

SYSTEMIC SYNERGISTIC DIAGNOSIS OF THE PREPAREDNESS OF FUTURE SPECIALISTS IN THE AVIATION INDUSTRY FOR PROFESSIONAL ACTIVITIES

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Abstract: This article is devoted to problems of professional preparedness of future specialists in the aviation industry completing higher education. This study uses criteria of systemic modeling of the educational process – didactic invariant elements of learning activities.

Keywords: systemic modeling, competence approach, didactic invariants, readiness for professional activities.

The increase in the flow of data in the informational and educational environment, and the socio-economic and political transformations at the present stage of development of the country, and the introduction of the competency-credit approach in higher education institutions (HEIs) have contributed to the formulation of fundamentally new challenges in the educational system as a whole, considering it as a coherent unity of teaching, education and personal development. These challenges are the results of general culture and education; they are products of the formation of the image of the outside world in the inner world of the individual affecting his or her professional subjectivity. These challenges directly affect the system of higher education, because it plays a leading role in the formation of scientific and intellectual potential of the country.

The changing paradigm in the system of higher education in Ukraine, according to the European Commission project "Setting educational structures in Europe," determined the transition away from a process approach in the organization of training, and contributed to the formation of a new approach to effective educational results which are taken as a foundation of preparation. The essence of this effective approach is that educational outcomes of preparation must be formed in terms of competencies, which the student acquires during the educational process. These competencies are based on the qualifications (competencies) that employers seek in the education graduates.

In addition, the introduction of this efficient approach in Ukrainian professional education contributed to the definition of the strategic goal of higher professional education according to the priority of social and economic vectors which are determined by the state regulatory documents. Its main idea is to provide the country with specialists adapted to variable labor market conditions and capable of carrying out multi-tasks sufficiently, absolutely and responsibly, ready for a continuous growth profile, social and professional mobility. According to this point of view, it becomes important not only the amount of productive knowledge obtained from the changeable, information-contradictory environment surrounding the educational system important, but also the ability of the subjects of the educational process to use this knowledge to make decisions actively and optimally. This enables the future specialist to navigate effectively in today's dynamic and information space.

Thus the purpose of education and its result become the system established factors according to which the social and psychological components of educational activities are organized, forming the most important tasks of modern professional education in Ukraine, namely: identifying of competencies (results of education) for qualification levels (competence); changing the structure and content of training, developing innovative technologies, and searching for valid and reliable means of diagnosing the training results.

Thereby the requirements are dominant, and they are connected to the definition of the optimality conditions of didactic professional training in universities and the quality criteria (system basis) of the training, understanding optimality conditions as quantitative and qualitative relationships between the didactic components of educational activities that allow entities that perform the conversion process of lessons in teaching knowledge and skills in new mental formations of

personality (experience, traits, orientation, ability), provided that knowledge becomes productive orientation and conviction of the individual student, and integrated and intellectual skills are brought to the professional abilities.

We know that the traditional system of training in universities is mainly focused on the subjects of the graduates' training when action-role-playing components (knowledge, abilities, skills) are decisive, but they represent only one part of the expert's professional competence, in particular, the content of professional competence of future specialist is updated (broadening and deepening), while further success of professional development depends on the level of the individual and his professional self-organization. That is why, according to some researchers, the subjective (personal) characteristics become the system conditions (criteria) of the future expert transition from one educational level to another, as they are responsible for the successful actualization of professional knowledge and skills, ensure harmonious professional development of the individual in the realization of a personal learning path that is possible only in flexible, adaptive educational systems that provide professionals the ability to gain self-education and self-development, rapid professional reorientation training. The development of personal qualities of future specialists creates integrated capabilities to implement the advanced nature of education through their independence, self-awareness, self-control which leads to effective learning throughout life.

Thus the implementation of new requirements for training future specialists in higher education is possible for many conditions of systematic and personal approach, but the primary conditions are such things as updating the structure and content of professional training in the conditions of integrated professional external information; implementation of informational and synergetic system of educational technologies, focused on the implementation of the educational process tasks of such specialist who is able to work effectively in a fast-changing environment.

Due to the orientation of the educational strategy of higher education in Ukraine on personal development transferring the emphasis on the results of education, the role of assessment becomes important in forming professional subjectivity of the future specialist. That is why the criteria for the optimal process of training future specialists in universities include:

- **the aim** (purposes) of training, which are interdependent and connected with the structure and content of training;
- **the result** obtained in the learning process, which is the formation of professional subjectivity of the future specialist;
- **the «coefficient of performance»** of the learning process, which links the learning outcome with the purposes formulated at the beginning of the professional training.

Based on the fact that any activities (including training) begin with the realization of the objective goal and taking into account differing vectors of the future psychologist in professional activity, we will consider the goal as the first criterion of formation of the future psychologist's subjectivity as a space-time vector. The components of this vector are in general, the subject-specific and general cognitive and pedagogical purposes. On the other hand, the purpose of professional training in universities, based on the basic conceptual provisions of the competency approach can be represented as a vector – function of interrelated and interdependent component competencies $\vec{C}_1, \vec{C}_2, \dots, \vec{C}_n$, which a specialist must learn according to the regulations of professional training, i.e.

$$\vec{T} = \vec{T}(\vec{C}_1, \vec{C}_2, \dots, \vec{C}_n). \quad (1)$$

To implement the defined objectives effectively for training future specialists, the mechanism must be chosen to correlate objectives (competencies) and real results (competencies) of training as a set of productive knowledge, integrated skills, and significant and professional qualities which the future specialist acquires during the training.

In our opinion, the solution to this problem is in the personal didactic system-modeling, in which we understand this term as the system of concerted actions that reliably and validly provide adequate mastering of simulated properties, connections and relationships of information and dynamic educational and converting facilities of natural and socio-cultural focus, where the subject is mental activity of the individual student.

Based on the concept of competence, professional integrity of concentric subjectivity of the future specialist's profile, taking into account regulations (GOST, EQC, OPP), that define a set of profession-oriented competencies, the algorithm of system modeling of the educational process and training of the future specialist and the concentricity of his development in the context of innovation management paradigm, the three main components that make up the core of man-social and psycho-

pedagogical nature of his training are namely professionally-oriented, professional molding and practical professional reflexive-evaluation. Each of these components includes several stages. Thus, the main purpose of the practical (reflexive-evaluation) phase is to update the productive use of knowledge, integrated skills and abilities; the formation of the way of thinking in professional activities of the future specialist includes the following components:

- diagnosis and evaluation of practical readiness of the future specialist for the profession;
- implementation of an integrated, information-activity, personal professional subjectivity of professional components in accordance with international educational standards (module organization of the learning process with coordinating interdisciplinary integrative courses);
- formation of integrated professional competencies of the individual (self-development and career advancement, competitiveness in the educational market, a high level of professional competence, co-creation opportunities with colleagues, strategic and practical thinking);
- readiness to form individual, marketing, psychological and pedagogical technologies in an integrated, dynamically synergetic environment, and strategies of acceleration and enrichment, which shows that, in the spiral-like learning process, the transition of the future specialist to each new level of education will be implemented by the optimal individual and didactic trajectory.

According to the second criterion of the formation of professional subjectivity, we consider the training future specialist as experience the student gained due to a systemic algorithm modeling the educational process of the optimization of training of future specialists in universities, namely, the amount of competencies which the experts have to design, i.e.:

$$R = \sum_{i=1}^n (C_i) \tag{2}$$

To show the third criterion of professional subjectivity formation, that is the "**coefficient of performance**" of the optimization training process of future professionals in higher education, linking learning outcomes and goals of training, which are reflected in the relevant regulations (GOST, EQC, OPP), we use the spatio-temporal dynamic model of educational standards, according to which the result of the educational process is related to its aims and content (knowledge, abilities, skills) correlations

$$R = (\vec{T} \cdot \vec{C}) \tag{2a}$$

where \vec{C} – the vector-function of educational content includes educational components of the learning experience (knowledge, abilities, skills) of the specialists' future training as a multi-vector component of the educational process.

It is known that the result is seen in the organizational structure and educational activity as an integrated system of integrated acquired skills and knowledge of professionally significant qualities formed by the student. At the same time, a question that interests employers arises, namely: is it possible, based on defined aims (competencies), to predict in advance and justify didactically the result of training activities (formation of appropriate competencies)?

To find the answer to this question we will use didactic invariants, where we understand invariant didactic educational level to be an element of educational activity, which is not changed by different research methods of studies. Based on this definition, as the first didactic invariant set us the goal of training psychologists as a vector - function of interrelated and interdependent components competencies that meet the professional subjectivity of future specialist, that is

$$D_1(I) = \vec{T} (\vec{C}_1, \vec{C}_2, \dots, \vec{C}_n). \tag{3}$$

$$D_2(I) = R (\vec{C}_1, \vec{C}_2, \dots, \vec{C}_n). \tag{4}$$

We choose the result of learning activities as the other didactic invariant which is connected with the aim and content of the future specialists' training

$$\vec{C} = \vec{C}(\vec{C}_{oe}; \vec{C}_{ss}; \vec{C}_{ee}), \tag{5}$$

Where $\vec{C}_{oe}; \vec{C}_{ss}; \vec{C}_{ee}$ are interdisciplinary vectors of general cognitive, subject-specific and pedagogical knowledge ratio.

$$D_2(I) = (\vec{T} \cdot \vec{C}) = T \cdot C \cdot \cos \alpha \tag{6}$$

Let us prove the latter ratio.

If the appropriateness of the formulas (1) and (3) is obvious, then try to establish a coherence between the formula (4) and (6). According to the definition of the work as a physical quantity formula (6), the work is the activity result which is done by the objects of the educational process (those who teach and those who learn) to transform the assimilated information into knowledge, abilities, skills i.e. mental formations of the student's personality (his competence) in accordance with education objectives (competencies) that are defined and shown in the regulations.

Based on the fact that the issue of optimal learning process is proved in the research [1, 2, 3] according to which the divergence from zero of another didactic invariant $D_2(I)$ is a prerequisite of a spiral-like learning process (identity dynamic of continuity and succession principles), the student's transition to a new educational level will be implemented through didactic spiral in student-optimal trajectory. It should be noted that if the vector curriculum is in the information-educational environment preparation in an arbitrary manner and is not the same, while the vector targets (\vec{T}) (lack of the disciplines' appropriateness according to training purposes and objectives of professional training), the training and educational preparation process will be carried out in a didactic spiral, provided the achievement of this educational level (EQC, OPP) targets the defined level of professional subjectivity of the student. The efficiency of the learning process that characterizes this relationship and which we choose as the third criterion of professional subjectivity formation of future specialist, is given by

$$d = \frac{C}{E} \cdot \cos \alpha \quad (7),$$

there-by confirming the difference ("gap") between the government order and competencies (knowledge, skills, skills, mental growths) which the future specialist should master and gain in the future expert-centered learning activities.

We consider three possible options for success in the process of training the future specialist of higher education in aviation orientation.

1. If the vector of educational content (\vec{C}) is in a plane perpendicular to the vector of (\vec{T}) the aim of educational level, i.e. the content of educational and job training programs of relevant disciplines is inconsistent with the purposes of training, reflected in the regulations of this level, based on the equation (6), the second didactic invariant $D_2(I)$ will be zero ($\cos 90^\circ = 0$). It means that the student does not have successful learning activities to transform obtained information during the learning process into productive skills and integrated abilities according to the goals of academic disciplines. Therefore he does not form the important professional qualities that he needs.

At the same time, the level of general cognitive knowledge of the student is sufficient to expand his circulation (abilities), whereby, after completion of this training level (course, phase), the success level of the educational process will not promote the transference of the student to a higher educational and professional level.

2. If the vector of the content of education (\vec{C}) is in the same plane as the vector of targets (\vec{T}) and, thus, it coincides with the direction (the content of training programs and job training courses meet training objectives), the student, having a sufficient level of knowledge and skills and high internal positive motivation is able to carry out training activities about internalization of productive knowledge in integrated skills and intellectual abilities, creating the corresponding components of professional subjectivity of future specialists. As a result, the student's psychological growth, which is formed after the obtained educational level, allows him to make a successful transition to the next level with a didactic spiral on optimal curves. The learning process for intellectual and professional development of the individual becomes harmoniously creative.

3. If the vector of educational content (\vec{C}) is in the same plane, but arbitrarily related to the objectives of the vector (\vec{T}), the success of the learning process in the didactic spiral will depend on the conditions when the transition to each subsequent level will only be determined after the student's achievement of educational and professional goals with specified levels of education and formation of the corresponding professional and important character qualities. The factor that characterizes this relationship corresponds to the ratio (7).

Conclusions

1. Implementation of a systemic modeling optimization process for training future professionals in higher education is possible by introducing training criteria (teaching invariants) into the educational process $D_1(I) = \vec{T}$; $D_2(I) = R$, that cause and bind the educational aims $D_1(I)$ (competence) and the result of education $D_2(I)$ (competences).

2. The difference from zero of the second didactic invariant ($D_2(I) \neq 0$) is a necessary condition similar to a spiral (harmonic) process of the professional subjectivity formation of the future specialist.

3. The student's activities in exteriorization of productive knowledge and intellectual skills in psychological growth are the most effective in the case of coincidence of "field of knowledge" and "field goals" in training the psychologist. In this case the learning process will be represented as a harmonious curve that is similar to a spiral, and intellectual and professional development of the individual will be creative.

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