

TRANSDISCIPLINARY APPROACH TO THE LEARNING PROCESS ORGANIZATION IN THE E-LEARNING INFORMATION ENVIRONMENT OF A COLLEGE

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ABSTRACT

The work relates to the professional teaching to the problem of teacher training, taking into account the current social challenges and the learning process management in college. This article focuses on the effectiveness of applying the transdisciplinary approach in the learning process organization when training future teachers in college in the context of e-learning implementation. Analysis of foreign and Russian scholars' theoretical positions on the issues of college educational management and the teacher training organization in the e-learning information environment is the leading approach to the case study, at the Ammosov North-Eastern Federal University (NEFU) focusing on training competitive specialists with a high level of professional thinking and managerial and educational culture. The method involves interviews more than 250 NEFU students pursuing a master's degree in Preschool Management, Project Management in Education, Innovative Processes in Education, Corporate e-Learning, and Technology and e-Learning management in the Teacher Training Institute at NEFU. The survey objectives were to study the level of formedness of professional, personal, and specialized competencies in future teachers.

Disciplinary: Education Sciences (College Education), Information Technology (Elearning).

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1. INTRODUCTION

The interest of modern pedagogical science and education practice to establishing interdisciplinary links, developing students' and teachers' skills and abilities in pedagogical and humanitarian areas, enhancing their information and technological activities in accordance with the realities of innovative development in Russian society is very high. The globalization of society and development of information technologies require constantly updating ways to acquire and use knowledge. At present, the system of higher vocational education assumes the transdisciplinary nature of its organization with the aim to achieve fundamentality, a quality level of education, versatility, and universality of individual knowledge and to solve complex problems in the nature-man-society system. The transdisciplinary approach is one of the promising approaches to the teacher training development in the North, since ethnocultural education is essentially natural and interdisciplinary in essence.

The modern educational policy of the Russian Federation assigns a strategic goal to the scientific community: to create conditions for domestic education competitive development in terms of the general education quality in the context of globalization for Russia to rank among the top ten countries in school education quality by 2024. The quality of education is defined by the state of the teaching community: teachers' qualifications and professionalism, readiness to search for new solutions in the field of training and education, creating conditions to accompany the life cycle of teacher's profession, including admission of talented young people to teacher training programs.

Analysis of the teacher training practice in universities of the Russian Federation has revealed the following trends: development of interaction between schools and colleges and a network partnership of educational establishments; development of diversified educational routes for teacher training in college, expansion of master's degree programs aimed at training educational managers; introduction of innovative training technologies aimed at improving the quality and efficiency of the learning process; implementation of a point rating system for monitoring students' knowledge; stepping up the requirements for academic research and social work of students, development of academic mobility programs for future teachers; stepping up the requirements for teaching and academic staff; the enhancing employability of graduates, which ensures a high rate of their employment and a steadily growing number of young professionals in educational institutions (Mikhaylova, 2015).

The research is conditioned by the need to study the pedagogical capacity of digital education in the training of future teachers in college, which is continuously and intensively associated with the use of electronic educational resources. Solving this problem requires studies and analysis by foreign and domestic researchers and subsequent development of new science-based academic syllabi focused on teacher training targeting the use of digital educational technologies and methods in teachers' professional practice as well as testing these syllabi in teacher training colleges of the North-East of Russia.

2. LITERATURE REVIEW

Transdisciplinarity is understood within different meanings, since the term itself is multidimensional as well as its semantic content. Its basic interpretations are the following: transdisciplinarity implies the principle of scientific research that goes beyond the scope of academic disciplines. Jean Piaget describes transdisciplinarity as a way to force scientific endeavor to go beyond science in the course of global synthesis of the world comprehension forms (Kolesnikova,

2014, Molchanov, 2013). Cognitive situations are called transdisciplinary if, for various reasons, the scientific mind has to transcend into the border zone with the vital world in search of integrity and its own validity in these situations (Kiyaschenko, 2009).

The transdisciplinary approach is an interdisciplinary scientific direction of structurally organized evolving systems that include the system of vocational training of educational management specialists. This approach provides a new way for expanding scientific and pedagogical knowledge focused on multidimensionality, complexity, and polyphony (alternativeness and variability) of the processes being cognized, discovering undisclosed or insufficiently disclosed states in them, and recognizing the meaningful role of chance in their development. The system of college education is capable of self-organization if it meets a number of requirements: it is complex, open, nonlinear, and stochastic, reaches a state of instability, and has sources as well as energy and information stocks.

Recently, the Russian educational system has been rapidly improving and developing. One of the areas that have served as a development basis for almost all life spheres in the 21st century, including education, is the implementation of digital education. E-learning is increasingly seen in research as the most effective type of learning that allows for the learning process optimization, especially in an economic downturn (Vlasova, 2014). According to the analysis of regulatory documents for the e-learning implementation in schools and colleges of Russia, the educational, teaching and research process and research activities of students comply with the Federal Educational Standard (FES), which indicates particular importance of the education informatization process in general and in particular of the use of e-learning and distance learning technologies (Marchuk, 2013). At the same time, the essence and specificity of implementing digital education in the process of schoolteacher training have not been sufficiently studied in the regional education system of the Republic of Sakha (Yakutia) (Barakhsanova, 2015). We believe that theoretical understanding of implementing digital education in the colleges of the Republic of Sakha (Yakutia) has allowed us to solve the following problems that are necessary to identify the specifics of digital education in schools and colleges, in determining the essence of students' digital dependence in educational activities and in practice (Barakhsanov et al., 2018).

Foreign researchers have accumulated vast experience in the use and development of digital education in various aspects of educational activities. Levin (2013) proposes a conceptual model of a new education system defined by three levels that affect education: social media as a new way of shaping public consciousness; personal online identity as a new way of personality formation, and Data Intensive Science as a new methodological paradigm. It is believed that these three phenomena originate from the evolution of three relevant areas where three fundamental phenomena, that is, social media, online self-identification and Data Intensive Science, have assumed great importance in the context of social media, whereby the abundance of diverse content that stimulates students' personality development online is a new type of education which fundamentally changes all its components: content, curriculum, and the learning environment. Walton (2015) addresses the relationship between results and value, selection processes and some attributes of information and explores how this relationship changes when moving from analogue to digital information. The article of Rosado (2006) explains that literacy does not only provide methods and tools for working with texts and figures in a specific cultural and ideological context but also makes a significant contribution to enriching the human thinking capacity with its subsequent transformation. This intellectual

enrichment occurs whenever humanity acquires new cognitive tools such as writing or such technical tools that digital technology has made possible. Belshaw (2012) notes the following eight components for the development of digital literacy: cultural, cognitive, constructive, communicative, confidential, creative, critical. and collective.

It should be noted that the analyzed papers do not sufficiently reflect the problem of studying digital education and its implementation mechanisms in the field of education that would take into account the specifics of national and regional educational systems of the Arctic Zone of the Russian Federation (AZRF), as well as in professional activities.

3. METHODOLOGY

The theoretical foundations of the research were laid by the works of Russian authors on e-learning, belonging to two schools of thought – NEFU Professor E.A. Barakhsanova (2017; 2018) and Herzen University Professor E.Z. Vlasova (2018) and learning using digital technology.

What we mean by transdisciplinarity is a high level of academic literacy, diversity of thought, and pansophy of an individual. In these terms, this approach virtually becomes a priority in the modern educational system, since it fully aligns with the principle of competency-based approach in teacher training. In this context, let us consider the concept of professional competence has been assigned numerous definitions. Based on the definition of Kodzhaspirova (2004), we define professional competence as an integral criterion for the quality of vocational training, professional activities, and personality traits, which characterizes a high level of human performance, work culture, and interpersonal communication, the ability to solve job-related problems in an proactive and creative way, as well as skills to manage social economic, legal, psychological and moral aspects of activity, the willingness to make managerial decisions, to be flexible and to adapt to a new operational environment. In this definition, the transdisciplinary essence of the competency concept as such is especially clearly in evidence, since its wording remains debatable in the educational theory. The immediacy of the problem is determined by the need to acquire certain competencies and holistic professional competence as a result of teacher training in college. As can be seen from this definition, the very principle of graduate's competence goes beyond the scope of science learnt by students; in addition, it affects the social, legal and other aspects of their activities, the objective (professional skills) and subjective (personal qualities) components. Khutorskoy (2003) determines professional competency as a certain personal characteristic, while competencies are a set of specific professional or functional characteristics, according to him. The concept of competency has become increasingly common at the common didactic, general pedagogical and methodological level, which is associated with its system-practical functions and integrative meta-subject role in education (Khutorskoy, 2003). According to him, the following components of all-objective (meta-subject) content of education are fulfilled, concentrated, and interconnected in the key educational competencies: real-life objects of the studied reality; universal cultural knowledge about the studied reality; general educational skills, expertise, and methods of activity. In the way of evidence, the author cites definitions of a “core competence” given by his colleagues, which can also be the rationale for the transdisciplinarity of basic concepts of the competency-based approach.

Based on the research analysis, the following basic approaches to the learning process in teacher training at Russian universities have been determined: knowledge (traditional), system-activity, humanistic, learner-centered, competency-based, archeological, and synergetic (Table 1).

Table 1. Approaches to teacher training in college education

Name of approach	Description
Knowledge	Education should be aimed at building solid academic knowledge in a future educational manager. Requirements for graduates involve acquisition of knowledge and skills to allow them to methodically process the content of education and to transfer it.
System-activity	Aimed at developing students' ability to design, forecast, and program their professional activities. The training is a triad that includes a system of formation of personal qualities and professional attributes, a system of professional educational culture, including mandatory formation of standard professional activity components and an interdependent system of their interaction.
Humanistic	It is believed that the identity of an educational manager comprises professional capabilities and individual psychological characteristics that are naturally interwoven. Therefore, such specialist training should be based on humanistic values realized and accepted by the individual as the essence of managerial and educational activities.
Competency-based	Education is focused on an internal change of value, need, and motivational structures of an individual, their interests, attitudes, standpoints, and personal meanings in mastering knowledge, skills, and methods of activity. It prioritizes personal goals and meanings in students' minds, while bringing social values and social meanings of mastering the system of competencies to a higher level.
Learner-centered	The need to form a value-based attitude to innovative practices as an individual and social mechanism of positive changes in college graduates, the implementation of which implies a creative and conscious transcendence beyond the traditional goals and methods of activity.
Acmeological	The manager training system in college should be focused on developing individual qualities and abilities that would ensure formation of a professional culture and development of professionalism
Synergetic	The possibility to take a new approach to tackling the problems of pedagogical system development, primarily considering it from the standpoint of "openness", co-creation and orientation towards self-development. Training a specialist with a wide range of professional skills results from the learning process organization. The learning process is a system that is in a state of flux and permanent self-development; the reality being cognized is a system containing multiple developing elements. Any learning system is a synergetic and self-organizing system.

The literature review shows that transdisciplinarity is aimed at attaining one of the most challenging objectives of the modern educational system—its transition to creative problem training and education methods that would ensure formation of a creative personality and development of their intellectual potential (Anufriyeva, 2009; Bulayeva, 2009; L. Darling-Hammond 2006; Foster, 2004; Zhidkikh, 2012; Miller, 2010; Mikhaylova, 2015; Kotova, 2016; A.D. Nikolayeva et al., 2016; Samsonova, 2009; Zaragoza 2017, Zeichner 2005).

We believe that the teacher training in the field of education requires taking into account and implementing certain principles to ensure formation of a creative personality of a future professional: 1) the principle of recognizing the inherent worth of a student's personality that is understood as an open opportunity in the learning process; 2) the principle of fluctuation (deviation) of creative thinking, whereby no functional system is stable, it inevitably accumulates deviations that can lead to chaos and even cause its disintegration; 3) the principle of inconsistency of the intellectual development process, whereby self-organization is possible with the system heterogeneity and with non-equilibrium structures, while self-development is understood as a self-actualization of the system's existing potential.

The need for the transdisciplinary approach to the learning process organization is conditioned by the fact that the subject system of higher vocational education is focused on independent academic disciplines that are clearly demarcated from one another, which moderates the process of establishing

and developing interdisciplinary links that are the most important imperative for the modern specialist training. Thus, interdisciplinary links are implemented through integrated courses that form the integral type of knowledge.

The use of transdisciplinary approach allowed for development of master's program "Corporate e-Learning" as an integrated system interconnected with the quality of education in college and providing an integrated approach to specialist training in the field of distance education, as well as training administrative officers and executive employees for the educational management authorities of various types.

The transdisciplinary approach involves a transfer of complete information blocks that give an overall picture of the world rather than that of a single phenomenon or problem. According to this principle, NEFU has developed the following training modules: Philosophical and Methodological Foundations of Pedagogical Research; Modern Information Technologies in Education; and Design in Education, including Research Activity.

Intramodular links among disciplines are an interdisciplinary synthesis of knowledge, illustrating profound changes in the methodological foundations of modern science, in the philosophical view of life, and in the very style of scientific thinking style. Thus, the module Philosophical and Methodological Foundations of Pedagogical Research reveals through studying the philosophy of science and education, contemporary issues in science and education, as well as the methodology of educational research. The course contents in this module draw on each other and at the same time serve to supplement each other.

We believe that the area for a professional fulfillment of masters' skills is not limited. A graduate may be sought after in national and municipal administration bodies, particularly, in state and regional education departments and scientific committees.

4. RESULTS

In order to study the students' beliefs about the teaching activities and to assess the formedness level of their professional, personal, and specialized competencies in learning, we conducted a survey among 250 students pursuing graduate studies in the following master's programs: Preschool Management, Project Management in Education, Innovative Processes in Education, Corporate eLearning, and E-learning Technology and Management at the NEFU Teacher Training Institute.

According to the survey results, 40% of the first and second students have no work experience, which indicates that the students have little idea of the job factors in their future professional engagement. 22% of the students have work experience up to one year long, the smallest percentage of respondents have from one to five years of experience—16% of students, 12% of the survey participants have from five to ten years of experience, and more than 8% of graduate students—over ten years (Table. 2).

The questionnaires included questions to evaluate the graduate students' competencies according to the degree of their indispensability for effective work in the field of education, as well as questions about their strengths and weaknesses as educational management graduates; they also had to outline proposals for improving their professional competencies.

Thus, when evaluating their managerial competencies, 87% of students respond that the ability to plan their activities and organize them is the most important along with having decision-making skills, 53% of students believe that leadership skills are required for efficient performance of an executive manager, while 18% of students mark delegation skills as mandatory competencies. In our

opinion, it is caused by the lack of management practice, whereby allocation of functions, delegation skills, and the ability to determine one's own leadership potential are required.

In evaluating the communication competencies, the students identified persuasion skills (87% of respondents), the ability to make contact (74% of respondents), and flexibility (71%), while only 51% of respondents mentioned the teamwork and listening skills as necessary competencies for successful managerial performance in education. We believe that this is caused by the lack of experience in real teams and insufficiently formed communicative skills. In evaluating personal competencies, the students noted responsibility (93%), the willingness for self-improvement (68%), and the ability to cope with stress (52%) as competencies critically needed by educational managers, while only 35% of students consider creativity as a mandatory competency of a teacher. Also, only the ability to apply knowledge in practice was identified by the students as a specialized competency necessary for a teacher (59%). The remaining competencies were estimated as optional by the students. Perhaps this is due to their poor awareness of a specific area of future professional engagement and the lack of practical experience.

When describing their strengths, the students mentioned communication skills, a creative approach to solving problems, a high career motivation, and the ability to plan and monitor performance. Among their weaknesses, the students pointed out the lack of job-related experience and inability to apply theory to the practice.

To develop the professional competencies and make changes in the learning process, the students mentioned the need to and proposed to increase the number of hours in on-the-job training program, to arrange internships with subsequent employment, to increase the amount of practical training with simultaneous reduction of classroom session time, and to organize practical training in the form of workshops targeting specific competencies. In addition, there were proposals to organize competence sharing meetings with successful educational managers from different institutions.

As an example regarding E-learning in machine learning can point to that once the data is available, we move into the iterative Data Science workflow of model building. This usually involves splitting the data into a training set and a validation set, trying different combinations of algorithms, and tuning their parameters and hyper-parameters. That produces a model that can be evaluated against the validation set, to assess the quality of its predictions. The step-by-step of this model training process becomes the machine learning pipeline.

Figure 1 shows how we structured the ML pipeline for a sales forecasting problem, highlighting the different source code, data, and model components and all of these are the product of E learning approach. The input data, the intermediate training and validation data sets, and the output model can potentially be large files, which we do not want to store in the source control repository. Also, the stages of the pipeline are usually in constant change, which makes it hard to reproduce them outside of the Data Scientist's local environment.

5. DISCUSSION

Based on the understanding of professional becoming in the field of project management in education as a complex process that should be comprehended from various perspectives, we have developed the educational module Project Management in the Context of Education Modernization that includes the following subjects: Strategic Development of Educational Systems based on Project Management, Expert Project Management in Education, Legal Framework of Project Management,

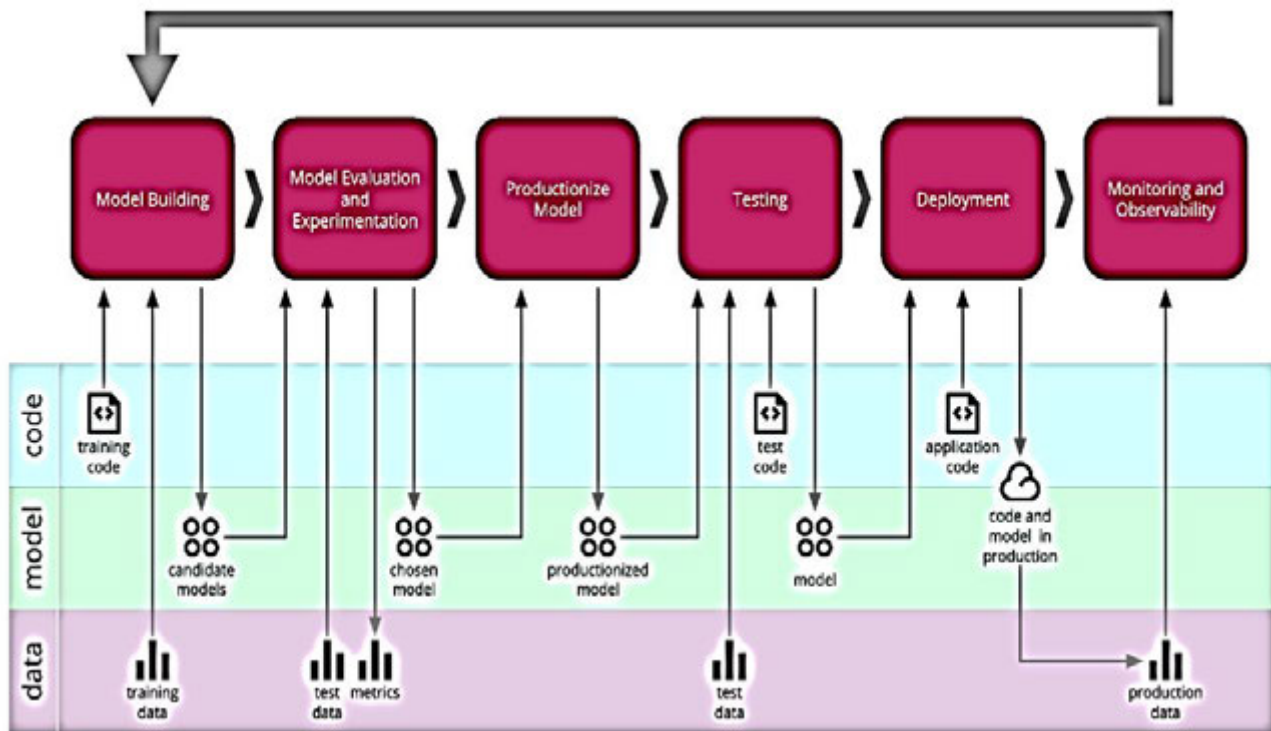


Figure 1: Machine Learning pipeline for our Sales Forecasting problem, and the 3 steps to automate it with DVC

The content and purpose of studying these disciplines allow one to create a modular integrated course with the aim to form all-objective skills in cognitive, evaluative, communicative, and creative activities, taking into account the competency-based approach and using the knowledge gained in the process of studying pedagogy, psychology, etc.

The choice of the proposed disciplines was agreed with the employer’s order, which is contained in the professional profile of educational project management masters.

In our opinion, this is expressed in the ability to design an educational environment that would ensure the educational process quality; in studying the state and potential of the controlled system and its macro- and microenvironment by using a suite of strategic and operational analysis methods; in research, organization and assessment of implementing the management process outcome using management technologies that comply with common and specific patterns of the controlled system development; in using the existing potential of the controlled system environment and designing ways to enrich and develop it to ensure management quality.

It is important for a future educational manager to develop personal and professional qualities that would contribute to the formation of readiness to hold personnel together, of communicative and leadership skills expressed in the ability to establish business contacts, to make a good impression, in openness to dialogue and discussion and focus on mutual consent; of the ability to stimulate the proactive attitude of employees for their professional fulfillment; the ability to ensure seamless interoperability of the team members.

These are exactly the personal and professional qualities of a future manager that will later help them build up conflict-free relationships with the staff, to hold the team members together and, basically, to proactively manage the staff. To ensure formation of these professional competencies, graduate students should develop individual learning routes for on-the-job training with the guidance

of an internship mentor.

This approach is based on self-study, self-organization, and self-management dominating their activities and consists in a stimulating or motivational effect on an individual aimed at their self-realization (Knyazeva, Kurdyumov, 2002).

Thus, when training future educational managers upon completion of the master's programs "Project Management in Education" and "Management in Vocational Education" at NEFU, the graduates are expected to have acquired common cultural, general professional, professional proper and specialized competencies.

Professional competencies are designed by types of activity in accordance with the Federal State Educational Standards of Higher Education 44.04.01 Teacher Training, where management, research and development, project and teaching activities have top priority.

Interdisciplinary integration is carried out on the basis of cyclic, interdisciplinary and intradisciplinary links and is a logically complete structure of multidisciplinary knowledge. Such integration does not merely supplement the content of one discipline with some knowledge from another, instead, it integrates them; it does not provide discipline-specific training, but rather activity-based that would form professionally important skills, abilities, and personal qualities (Vishnyakova, 2007).

The formation of scientific concepts on an interdisciplinary basis is facilitated by the following pedagogical, common didactic and psychological conditions:

1) study of individual academic disciplines coordinated in time, whereby each of them draws on the preceding conceptual framework and prepares students for efficient assimilation of concepts from the subsequent discipline;

2) the need to ensure continuity and consistency in concept development; concepts that are common to a number of disciplines should be continuously developed from one academic discipline to another, filled with new content, and enriched with new links;

3) unity in the interpretation of general scientific notions;

4) avoiding overlap of the same concepts in studying different subjects;

5) implementing a consistent approach to defining identical classes of concepts (Chebyshev, 1998).

When fulfilled, these functions allow for all-round education of students, which is why the educational function is an integrating function.

Integrated courses can become the most acceptable way of forming an integral type of knowledge with the existing subject-block educational system. Their development and construction methods vary and depend on the goal setting, the degree of involvement of the integrated disciplines in the general problem field, the nature of interdisciplinary links (direct or mediated) and, ultimately, on the authors' individuality of the developers.

Creating a module imposes the following mandatory requirements:

- time consistency in the study of individual academic disciplines, whereby each of them draws on the preceding conceptual framework and creates the basis for efficient assimilation of concepts on an interdisciplinary basis;

- continuity and consistency in concept development, providing for their continuous development, filling with new content, and enrichment with new links;

- unity in the interpretation of general scientific notions;
- implementing a consistent approach to the learning process organization in all the module components.

At the present stage, interdisciplinary integration is impossible without the education informatization. One of its focus areas is creating interdisciplinary network educational and methodical complexes consisting of a working syllabus of a subject; guidelines for practice and laboratory operations; assignments for individual student's work; assessment tools; sample questions to prepare for an exam or test; guidelines for writing a thesis (if included in the curriculum); a reference list and Internet resources; an online lecture course; materials for additional in-depth study of the discipline; criteria for assessing learning outcomes.

The complex of the above disciplines complies with the principle of initial course modularity, since it implies a clearly structured material, dynamic presentation, the relevance of the knowledge gained, the ability to apply various didactic tools, such as integrated lectures, design, etc.

The problem is that a future specialist must possess skills and professional mobility to promptly respond to constantly emerging changes in their practical activities and scholarly endeavor.

Thus, interdisciplinary integration is one of the most important areas for improving modern college education.

6. FINDINGS

The vocational training process is considered as a holistic and synergetic educational system centered on the personality of a student that is, in turn, also a complex self-organizing system.

It is necessary to emphasize that systems including several multiple-system components that constitute an integral synergetic system are actually implemented in the context of diversity, fragmentarity, randomness, spontaneity, and unpredictability.

Currently, the use of synergetic approach plays an enormous role in professional becoming of an educational manager, whereby the result of learning process organization is a trained specialist with a wide range of professional skills.

Some of these qualities are specific to a manager, while others are more general in nature and are considered mandatory for graduates of any teaching programs. When training an educational manager, the multi-variance stands for creating conditions of choice and providing each person with a chance to take an individual route to success in the college educational environment, thereby stimulating the independent choices and responsible decisions, ensuring the development of an alternative and independent path. More specifically, this choice is the ability to determine an individual education path and the rate of learning, to achieve different levels of academic literacy, to choose the type of institutions, academic disciplines and teachers, forms and methods of teaching, individual tools and techniques, drawing on synergetic principles of pedagogy.

7. AVAILABILITY OF DATA AND MATERIAL

Information used and generated from this work is available by contacting the corresponding author.

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