results of the input control are expressed by multidimensional vector and then the goals of training are being set, the conditions and basis for achieving these goals are being determined. A large role at this stage is assigned to motivation. The student is aware of the prospects for his development, chooses the concept of movement towards the goal and predicts a model of an individual trajectory.

At the operationally active stage, methods and teaching means are implemented on the basis of their variation in accordance with the personality characteristics and target settings of the student. To identify achievements and shortcomings in the drawbacks in mastering the discipline and the formation of competence, various forms and means of current control are being used. The consequence of the diagnostic measures is the correction of the trajectory. Positive and negative changes are taken into account during the trajectory. An adjustment may be expressed in the elaboration of the final and nearest current state.

At the control stage, the results are analyzed, a reflection of the implementation of the trajectory is being carried out. The final control allows you to identify the conformity of the final result of the goal. A retrospective analysis of the dynamics of the formation of competencies is necessary to obtain the information about changes in the cognitive, operationally-active and motivationally objective areas of student activity. Based on the analysis, the development of professional self-efficacy of a future specialist is being predicted.

The key task of vector modeling of the process of building an individual educational trajectory is to develop the learner’s abilities through cognition, experience and evaluation in the internal and external

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plan of activity (Steinberg & Manko, 2017), so that the active, emotional and intellectual spheres could be activated in parallel.

The results of testing vector modeling during the formation of a personalized information educational environment (Dorofeev, Chirkina, Gagloev, & Savina, 2018; Vakhidova, Gabitova, & Ivanov, 2018) give an opportunity to reveal the following features of effective training of specialists:

- didactic multidimensional technology determines the functions of the educational environment, its structure and content;

- the cognitive representation of knowledge is implemented by means of logically semantic modeling;

- macro- and micronavigation in academic material is carried out through coordination of the external and internal plans of educational cognitive activity;

- the subagent organization of the system integrates with the structure of didactic multidimensional technology.

Designing an individual trajectory allows you to make the process of professional training more The result is achieved through the optimal organization of professionally oriented student activities. Such an interpretation of the learning process leads us to the formulation of the new term "optimal individual trajectory of professional self-efficacy".

7. Conclusion

The levels of professional self-efficacy "personization - personification - personalization" determine the competency-based training specialist format, which is represented in professional standards. For each generalized labor function, additional professional competencies and appropriate tools for evaluating a specialist during the final examination can be introduced. In the future, we plan to conduct the differentiation of additional competencies and propose a matrix for evaluating the functional of a specialist. The design of the individual trajectory was carried out in order to:

- formalize the stages of the process of formation of competence for subsequent mathematical processing of the results of diagnostic procedures;

- to provide a quantitative assessment of the heterogeneous components of multidimensional competence;

- to reflect the dynamics of the passing of an individual trajectory.

Among the prospective areas of specialist training it should be noted:

- justification of the means of organizing of the educational process in a personified educational information environment;

- the formation of individual educational trajectories in accordance with the levels of personality development;

- identification of the conditions of a personified information educational environment that provides the holistic development of a specialist's personality and his individual qualities.

In building optimal educational strategies for a future specialist, the regulations of professional and personal development, taking into account his educational, professional and cultural needs are important.

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Vector modeling takes into account the capabilities, actions and results that are comparable with such components of a personified information educational environment as information, process and conditions.

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