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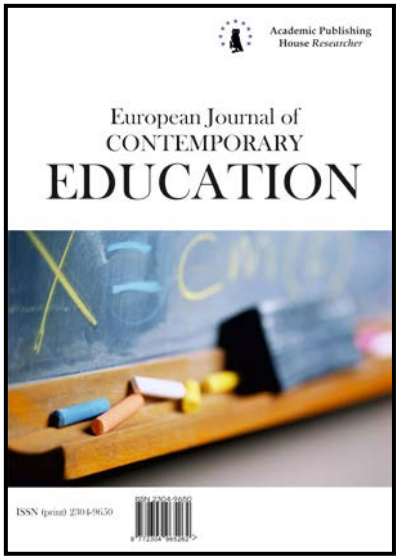

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The Development of the Foundations of Modern Pedagogy: Paradigmal and Methodological Aspects of Research

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Abstract

Changes in the various fields of knowledge influenced the pedagogical science. The article explains the structure of the foundations of modern pedagogy through paradigmal and methodological aspects. Bases of modern pedagogy include complex of paradigms, object and subject of science, general and specific principles, methods and technologies. Paradigmal analysis of bases of modern pedagogy showed that paradigms performed informational, instrumental and technological functions through connections with factors, approaches and principles accordingly. The research of methodological aspect of bases of modern pedagogics allowed to define the structure of the methodological system and main characteristics of the pedagogical system. In the article considers specific principles of optimality, optimization, adaptation and rules of their use in a pedagogical theory and practice.

Keywords: foundations of pedagogy, methodology, paradigm, educational system, educational process, the principle, optimality, optimization, interval, adaptation.

Introduction

During the second part of the 20th- beginning of the 21st centuries,, there have been substantial changes in various areas of knowledge, including pedagogy. In scientific and educational pedagogical literature, there is often used the phrase "the foundations of pedagogy", but the authors consider differently composition and structure of the basics of science, aspects of learning.

In particular, S.I. Hessen calls a philosophical method ("pedagogy is applied philosophy") the basis of pedagogy: it is a foundation upon which pedagogical creativity, expertise, systems and methods can be built [1].

Educational psychology is the study of patterns of mental activity in training, education, development of social experience (P.Y. Galperin). Educational sociology which investigates interaction between main factors of education: social environment, activities of an individual, purposeful activity of special institutions (governmental, non-governmental) in the process of identity formation has a significant influence on the development of pedagogy.

At the turn of philosophy, pedagogy, psychology, sociology, theory of social communication and history, the pedagogical process of cognition (thinking) is studied. It allows getting into the cause-effect relations of the educational process, analyzing activities, views, experiences, finding science-based explanation of problems and their solutions, as well as predicting results of the paper [2, p. 252]. Recent studies have shown that educational knowledge has features that allow you to explore the pedagogical phenomena and objects and thus affect the foundations of science. In particular, we are talking about characteristics, such as systemness, multilevelness, optimality, adaptability, harmony, conclusiveness, structural and functional completeness. For the analysis of the scientific foundations of modern pedagogics, we use the above characteristics of pedagogical knowledge.

Materials and methods

The purpose of the article is to determine the structure of the pedagogical principles, to implement the aspect analysis of the pedagogical principles in the framework of evaluation the impact of characteristics of pedagogical knowledge on their development. This goal attainment involves the following tasks: support of the extended structure of modern pedagogy foundations; to define research aspects of the science foundations – paradigmatic and methodological; performance of aspect analysis of pedagogical fundamentals; identification of the impact of the pedagogical knowledge characteristics on their development with the emergence of new paradigms, approaches, principles.

Discussion and results

An object, a subject and methods are considered to be components of a science. For example, complex systems of various nature (technical, economic, biological, etc.) are the object of cybernetics, which appeared in the middle of the 20thcentury on the basis of scientific and technological progress, management processes is the subject, and modeling - the main method. These components are interrelated as follows: management processes take place in the system which is a condition for their implementation; modeling is necessary to determine the characteristics of the system according to its model, and to select the appropriate parameters of management.

There are several different points of view about nature of the object and the subject of pedagogy. Well-known Russian scientist V.P. Bespal'ko, whose ideas we share, says that the object of pedagogy is a person of any age, and the subject - teaching system as a condition for providing the person with learning processes, education, development and socialization [3, p. 463-464].

A.N. Aleksyuk notes that it is necessary to make clear the difference between the object and the subject of the science and the object and the subject of the investigation [4, p. 375]. The processes in the educational system are the object of the investigation in pedagogy in most cases, and the best (most effective) conditions for their implementation are the subject. So, in T.V. Lavrik's thesis, the object is the training of the university undergraduates in distance learning, and the subject - pedagogical conditions for optimization of distance learning bachelors, who study "System Sciences and Cybernetics" course at the university [5].

Recently, there has been expansion of components of the foundations of education influenced by pedagogical knowledge development. Theoretical and methodological system is considered as one of the foundations with such components: a set of paradigms; object and subject; general principles (philosophical methodology); approaches - theoretical concepts which can be used in the majority of sciences; specific principles, as well as ways to solve raised issues (modeling, methods of mathematical statistics); stages of the pedagogical process and the appropriate means [6, p. 204-205].

Let's take a closer look at the components that form the basis of modern pedagogy. The paradigm (example, sample) is: 1) a theory (model of formulation) taken as a sample of solving research tasks defined by the scientific community; 2) methodological principles of the unity of the scientific community (schools, trends) that greatly facilitates their professional communication [2, p. 248].

If a paradigm is a component of the foundations of science, it must be linked with other components – theoretical, methodological, and technological.

Modern pedagogy is based on a set of paradigms: knowledge, cultural, humanistic, administrative, social and communicational, societal, anthropocentric, technological [7]. Each paradigm is associated with an appropriate approach (systemic, cultural, humanistic, cyber, social, communication, technology) and through it affects the questions raised. The approach and method provide the instrumentality of the paradigm, its relationship with technology of the pedagogical process.

For example, knowledge-based paradigm rests on the systemic nature of educational facilities; system approach allows presenting educational system as a set of sequentially arranged components (teacher, objectives, principles, contents, methods, forms of joint activities, students) connected by backward and forward linkages. The main characteristics of the educational system are as follows: integrity, purposefulness, completeness (structural, functional), a large amount of diversity, stochastic processes, multilevelness (individual, group, of the institution, the educational system), multivariability (organization, management, communication), optimality, adaptability, harmony.

The basic method of construction and study of the educational system is a simulation. The following types of models are used: multiple, graph, structural and functional, network. Multiple model includes a plurality of components of pedagogical system arranged in a certain order, but it does not reflect the links between them.

Graph and structural and functional models reflect the components of the system, the order of their arrangement, forward and backward linkages between them. The network model of the pedagogical system displays all the above-mentioned characteristics, as well as its multi-level and multi-dimensional ones.

The analysis of the paradigms demonstrates that their combination is fully functional as it describes the static and dynamic teaching facilities, namely: knowledge, cultural, and humanistic paradigms describe statics; management, social and communication, and technology paradigms - dynamics.

A study of the development of the educational foundations is performed by means of aspect analysis. [8]. Methodological and paradigmatic aspects are selected due to the fact that it is in these areas, recently, pedagogy developed rapidly.

The study of the paradigmatic aspects of the educational foundations shows that the paradigm performs an information function through the connection with the factors, in particular: with objective factor - through societal function; with subjective factor - through knowledge, cultural, administrative, social and communication, and technological functions; with personal factor - through humanistic; and with human factor - through anthropocentric function.

As noted above, the paradigms in the set allow a review of educational objects in statics and dynamics. To perform this task at the beginning of the 21st century, two paradigms - management and social and communication - are established [9; 10].

The essence of management paradigm can be expressed by the following key theses: educational system as a condition for the implementation of the pedagogical process is differentiated into three interrelated subsystems: organization, management and communication. An integrated educational system is a process because subsystems are the conditions of the steps of the pedagogical process: the reference, cognitive and conversive, control and reflexive.

The optimality paradigm, associated with management paradigm, allows the criteria (culture of activities, culture of management – Y.V. Yaresko) and constraints (time, material, intellectual) to be proved and thus to pose the optimization problem. The paradigm of adaptation, also associated with the paradigm of management, can consider, for a criterion, a gradual transition from direct management to co-management and self-management in accordance with stages of the pedagogical process.

Application of the paradigmatic development aspect of the fundamentals of pedagogy allows us to conclude that during the above period the subject and the object of pedagogy have changed (V.P. Bespal'ko), the methodological system was supplemented by two paradigms (administrative, social and communication); it is discovered that the paradigm takes an intermediate position between the factor as a source of information and an approach that allows for an instrumental function of the paradigm - to influence the development of the components of the pedagogical systems and technologies of the pedagogical process.

Paradigmatic aspect considering the basics of pedagogy is closely related to the methodological aspect, which purpose is to justify the features of the methodological principles of the science (research). Definition of educational methodology is outlined by the authors of the article [11]. Educational methodology is the study of methods of organization (the impact on the person), management (impact on activities) that occur in the process of intercourse of subjects of pedagogical system for the reception, conversion, assimilation, preservation and use of information, providing knowledge and transformation of educational objects (pedagogical system, pedagogical process, pedagogical situation, pedagogical fact, etc.). An analysis of this definition indicates that the teaching methodology is considered in relation to those objects which are studied by means of it.

Pedagogical objects are multi-dimensional, so a set of their perception methods is represented in the form of the three taken together: the organization, management, and communication. In this case, the educational methodology is characterized by adaptability which provides correlation of the stages of the technology to the methods of organization, management, and communication, respectively.

Definition of educational methodology shows that in addition to technological display, there are such criterion characteristics of the methodology as: versatility, instrumentality, reflexivity, focus on problem solving and integration.

At this point of pedagogy development, when the processes of differentiation leave behind the integration processes, come first: a link between theory and practice (universality); implementation in practice of integration of pedagogical systems of organization, management, and communication (instrumental); integration of the components of pedagogical systems for solving specific problems; provision of continuity between the levels of the educational system; realization of the relationship between goals, objectives, stages of educational process, and results.

The analysis shows that methodological knowledge is a hierarchical system which includes: a philosophical, common scientific, specific scientific, and technological levels. Let us consider the methodological system components that are applied in modern pedagogy and scientific pedagogical research.

The philosophical methodology includes approaches (principles): objectivity, clarity, consistency and historicity, subjects' activity in understanding and transforming objects, affiliation with practice, determinism, isomorphism, ascent from the abstract to the concrete, systemic approach. Specific approaches that are used in pedagogy are the principles of optimality, optimization, adaptation, and interval.

System principle is used to build different models of pedagogic systems that reflect its characteristics: the completeness of components, their order, a set of links (direct, reverse), multi-level and multi-dimensional structure. These characteristics should be supplemented with new ones, namely: optimality, adaptability, interval.

The essence of the optimality principle in pedagogy (by S.U. Goncharenko) is to achieve, by a student or a teacher, maximum cognitive or educational effects with minimum cost of material resources and effort (criteria) for a limited time (limit). Therefore, the principle of optimality requires the implementation of the optimization problem formulation for a teaching object - the definition of optimality criteria and restrictions. For example, T.V. Lavrik defines the optimization object as the system of distance training of university undergraduates; the optimality criteria - the

ability to self-organization and self-management, the quality of knowledge and skills in the disciplines of professional cycle; and the limitations – active work time with teaching materials on the computer [5].

Comparison of two formulations of optimization problems shows that time is the limitation; one of the criteria is the desire to maximize the training effect; the difference is in the second criteria: according to S.U. Goncharenko, criterion tends to the minimum value, while by T.V. Lavrik – to the maximum. From our point of view, if the criteria have different directions (max, min), it is more difficult to achieve consensus in solving optimization problems in social area. In this case, the second criterion should be considered as a limitation. It is a decision taken in the process of the facility optimization in technical area (T.O. Dmitrenko).

Comparison of optimality and optimization principles shows that the first one is directed to a system and requires the determination of criteria and constraints. The principle of optimization, unlike the first one, is aimed at the achievement of the optimum system. Principles of optimality and optimization are related to the law by which the system tends to reach an equilibrium, and this state is an extreme (V.A. Oleynikov).

The principles of optimality and optimization are realized according to a set of rules:

1. Analysis of the situation and definition of the characteristics of the educational system.
2. Justification of optimality criteria and restrictions.
3. Development of pedagogical conditions of optimization, taking into account the characteristics of the educational system, criteria, and restrictions.
4. Clarification of educational system components in accordance with optimization of educational conditions.
5. Development of a model of the pedagogical process with key components: target; factors that affect the educational system; contradictions that arise under the influence of the factors; mechanisms that reduce action of contradictions; stages of educational technology; facilities that are used in each stage; results.

Optimization of the educational system for the selected criteria and restrictions is a condition for increasing the efficiency of the pedagogical process. An analysis of all above rules shows that they can be divided into two groups: the first and the second rules are relate to the implementation of the principle of optimality, the rest - to the optimization principle. All the rules are an algorithm for solving the optimization problem, while the first two being a statement of the problem.

Let us consider the second specific principle - the principle of adaptation. This term usually refers to the area of biology in which the process of adaptation is the adaptation of the structure and functions of the body and its organs to the environmental conditions. However the concept of adaptation is used not only in the natural sciences but also in the humanities, in particular, when matter concerns human adaptation to the environment. In engineering sciences (engineering cybernetics), adaptation is interpreted as the ability of technical devices or systems to adapt to the environmental conditions that change, or (and) their internal changes, thereby increasing the efficiency of their operation. Cybernetician L.P. Krayzmer considers adaptation broadly as the process of changing properties of the system, allowing it to reach a certain, often optimal, or at least satisfactory operation under initial uncertainty and external conditions that change [12]. Under the systems' properties, the author understands its susceptibility to external influences, some of the parameters, structure, and functioning algorithm. It is significant that the author notes the relationship between adaptation and optimization. In our opinion, adaptation is a process that changes the parameters, structure, and algorithm. This process can be run well if the criteria reaches the optimum value under certain restrictions.

Developing the concept of adaptation at the interdisciplinary level, V.I. Shkinder formulates the following definition: "Adaptation is an addressed system interoperability of different levels, in which there is an exchange of matter, energy and information, and their mutual enrichment and development" [13, p. 48-59]. The analysis shows that this definition is specifically designed for systems of any nature, hierarchy levels, resources, along with the guidance for the enrichment and development of systems that adapt.

We believe that L.P. Krayzmer and V.I. Shkinder considered those systems as one-dimensional. When it comes to adapting the educational system, it should be studied as a three-dimensional (organization, management, communication), whose main resource is information, and a result is an adaptation (suitability) to external and internal influences.

The above three types of adaptation definitions are designed to the following levels of abstraction: the empirical (in biology - adaptation of the organism to environmental conditions); theoretical (in cybernetics - changes in the sytem properties during its operation: parameters, structure, algorithm); methodological (the adaptation of a multidimensional, hierarchical system of any nature to external and internal influences). Empirical definitions are based on facts, theoretical - on algorithms of functioning, and methodological - on system models.

Thus, depending on the level of abstraction, we have three definitions to adapt the educational system:

- empirical - adaptation to external influences on the part of the objective and subjective factors, as well as internal - personal and human factors - in order to overcome the contradictions and improve the efficiency of the pedagogical process;
- theoretical - adaptation to internal and external impacts through changes in structure and functions of the system and its components to increase the efficiency of the pedagogical process;
- methodological - adaptation that occurs through integration of subsystems of the organization (impact on the personalities of the subjects), management (impact on the subjects' activity), and communication with the joint productive activity to improve the efficiency of the pedagogical process.

The principle of adaptation is associated with such laws:

- universal - any system is aimed to maintain the dynamic equilibrium by resisting internal and external factors, and this condition can be optimal;
- general - any system adapts to the impacts (internal, external) by changing the structure, function, and operation algorithm;
- private - educational system adapts to changes in the objective, subjective, personal, and human factors through a corresponding organization as an impact on a person (system-forming factor in the indicative stage of technology), management of subjects (system-forming factor at the stage of knowledge and transformation of objects), and communication with joint productive activity of the subjects at the stage of monitoring and reflection.

Application rules for the principle of adaptation:

1. To carry out the differentiation of the educational system into three subsystems: organization, management, and communication.
2. To consider the impact of factors (objective, subjective, personal and human) on the subsystems of the organization, management, communication and to reveal contradictions.
3. To carry out the integration of educational systems based on specified criteria and restrictions as conditions for continuous pedagogical process with the following stages: indicative, informative and transformative, and check-reflexive.

Adaptability of the educational system is seen as the ability to maintain an efficient (optimal) state of functioning in accordance with the criteria and restrictions by a change in the structure and functions (system, subsystems) that are under the influence of objective, subjective, personal, and human factors.

The Psychology Dictionary defines adaptability as the functioning tendency of a targeted system, i.e., a correspondence between the objectives and the achieved results (equilibrium - homeostasis, enjoyment, practical benefits, success) [14, p. 11-12].

The principles of systematic, structural and functional completeness, optimality, optimization, and adaptation are linked as they are designed to deal with complex systems which components are people, that is, coherent, purposeful. Adaptation should be considered as a means of optimization, while optimization is a special case of adaptation, where the result of the process is the best available system functioning for present conditions. Educational system usually aims to achieve planned results, so it can be considered as adaptive.

In the second half of the 20th century, a philosopher F.V. Lazarev substantiates the principle of interval approach associated with the consideration of complex systems of various nature by building their models. The scientist proves the need for a new principle for the achievements of physics at the beginning of the 20th century (quantum-mechanics). F.V. Lazarev introduces the concept of the interval approach which not merely captures one side or another of the object, but, within the interval, the object is an integrity – a "possible world" in the structure of reality which determines the existence of the object as a "partial" in a particular embodiment of its actualization

[15, p. 127]. Any object may be considered as a one-dimensional by using the concept of the "interval"; a set of models, developed at certain intervals and form a model of the object.

Application rules for the principle of intervals in the study of the educational system considered a multi-dimensional (multi-interval):

1. To present the educational system as a collection of organizational, management and communication subsystems.

2. Subsystems of the educational system are considered as intervals.

3. At each interval, a subsystem of the educational system is an integrity with all components and relations that perform the corresponding functions.

4. Integration of subsystems takes place on the basis of providing a holistic pedagogical process aimed at achieving the goal which consists of indicative, cognitive and conversion, control and reflexive stages.

Conclusion

1. Structure of the pedagogical principles consists of a set of paradigms (knowledge, cultural, humanistic, managerial, communication and social, societal, anthropocentric, technological); an object (a person of any age); a subject (a pedagogical system as a condition for the pedagogical process realization); common principles (objectivity, clarity, historicity and consistency, subjects' activity in understanding and transforming objects, practice relations, determinism, isomorphism, ascent from the abstract to the concrete, systemic); approaches (systemic, culturalogical, humanistic, cybernetic, social and communication, technological); specific principles (interval, optimal, optimization, adaptation) and methods (simulation of pedagogical objects, statistical methods); pedagogical technology (a set of pedagogical process steps and corresponding facilities).

2. Paradigmatic aspect of learning the foundations of pedagogy showed that paradigms carry out the information function through the connection with factors (objective, subjective, personal and human); instrumental function - through the connection with approaches; technological function – through the connection with principles and rules. Consequently, the management paradigm is associated with paradigms of optimization and adaptation, cybernetic approach (optimal control, adaptive control), principles of optimality, optimization and adaptation, as well as the relevant regulations.

3. A study of the methodological aspect of the pedagogical foundations gives an opportunity to develop components of the methodological system that include philosophical and specific principles as well as characteristics of the educational system: the completeness of the components, their order, a set of relationships and their direction (forward, backward), multilevelness, multidimensionality, optimality, adaptability, interval, and harmony.

4. The principle of optimality is aimed at the system (optimal educational system as a condition for achieving effective educational process) and requires the creation of its models, study of the criteria and restrictions. The principle of optimization is aimed at the process of achievement of system's optimality. Rules for implementation of the principles have been developed: the principle of optimality requires an analysis of the situation (peculiarities of the educational system and the industry specifics in which professionals work), substantiation of the criteria, restrictions; the principle of optimization is realized by such rules: the development of pedagogical conditions of optimization, specification of components of the pedagogical system, the development of the model of the pedagogical process and its implementation in practice.

5. The adaption in pedagogics is considered as a three-dimensional object (levels: empirical, theoretical, technological). The principle of adaptation is associated with the universal, general, and special laws; the rules for application of the adaptation principle in pedagogy have been formulated; the definition of the educational system adaptability has been developed.

6. The rules for the application of the Lazarev's principle of intervals for complex pedagogical objects (for example, the educational system) have been grounded. The essence of the principle of intervals is that the subsystems of the educational system (organization, management, and communication) are considered at each interval as an integrity; their integration is to ensure the integrity of the pedagogical process.

Further studies towards the development of the modern pedagogy foundations will be conducted with the help of signs and symbols and managerial aspects of their consideration.

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