Chapter 12

Scientific and Theoretical Prerequisites for Improvement of Modern Pedagogical Technologies

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Additional information is available at the end of the chapter

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Abstract

It is established that pedagogy performs the same functions as any other scientific discipline: description, explanation, and prediction of phenomena of that area of reality it studies. However, in the social and humanitarian sphere, it has its own characteristics. Pedagogical science cannot confine itself to objective reflection of what it is studying. Pedagogical science is required to influence the pedagogical reality and to transform and improve the pedagogical process. Therefore, it combines two functions: scientific-theoretical and constructive-technical. Scientific-theoretical function is a reflection of the pedagogical reality as it is. The constructive-technical one is a regulative function that reflects the pedagogical reality as it should be. The pedagogical process is closely connected with the application of teaching technologies. The application of teaching technologies presupposes organizational arrangement of all dependencies of the learning process, alignment of its stages, identification of conditions for their implementation, and correlation of methods, forms, measures, and means of training during conducting classes with capabilities of the teacher and students.

Keywords: pedagogy, pedagogical technologies, subject and object of pedagogy, types and features of building pedagogical technologies

1. Introduction

This chapter consists of seven sections: "Introduction," "Functions and tasks of pedagogy," "Categories of pedagogy," "The system of pedagogical sciences," "Connection of pedagogics with other sciences," "Connection of pedagogy with practice," and "Characteristics of pedagogical technologies." In each section, the basic definitions and concepts are related to pedagogy, as a science.

In the introduction and in Section 2, the definition of pedagogy as science. The functions and tasks of pedagogy in the modern world. In Section 3, the definitions of the main categories of pedagogy. What is the education, development, education, training of people, and also paid special attention to such categories as self-education, self-education, pedagogical process, and pedagogical interaction. Sections 4 and 5 show the differentiation of pedagogy by industry and its relationship with other sciences. Section 6 illustrates the relationship between pedagogy and practice and in the final Section 7, the characteristic of modern pedagogical technology.

Improving the modern pedagogical technologies is closely connected with development of pedagogy as a science. The word "pedagogy" (Greek *paidagógiké*) is understood in different ways. First, pedagogical science is called in such way. Second, according to a different opinion, the art of upbringing is called in such way. Sometimes, pedagogy is understood as a system of activity, which is designed in educational materials, methods, and recommendations [1–3].

The multi-meaning term "pedagogy" means:

- Various ideas, accounts, views on goals, contents, and technologies of upbringing, training, and education
- Area of scientific research related to upbringing, training, and education
- Specialty, qualifications of teachers, their practical activities in upbringing, training, and education
- Academic subject
- Art, virtuosity, and mastery of teachers in education and upbringing

Yet, despite different interpretations, pedagogy is, first of all, *pedagogical science*, the field of scientific disciplines on upbringing, training, and education of a person.

2. Functions and tasks of pedagogy

It is accepted to distinguish between the object and the subject of science.

The object of science is an area, a part of reality, which the given science studies, its cognitive field.

For pedagogy, such a cognitive field, the main *object*, is a person, from the point of view of its upbringing, formation, development, and education in the course of the pedagogical process. Pedagogy learns its object, a growing, developing person, in integral fusion of the natural, social, and individual, personal in it, in its essence, formation, abilities, and activities.

The subject of pedagogy is the essence and laws of the pedagogical process in general and constituents of its processes in particular, as well as formation and development of personality in them. Thus, this is a *pedagogical process* as a special kind of interaction between people [4–7].

Its modern content includes a whole system of interrelated processes: training upbringing, self-improvement, development, education, and psychological preparation [8, 9].

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The object of pedagogy as a practice in modern understanding is the interaction of participants in the pedagogical process, and its *subject* is goals, contents, and ways of interaction of pedagogical technologies.

Pedagogy is a science that studies the laws, principles, methods, means, forms, contents, and technologies of organization and implementation of the pedagogical process as a factor and means of a human development throughout its life.

Pedagogy carries out the same functions as any other scientific discipline: description, explanation, and prediction of phenomena of that area of reality it studies. However, in the social and humanitarian sphere, it has its own characteristics. Pedagogical science cannot confine itself to objective reflection of what it is studying. Pedagogical science is required to influence the pedagogical reality and to transform and improve the pedagogical process. Therefore, it combines two functions: scientific-theoretical and constructive-technical. Scientific-theoretical function is a reflection of the pedagogical reality as it is. The constructive-technical one is a regulative function that reflects the pedagogical reality as it should be.

Pedagogy studies the following *main problems*:

- Identification and analysis of the essence and laws of the pedagogical process, development, and formation of the personality and their impact on upbringing and education
- Definition of goals of upbringing, training, and education
- Development of the content of upbringing, training, and education
- Research and development of methods and technologies of upbringing and education

In pedagogical science, there are several bases for classifying its tasks. According to one of them, the permanent and temporary tasks of pedagogy are distinguished.

The *permanent* tasks are:

- Identification of laws in the field of upbringing, education, and training and management of educational and upbringing systems
- Study and generalization of practice and experience of pedagogical activity
- Analysis of positive and negative trends within the pedagogical process and its structure
- Introduction of modern pedagogical and information technologies into practice
- Development of new methods, forms, means, systems of education, upbringing, and management of educational structures
- Prediction of development of pedagogical theory and practice
- Introduction of results of pedagogical research into practice

The *temporary tasks* of pedagogy are dictated by needs of practice and science itself. In particular, it is the creation of electronic textbooks and their libraries, development of state educational standards and requirements, introduction of automated training systems and programs, analysis of typical conflicts in the "teacher-student" relationship, etc.

3. Categories of pedagogy

The main categories of pedagogy reflect its essence. They include upbringing, development, education, and training of people. Significant categories are self-education, self-improvement, pedagogical process, and pedagogical interaction.

Let us consider the essence of these categories.

Upbringing has two meanings in the pedagogical science. In the broad sense, it is the process of targeted influence on a person. The goal of education is accumulation by a human of a social experience necessary to live in society and formation of a certain system of values. In this case, upbringing is seen as a purposeful process of forming the intellect, spiritual, and physical forces of an individual, preparing it for life and active labor activity.

In the narrow sense, upbringing is a systematic, purposeful influence on people being educated in order to form certain specific qualities, views, beliefs, desired attitudes toward people, and phenomena of the surrounding world. Upbringing is also interpreted in the narrower concrete sense, as a solution to a certain educational task.

Self-improvement is the conscious and purposeful work of a person in shaping desired traits, personality qualities, and behaviors.

Training is a purposeful process of interaction between teachers and students in transfer and assimilation of social experience, formation of knowledge, skills, and abilities. In this case, activity of teachers is called teaching, and activity of students is learning [10, 11].

Training in a certain sense differs from upbringing by the degree of organization; the training process is defined more clearly and is characterized by the usage of special means of teaching.

Education is the process and result of mastering the levels of cultural heritage defined by society, mastering the system of knowledge, skills, and abilities, as well as forming a worldview, moral, and other qualities of the individual on their basis and development of creative forces and talents. Education is a pedagogically organized process aimed at the formation of a high level of individual development of a human.

Self-education is a purposeful and meaningful work of a person, connected with the search and mastering of knowledge.

Development is the process of becoming, formation, and improvement of a human's personality under the influence of external and internal, controlled and uncontrolled, and social and natural factors, among which purposeful education and upbringing play a leading role. In a narrower sense, development is understood as improvement of intellectual, physical, and other personal qualities.

The pedagogical process is a specially organized interaction of teachers and students in order to solve tasks of education, upbringing, education, and personal development. It is a chain of individual pedagogical interactions.

Pedagogical interactions are intentional mutual contacts of a teacher with a student, aimed at changes in behavior, activity, consciousness, psyche, and attitude of the student to the surrounding world.

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The concept of "pedagogical interaction" denotes the most significant specific feature of practical pedagogy and its *bilateral, subject-subject* nature. At the same time, a student is not simply present within the pedagogical process; he/she, like a teacher, acts as a participant or, more precisely, interacts, as he/she actively responds to actions of the teacher, and the latter builds further work taking into account the student's response to these actions. In the concept of "pedagogical interaction," the activity of the student and presence of interaction between its participants as subjects of the pedagogical process as a whole are emphasized. This is the specificity of the modern subject-subject approach to the pedagogical process.

4. The system of pedagogical sciences

Developing, every science enriches its theory, is filled with new content. At the same time, scientific differentiation of the most important research directions is carried out. The level of development of science as a whole is evaluated according to the degree of research differentiation.

At present, the term "pedagogy" refers to an entire *system of pedagogical sciences* or branches of pedagogy. They are:

1. *General pedagogy* is *a basic scientific discipline* that studies basic laws of upbringing and education, theory of the pedagogical process, need, possibilities, and ways of its implementation.
2. *History of pedagogy* studies the evolution and the current state of pedagogical systems, goals, theory, and practice, the development of pedagogical learning, and the ideas for upbringing and training within different historical epochs.
3. *Comparative pedagogy* considers laws of functioning and development of educational and upbringing systems in different countries by comparing and finding similarities and differences.
4. *Didactics* is a theory of learning, mainly studying content and technologies and methods of teaching and learning in educational institutions.
5. *Private pedagogical methods* study laws of teaching and studying specific academic disciplines in all types of educational institutions.
6. *Theory of upbringing* considers laws, principles, methods, means, and forms of upbringing.
7. *Age pedagogy* studies peculiarities of upbringing, training, and education of a person at different stages of his life path, depending on specifics of educational activity within certain age groups. In particular, *preschool pedagogy, school pedagogy, pedagogy of vocational education, pedagogy of secondary specialized education, higher school pedagogy, and adult pedagogy* are distinguished.
8. *Professional pedagogy* studies laws, carries out theoretical justification, and develops principles and technologies of education and upbringing of a person, oriented to a specific labor and professional sphere of activity. It engages in problems of improvement of professional skills, retraining of workers, and acquisition of a new occupation at mature age.

Depending on the type of professional activity, *engineering*, *production*, *medical*, *theatrical*, *sports*, *and military pedagogy* are distinguished.

9. *Social pedagogy* contains theoretical and applied developments in the field of social upbringing carried out both in the fostering institutions and in various organizations, for which it is not a leading function, and explores upbringing forces of society and ways of their actualization by integrating capabilities of public, state, and private organizations.
10. *Special pedagogy* develops theoretical bases, principles, methods, forms, and means of upbringing and education of a person having deviations in physical or mental development.
11. *Correctional pedagogy* studies laws and causes of deviant behavior and develops ways and methods to overcome such behavior.
12. *Correctional labor pedagogy* contains theoretical justification and development of a practice of rehabilitation of persons in custody for crimes committed.

5. Connection of pedagogics with other sciences

One of the most important characteristics of any science is its connection with other scientific branches. This serves as an important source of development and is manifested in three aspects: first, some sciences in relation to other ones fulfill worldview and methodological functions; second, content of knowledge of certain sciences helps other ones to penetrate deeper into the subject of research; and, third, within the process of interconnection of sciences, their mutual enrichment by methods of research takes place.

Among the first, there were links established between pedagogy and philosophy, and psychology, which remain an important condition for development of pedagogical theory and practice.

First of all, pedagogical science is connected with *philosophy*, which, in relation to it, serves as a worldview and methodological basis. Philosophical ideas contributed to creation of pedagogical concepts and theories; they set the direction of search and serve as the methodological basis of pedagogy, being the basis for understanding goals of upbringing and education.

Many outstanding scientists-teachers turned to philosophical knowledge within the process of solving scientific problems. Development of the theory of education based on a philosophical ethical concept by the German teacher *Johann Friedrich Herbart* (1776–1841) is indicative in this regard. Public and personal moralities, according to the said scientist, rest on eternal and unchanging moral ideas. The main goal of education, in his opinion, resolves into assimilation of these moral ideas.

In the history of philosophy, two opposing concepts are distinguished, which influenced a solution of pedagogical problems. One of the concepts associated with Socrates and Plato, who believed that natural content of a human is decisive in its development, is that external conditions play a secondary role in its formation. Democritus and Epicurus adhered to the opposite point of view. They believed that the external conditions and circumstances of life

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exert a determining influence on development of a human. These two approaches to solving the most important pedagogical problem related to human development remain today as well.

A special place in the development of pedagogical science, methodology of its research, is occupied by dialectics as the philosophical basis of cognition of the surrounding world. Its content is composed of dialectical principles, laws, and categories.

Principles of dialectics reflect the essence of a human, its inner world, and the place in the surrounding world. They reveal the strategy of scientific and pedagogical knowledge and give the most general guidelines in this complex process. For example, the philosophical *principle of universal communication* reflects the complexity of the surrounding world and its phenomena, including pedagogical ones. It focuses on the analysis of pedagogical phenomena in the relationship not only with their internal elements but also with external factors and conditions, without which a reliable result of scientific research cannot be obtained. Other philosophical principles perform a similar function. Thus, the *principle of development* indicates the need to study pedagogical phenomena in their dynamics and historical and logical sequence. The *principle of determinism* requires discovery of causality, the analysis of the phenomena under study through the prism of factors conditioning them, etc.

Laws of dialectics possess the role of mechanisms, by which it is possible to identify and formulate pedagogical problems, predict development of pedagogical phenomena, and find ways of solving pedagogical problems.

The law of unity and struggle of opposites allows identifying contradictions in a pedagogical phenomenon, without which it is impossible to formulate a scientific problem, and this is an important step on the way to its solution. Examples of contradictions as the basis for formulation of a scientific problem are the contradictions between existing methods of teaching and new requirements for the learning process, conditioned by increasing the needs of training specialists.

The law of mutual transition of quantitative and qualitative changes allows predicting changes in pedagogical phenomena, to study the mechanism of their development. If due to the first law (of unity and struggle of opposites), it is possible to formulate a scientific problem; the second one helps to put forward a hypothesis on its solution and to work out ways of proof. Knowing the content of one of the central categories of the law under consideration, "measures," we perceive that achievement of new quantitative characteristics of pedagogical phenomena is impossible within the framework of the old quality. The law under consideration also provides the key to understanding the need to introduce new teaching technologies into the pedagogical process.

The law of the negation of the negation allows imagining the direction of development of pedagogical phenomena from simple ones to complex ones, observing a progress in this, seeing correlation between the new and the old, as well as many other aspects. With the help of this law, it is possible not only to predict changes in phenomena but also to orient oneself correctly in the choice of ways and means of purposeful influence on them. Thus, it is possible to explain the relationship between the class-lesson system developed by J.A. Comenius and its modern models, as well as the way of preserving valuable elements of the system in the course of its evolution.

One of the most contemporary pedagogical problems is correlation between traditional, classical forms and methods of teaching and education and nontraditional, innovative ones. The key to solving this problem is, to a certain extent, laid down in the law under consideration. In particular, its methodology requires continuity of and compliance with the boundaries of application of certain forms and methods in the process of education and upbringing.

Psychology, especially age and pedagogical, is particularly important for solving specific problems of education and upbringing. There are several most important links between pedagogy and psychology. The main one is the subject of research of these sciences. Psychology studies laws of development of a human psyche; pedagogy develops methods, ways, and means of its upbringing and development of personality. Upbringing, education, and training are nothing like development of psyche.

The second important point is commonality of research methods. The existence of a close connection between psychology and pedagogy is also evidenced by the interpenetration of basic concepts of these sciences. Pedagogy uses psychological knowledge to identify, describe, explain, and systematize pedagogical facts. One of the demonstrative manifestations of such relationship was formation of such branch of psychology as pedagogical psychology. An equally important feature of such relationship is methods of these two sciences. In pedagogy, many of them are borrowed from psychology. It concerns especially testing, interviewing, and other empirical methods.

Connection between pedagogical thought and psychological knowledge is reflected in views of many thinkers of the past. Therefore, according to Plato, all knowledge is a memory. The soul remembers what she was able to contemplate before its earthly birth. Thus, education and upbringing resolve into mastering methods and ways of such a memory.

Ideas of Aristotle are no less significant in this aspect. As already mentioned, he distinguished three kinds of soul in a human, vegetative, bestial, and intelligent, each of which manifests itself in various human functions. The three kinds of soul, according to Aristotle, correspond to physical, moral, and mental upbringing. The goal of upbringing, in his opinion, is to develop the higher sides of the soul, intelligent and strong-willed. Ancient Greek philosophers also believed that nature gives a human only a germ of abilities that should be developed during upbringing. Nature, according to ideas of the thinker, closely linked the three kinds of soul in a human, and during upbringing, we should follow it, linking physical, moral, and mental upbringing in a single process.

Psychology performs a methodological function in relation to pedagogy. For example, the personal approach developed in psychology finds expression in such pedagogical principles as individual and differentiated approach in the process of education and upbringing and reliance on positive qualities of a personality.

A very important methodological function in relation to pedagogy is the principle of the activity approach, which constitutes the core of psychology. It reveals upbringing possibilities of any kind of activity and requires the process of education and upbringing to be carried out in close connection with life.

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The psychological justification is also laid down in pedagogical concepts of teaching, developed in pedagogy. Therefore, the basis of the associative-reflex concept of training is psychophysiological laws of the conditioned reflex activity of the human cerebral cortex, as well as the mnemonic laws of psychology. Programmed training has developed on the basis of the psychology of behaviorism. Many pedagogical laws are based on the fundamental principles of psychoanalysis, Gestalt psychology, cognitive psychology, humanistic psychology, and other psychological directions and schools.

In modern conditions, the relationship between psychology and pedagogy develops in two directions. On the one hand, psychological research should be directed rather at advancing development of pedagogical theory and practice than at justifying of established forms and methods of teaching and upbringing. On the other hand, pedagogical research should not only be based on the achievements of psychological science but also stimulate their development in the right direction.

The research was spent more than 8 years. The advanced ideas of prominent teachers from 17 countries of Europe and Asia were studied and analyzed.

Pedagogy is closely connected with the biological sciences: *physiology*, *human anatomy*, and *medicine*. To understand mechanisms of managing physical and mental development, it is important to know laws of vital activity of the organism as a whole and its individual parts, functional systems, and basic conditions on maintaining health. Knowledge of laws of functioning of higher nervous activity makes it possible to design and develop teaching technologies and tools that contribute to optimal development of a personality [12–14].

Content of the pedagogical science is inextricably linked with *sociology*, *political science*, *economics*, *law*, and *other socioeconomic sciences*, which significantly supplement pedagogy with knowledge, special information about conditions of functioning of participants in the educational process, and subjects of pedagogical interaction.

Socioeconomic sciences substantially enrich methods of pedagogy. Especially, it concerns *sociology*. Many of its empirical methods after appropriate adaptation are widely used in pedagogy. We are talking about methods for studying preferences, multiple comparisons, statistical analysis of sociological information, expert assessments, etc.

Modern pedagogical thought cannot be full without a content of *historical* and *cultural knowledge* in it. Development of pedagogy and realization of its practical functions today imply an appeal to the historical past, as well as to achievements of culture in the broadest sense.

In recent years, connection between pedagogy and *mathematics*, *computer science*, *and programming* has increased significantly. New information technologies and equipment are being used more and more in pedagogical research; their didactic possibilities are increasingly being studied [7, 13].

There is a special relationship between pedagogy and *methods* of various academic disciplines. On the one hand, pedagogical science is the most important theoretical basis in relation to them, and, on the other hand, improvement and development of specific methods issue new theoretical and methodological tasks for pedagogy.

Pedagogy is closely interrelated with many other branches of scientific knowledge, *ethics and esthetics*, *rhetoric*, *ethnography*, *ethnology*, *management*, etc.

Speaking about the relationship of pedagogy with other sciences, it is impossible not to notice its responsive influence on them. For example, theoretical ideas about the role of educational collective in the formation of personality, fundamentally developed in pedagogy, have had and continue to have an impact on development of research on this problem in psychology, philosophy, ethics, sociology, management, etc.

6. Connection of pedagogy with practice

One of the important problems needed to be solved when mastering pedagogical knowledge is understanding the correlation of pedagogical science and practice. This is especially important in connection with a *significant expansion in modern conditions of areas of manifestations of pedagogical practice* and a clear increase in the impact of pedagogy on various spheres of human activity and communication.

Today, the scientific status of pedagogy is no longer questioned. The dispute turned into a plane of correlation with practice. Actual achievements of teachers become too ambiguous. In one case, they are conditioned by deep knowledge and skillful application of the theory; in another case, success is brought by the high personal skill of a teacher and the art of pedagogical influence and interaction, intuition, and instinct. There is not always a consistency between pedagogical theory and practice. It should also be taken into account that the development of pedagogy does not automatically ensure quality of upbringing and education. The theory to be transformed into appropriate technologies is necessary.

It should be noticed that *at present*, *pedagogy is rapidly progressing*. In recent decades, tangible progress has been made in a number of its areas, especially in development of new learning technologies.

There is another problem related to the scientific status of pedagogy. Many theorists, following the principles of classification of sciences proposed by the German philosophers Windelband (1848–1915) and Rickert (1863–1936), refer pedagogy to the so-called normative sciences. This is due to the content of knowledge in pedagogy. By now, many pedagogical laws have been expressing the most general tendencies in the development of pedagogical phenomena. For example, the law reflecting dependence of development of a personality on a social environment is multifactorial and, due to this, is ambiguously interpreted by various pedagogical schools. Thus, the sociogenic direction absolutizes the role of the social environment in development of a personality.

Representatives of the biogenic direction in pedagogy, on the contrary, give priority to development of personality to heredity rather than to the social environment.

In contrast to the above extreme positions, pedagogy should justify the dialectical unity of the social environment and the genetic, natural data of a personality in the process of its development.

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Polyvariety and ambiguity of conclusions of pedagogy often force it to establish specific norms for interaction of subjects and objects of upbringing, which are not always provided with scientific support.

Thus, in whole, it should be recognized that *pedagogy as a complex social phenomenon stands in the unity of two statuses, as a science and practice of teaching and upbringing*. Its second status can find its concrete manifestation in normative science or in the form of art.

Pedagogical practice in modern conditions is greatly expanded and manifests itself in such forms as upbringing, reeducation, general education, additional education, supplementary education, vocational education, industrial and in-house training, military training, postgraduate education, advanced training and retraining, continuous education, adult education, and educational and sociocultural activities [15–18].

Considering pedagogy as a science and practice, its connection with the so-called folk pedagogy or ethno-pedagogy should be taken into account.

Ethno-pedagogy is a specific set of rules and regulations that spontaneously developed over a long period of history in certain geopolitical and socioeconomic conditions of one or another social community.

It is closely connected with the history of people, their culture, values, and ideals and reflects the rich experience of coexistence of generations, their traditions, and continuity. Folk pedagogy is primary for every person. It finds its application in any family. Our ancestors nursed, raised, taught and brought up children, without the knowledge of pedagogical science in the proper sense of the word.

Thus, mastering of pedagogical knowledge is associated with the assimilation of general fundamentals of pedagogy, its branches, and concepts, which point to a certain class of essentially similar phenomena and constitute the subject of this science.

7. Characteristics of pedagogical technologies

Technology (from the Greek *techne*—art, skill, ability) is a set of techniques and methods of obtaining, processing, and reprocessing of raw materials and finished materials.

Since the early 1960s, the concept of "pedagogical technology" has spread. The reason for its emergence was the attempts to bring education to a qualitatively new level in the conditions of scientific and technological progress. Initially, the technologization of education was associated mainly with application of new technical means of teaching. However, today pedagogical technology is not just a set of organizational forms and methods for application of various teaching means but also research aimed at identifying principles of development and finding ways to optimize the educational process, applying new methods and developing educational materials and technical means of teaching.

In 1986, the UNESCO's formulation was given.

Pedagogical technology is a systematic method of planning, applying, and evaluating the entire process of learning and mastering knowledge by taking into account human and technical resources, as well as interaction between them to achieve a more effective form of education.

In general, pedagogical technologies are classified as follows: technology of education, upbringing, and development.

Training technologies can be divided into learning and self-learning technologies.

The process of implementing the content of the technology, prescribed by curricula, which is a system of forms, methods, techniques, and means of teaching ensuring the most effective achievement of the goals set is understood under the *training technology*.

Preparation for each lesson requires a lot of hard work from its supervisor and presupposes creation of the very technology. In turn, *creation of technology for conducting a lesson is associated with a certain sequence of actions, which can be represented in the form of the following algorithm*:

1. *Analysis and formulation of educational goals*. Whereupon, both the ultimate goals of the pedagogical process and the goals of the specific lesson should be analyzed.
2. *Selection of a concept of learning*, which will serve as the basis for organizing training activities in the course of a lesson.
3. *Actual creation of a training technology*. This stage includes a certain sequence of actions:
    - Organization of selection and structuring of educational material
    - Selection of arguments, evidence, examples, and definition of tasks and goals on formation of skills and abilities
    - Selection of a form of conducting a lesson
    - Selection of the most rational methods of teaching that should be used during a lesson
    - Selection of training and educational equipment
    - Selection of methods for activating students' educational and cognitive activities

According to the mentioned classification, let us consider an example of formation of a technology for conducting an academic lesson.

The initial stage is characterized by the need to analyze the content of the training prescribed by the documents on organization of academic work. Based on the findings, the goals that need to be given priority in the educational process are determined. In accordance with the goals determined, the didactic processing of the content is carried out, ensuring their achievement in the aggregate or due to the priority implementation of one of them.

The listed data forms the basis of the technology being developed.

Thus, the *training technology* is a system of activities for organization and implementation of the learning process, prescribing a certain sequence of actions and achievement of certain goals. It is characterized by the following parameters:

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- Learning goals should be specific and measurable.
- Pedagogical operations are reproducible.
- Operations form a complete process to achieve a goal.
- Teacher's subjectivity is minimized.

Freedom of the teacher is possible in the range of actions that provides approximation to goals. Since implementation of technology is influenced by many variables related to characteristics of teachers and students, or conditions, in which the pedagogical process is carried out, creativity of a teacher cannot and should not be excluded.

It is supposed in any technology both at the stage of its creation and its implementation.

Training technologies can be classified according to the following parameters:

- By the object of impact
- By the subject environment
- By the means being applied
- By the organization of training activities
- By the methodical task

Progress constantly makes its own adjustments, including adjustments into educational activities as well. Newly created forms, methods, training means, and elements of an educational-material base potentially have significant opportunities to improve efficiency and quality of training of specialists. Such innovations have determined a new type of learning technologies, the innovative ones.

Innovation in pedagogy is considered development, creation, and introduction of various types of novelties and innovations that generate essential or significant changes in the quality parameters of the educational process.

Qualitative parameters may differ, depending on the types of pedagogical innovation, which are modernizing and reforming. In the first case, this means improvement of the educational process due to improvement of the qualitative parameters of the existing elements of technology and, in the second case, application of innovations radically changing the system of conducting a lesson.

Innovative training technologies in comparison with traditional technologies allow improving quality and efficiency of the educational process. This is performed on the basis of changing learning objectives, role positions, and functions of a teacher and students, specifics of organization of educational and cognitive activities, and forms of educational interactions.

Developing or applying already-tested training technologies in the system of higher education, it is important to proceed from the fact that the educational process should be built so that future specialists learn to acquire knowledge, skills, and abilities on their own and form the integral psychological structure of future professional activity [1, 4, 6, 8].

7.1. Innovative training technologies

Next, consider the basic innovative training technologies. They include design and creative technologies, technologies of the developmental learning, computer training technologies, and technologies of distant and modular training.

The basis of design and creative technologies is creative activity of students in the process of scientific research, solution of scientific and technical problems, and development of specific projects. The base of such technologies is a personality-activity approach, according to which education is not only assimilation of knowledge but also the ways of such assimilation, development of cognitive forces, and creative potential of students.

Within the project-constructive system, the activity of creating something new and the personality of a student come first, whereupon, its personal responsibility for the results of its developments and project implementation are focused.

Knowledge, skills, and abilities in such a system are considered not as a learning goal but as a means of developing a student and formation of a methodological style of thinking. As the main goal, the task of development of a personality, preparation for functioning, life activity in conditions of a technological society is put at the forefront. This goal is realized by development of abilities and acquisition of practical experience of self-education, creative professional activity, and improvement of personal responsibility for created and implemented actual projects into educational and life situations.

In this technological model, content of training is substantially changed. Unlike the formalized system of knowledge presented in the final form in traditional educational technologies, when implementing a design and constructive approach, instead of memorizing theories, laws, and formulas, special attention is paid to development of the ability to solve all kinds of theoretical and practical tasks and problems. The processes of design, modeling, research, and construction of various objects and processes are put on the first place. In this case, knowledge is systematized and structured in accordance with the hierarchy of cognizable objects and processes. A student should have open access to them through a database, reference book, or textbook and assimilate them in the context of the processes of design, modeling, construction, or research. The structure of presentation of educational information should be such that a student could trace the history of origin of this knowledge, not only in chronological order but also as a result of resolution of contradictions. Thus, in this model, knowledge becomes a means rather than an object of personal development.

Unlike traditional technologies with the dominance of memorization, whose effectiveness is affected by the content, form, difficulty, relevance, and volume of educational material, in the design and creative models, the basic mechanism is involuntary memorization, which, in combination with practical activity, can provide more solid, well-structured knowledge. In addition, the design and creative technology increases the degree of meaningfulness of the educational material due to the clarity, concreteness, and minimality of formulation of each project task.

Usually, the difficulty of the learning material is focused on an average student. The proposed educational environment provides an opportunity for each of them to establish their own

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level of complexity on an actual fragment of knowledge, which creates conditions for realization of the model of complete assimilation. Actually, the structure of the material essentially differs from the traditional one, the formal one predetermined by logic of the corresponding science. In the project and creative models, communication in the teaching material is established according to principles of the hierarchy of the material world and logic of common sense. Deployment of the system of concepts is performed in the dynamics of project activity.

In such technologies, the role of a teacher also changes. He ceases to be "the sole custodian of truth and knowledge," from a mentor turns into a project manager, a colleague, and a consultant. In this case, authoritarian pedagogy is replaced by the principles of cooperation and support that fit organically into this technological model.

The theory of the developmental learning is equally important in practice. The theory of the developmental learning originates in the works of J.H. Pestalozzi, A. Diesterweg, and K.D. Ushinsky. Its scientific justification was given by L.S. Vygotsky. The theory was further developed in the works of L.V. Zankov, D.B. Elkonin, V.V. Davydov, N.A. Menchinskaya, and others. In their concepts, education and development are represented as a system of dialectically interconnected aspects of a single process. Learning is recognized as a driving force behind a person's mental development and formation of totality of personal qualities in it.

Currently, a number of technologies have been developed that differ in their target orientations, content, and methodology peculiarities. Most of them are designed to teach school students, but they are also being actively introduced into institutional pedagogy. Thus, the concept of continuity and integrity of education is realized.

The key element of this technology is a comprehensive study of a personality, which is carried out by special methods and is intended not only to determine the initial level of intellectual development but also to determine the psychological characteristics of a personality, as well as leading strategies and styles of thinking. These data are further used to form optimized technological learning structures, as well as for the psychological support of the educational process, the main tasks of which are development of cognitive abilities of students, mastering of productive methods of educational activity by them, which best correspond to their personality types and development of reflexive abilities.

The following levels of knowledge mastering are distinguished:

1. *Acquisition, recognition, and familiarity*. In educational practice, this level is designated by the categories "to be acquainted" and "to have a notion." A student should be able to identify an object (a phenomenon), give its qualitative description, formulate characteristic properties, and indicate its relation to objects (phenomena) of the same kind.

2. *Copying and reproduction*. This level corresponds to the requirement "to know," implying the ability to reproduce the educational material with a specified degree of accuracy, to formulate and write down a law and definition, and to describe events and processes with sufficient completeness.

3. *Understanding* presupposes the ability to emphasize underlying cause-effect relationships in a structure of information, to present it in various forms.

4. *Skill* corresponding to the category "to be able to use," presupposing the ability to apply the knowledge gained to solve standard tasks of the relevant field of activity with possible usage of a reference material.
5. *Possession, transfer, and transformation*. This level may be identified by the category "to possess." In addition, this level allows you to transfer your knowledge and skills to other border areas of activity, to solve nonstandard tasks.
6. *Production of new knowledge*. This creative level corresponds to the categories "creative skill" and "creativity," presupposing the ability to create new socially significant objects. Traditional education did not set the goal to reach such a level; therefore, as a rule, it was not distinguished.

It should be noticed that the fifth and sixth levels are creative; they correspond to productive creative activity.

The system of methods for developing productive thinking based on the principles of creative pedagogy is equally important. It is filled with methods of developing imagination, fantasy, and abilities, not only to analysis but also to synthesis, ways, and means of overcoming stereotypes of thinking.

Currently, technologies of the developmental learning are increasingly applied in higher education (both in the traditional system of disciplines and in specialized courses of scientific and technical creativity, innovation, and training).

Computer training technologies (CTTs) are based on application of personal computers in their organic connection with learning goals, content of training, computer programs, and didactic methods of application as a means of training.

CTTs include the following components:

- Technical environment
- Software environment (a set of software means for implementation of a training technology)
- Subject environment (content of a specific subject area of science, technology, and knowledge)
- Methodological environment (instructions, methods of evaluation of effectiveness, etc.)

On this basis, a large number of *computer training means* has been implemented recently; they are automated training systems (ATS), automated training courses (ATC), computer simulators, training computer games, electronic textbooks, etc.

Application of computers in the learning process contributes to implementation of didactic principles and fills them with new opportunities:

- The principle of scientificity and usage of modern computer technology allow you to reflect in the educational process today's boundaries of science and bring students to the level of advanced knowledge.

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- The principle of visibility is implemented to a sufficient extent on the basis of multimedia technologies, image media, hypermedia, and hypertext.
- The principle of activity, working with a computer provides an increase in students' creative activity and improvement of mental processes (perception, association, intuition, etc.), which ultimately has a positive effect on the level of knowledge.
- The principle of systematicity and consistency is ensured through a programmed presentation of educational information, which determines the successful assimilation of not only the subject knowledge of the relevant science but also its structure, logic, and methods of study.
- The principle of individualization of learning is realized with the help of adaptive software that provides each student with its own level of complexity of the information provided.

Computerization of learning inevitably comes down to the processes of transfer of knowledge, on which the traditional system relies. However, just as printed materials and technical means of communication could lead to a huge expansion of possibilities of human cognition, fixation, and transfer of experience, a computer should increase the potential of human thinking and cause certain changes in the structure of mental activity.

In the learning environment created by a computer, the basic processes are organization and interpretation of information. This environment forms such characteristics of thinking as a propensity for experimentation, flexibility, coherence, and structurality. Learning conditions created by the "electronic environment" should contribute to development of creative thinking of students, to orient them to the search for nonobvious links and laws and to solve problems. Obviously, this system requires special organization of activities, interaction between teachers and students, and special learning environment.

Standard forms of information representation on the screen of a personal computer (PC) are text and graphic forms. They make it possible to use the PC widely as a learning tool, but it remains only an auxiliary, more or less supplementary to the basic, traditional means and methods. With the usage of only two forms of information transfer outside the capabilities of a personal computer, information is presented in a natural and familiar form for a person: audio, video, and animation.

No less significant lack of computer training is the lack of interactivity, that is, a student's ability to actively intervene in the process, ask questions, exercise self-control, and receive more detailed and accessible explanations for sections and fragments of educational material that are not clear to him. After all, these are methods that form the basis of learning.

However, the computer boom that has embraced our planet in the past decade has spawned new computer technologies allowing us to come close to transforming PC into a powerful educational tool, which, naturally, does not exclude the presence of a human teacher.

New CTTs, which allows to expand qualitatively training capabilities of PC and to provide interactivity of the communication process with it, have become called multimedia (from the English *multi* (a lot, many) and *media* (means)), and their usage in teaching, *multimedia technologies*. It is believed that their emergence will make a breakthrough and an unprecedented leap in the field of education.

A set of hardware and software providing such a representation of information, in which a person perceives it simultaneously and in parallel with several senses, is understood by *multimedia technology*. After all, in real life, this happens exactly when we receive more than 90% of information from the joint activity of the organs of vision and hearing, and not successively, as it is saved in PC.

To implement multimedia training technologies, it is required to have modern computers performing a large number of functions.

Despite only a decade of existence of this technology, the world has accumulated a lot of experience in development, creation, and usage of hardware and software training products. As they improve, the main advantages of multimedia are revealed.

They consist in the presence of branch points in training programs, which allows students to regulate individually the process of perception of information, whereupon, the more such points, the more intensive the program and the more flexible its usage within the learning process. Another advantage of multimedia is the ability to choose from several alternatives, followed by an assessment of correctness of each step. Current self-control is especially necessary in the process of self-education and self-learning.

Combination of audio comments with video information or animation, which allows you gradually, step by step, to explain the most complex processes in development of objects, should be recognized as an important advantage.

This type of training has one more, entertaining and emotional, advantage. Building of the learning process in the form of interactive educational games sharply increases interest and attention to a learning material, and the musical accompaniment brings esthetic satisfaction and improves quality of information.

With the usage of multimedia, the role of a teacher also significantly changes, which has become more effective in spending learning time, focusing on individual assistance to students, discussing information, and developing their creative approach.

Currently, there are quite a lot of different training courses. Of them, the most methodically prepared are interactive language courses that combine a colloquial dictionary with explanatory pictures, grammar training technique, set of situational dialogs accompanied by audio and video, as well as tests and possibility of pronunciation correction by recording the speech of a student.

The amount of knowledge generated by the mankind in the course of its development now doubles almost every 10 years. To maintain and support the scientific and educational potential of the higher school, it is necessary to provide student and teaching staff with wide and open access to accumulated information resources. The solution of this task is assigned to new distant learning forms.

Distant learning is understood as a complex of educational services provided with the help of a specialized information and educational environment at any distance from educational institutions.

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This is, first of all, a set of information technologies ensuring delivery of the major part of the learning material to students, interaction of students and teachers, provision of students with the opportunity to work independently to assimilate the learning material, and assessment of acquired knowledge, skills, and habits.

The means of implementing distant learning technology are divided into three main groups:

- Audiovisual (printed material, audio cassettes, videotapes, videodisks)
- Computer (computer training programs, electronic textbooks, models, interactive video, and multimedia programs)
- Telecommunication systems (teleconferences, videoconferences, e-mail, and video text work with databases in the direct access mode)

With the help of the telecommunication system, they give a student a wide range of opportunities for individual learning.

The distant learning technology is a combination of forms, methods, and means of interaction between a computer and a student within the process of independent but controlled mastering of a certain array of knowledge. It is built on the specific content accumulated in special courses and modules that are designed for distant learning and are located in data and knowledge banks, video libraries, etc.

The main features of the distant learning (DL):

- Freedom of choice of time and place of training, which makes it very attractive
- Provision of an opportunity to train citizens in those regions of a country, where there are no other opportunities for higher education, or citizens with physical disabilities
- The use of sophisticated modern technologies (with a fairly simple user interface), which makes the learning process more individual, effective, exciting, and interesting

As the main properties of distant learning, the following ones may be identified:

1. *Flexibility*. Students of this system basically do not attend regular classes (lectures, seminars) but work at a convenient time and at a suitable pace and place. Moreover, everyone can study as much as needed to master a subject and obtain necessary credits for selected courses.
2. *Adaptability*. The system of distant education provides each user with a choice, creation, and implementation of an individual trajectory of education or acquisition of skills.
3. *Modularity*. Distant learning programs are based on the modular principle. Each separate course creates a comprehensive view of a particular subject area. This allows forming of a curriculum, which meets individual or group needs, from a set of independent module courses.

4. *Economic efficiency*. World experience shows that the distant education costs 50% cheaper than traditional educational forms. Relatively, lower cost is provided due to usage of more concentrated representation and unification of content, orientation of teaching technologies to a greater number of students, and through more efficient usage of existing training areas and technical facilities.

5. *A new role of a teacher*. It is entrusted with such functions as coordinating the cognitive process, correcting the course taught, and consulting during preparation of an individual curriculum, management of educational projects, etc.

Distant learning technologies are one of the forms of the system of continuous education, which is designed to realize the human rights for information and education. Distant education opens equal opportunities for students and civil and military specialists in all regions of a country and abroad. This is due to more active usage of the scientific and educational potential of leading universities, various industry centers for training and retraining of personnel, as well as centers for professional development, and other educational institutions.

Modern technologies include the *modular training*. The essence of the *modular training* is that it allows each student to achieve specific goals of educational and cognitive activity independently (or with the support of a teacher). The so-called training modules serve as an educational tool.

Modular curriculum consists of a complex didactic goal (CDG) and a set of modules, M1, M2 … Mn, ensuring its achievement.

The complex didactic goal should determine the level of mastering a learning material, its use in practice, as well as in subsequent academic disciplines. To formulate a modular program, a teacher identifies the main scientific ideas of this discipline. Further, from the CDG, integrating didactic goals (IDG) are singled out, each of which has its own training module, M1, M2 … Mn. Since these modules contain large blocks of educational material, the integrating didactic goal is divided into private didactic goals (PDG), each of which has its own learning element, LE1, LE2 … LEk.

Thus, a "tree" of goals is constructed. Its top is CDG for building a modular program, the middle layer is IDG for building modules, and the lower layer is PDG for building learning elements. Management of the learning process is due to organization of control, analysis, and necessary correction. Before introduction of each new module, the input control of knowledge and skills of students and determination of the level of their readiness for mastering this module are conducted. In the course of work with each learning element, current and intermediate controls are carried out in combination with a student's self-control. After completion of work with the module, the output control is carried out in order to establish the level of mastering the material and the need for its improvement.

Development of a modular program requires from a teacher not only a deep knowledge of the material but also a high methodological skill. For effective independent work on studying the material for students, a module should be written in such words the teacher seemed talking with a student via the text, activated it to search, reasoning, and guessing. The style of writing should be accessible, focus on success, and inspire.

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Structure of a module contains a list of all learning elements included in it, for each of which information (reference to an available source), instructions with correct tasks, and recommendations for studying the content are given. Each learning element is preceded by the wording of a goal of its study, and at the end of the content part of the module, a generalization (summary) and a control task are offered.

Modular training integrates, to some extent, progressive experience accumulated in pedagogical theory and practice. In particular, the idea of activating educational and cognitive activity, which is provided by rigid logic of metered material supply and a clear system of self-control, is borrowed from the programmed learning. The system approach enriched the modular training with the idea of flexible management of the learning process due to the individual choice of the pace of mastering a material.

The great complexity of creating modules and considerable expenses for their publication and replication should be referred to the apparent disadvantages of the modular training technology. The usage of this technology requires high qualifications of teachers, their motivation, and availability to the modular training.

An important place in pedagogy is occupied by training technologies based on graphic methods of information compression. A typical example of training technologies based on graphic methods of information compression is the method of V.F. Shatalov, one of the outstanding teachers-innovators of the twentieth century. Using many years of experience in teaching mathematics and physics in the secondary school of Donetsk (Ukraine), he developed the so-called method of supportive signals in his "supportive compendium."

The supportive compendium is a compendium code, which can be recognized only by a student or teacher dedicated to it. This compendium is very concise; it contains one notebook page of the material of several lessons coded in a figurative, easily visible form. There are short key phrases, individual words and concepts, mathematical calculations, and numbers to remember on the page.

Arrangement of the material, frame, arrows, different fonts, and colors that highlight the main parts is strictly thought out and makes up a logically harmonious and systemic algorithm of reasoning, trajectory of movement of idea, and movement of thought. At the same time, this compendium is the base for a teacher's 20-minute lecture at a lesson. Naturally, when composing such a compendium, a teacher should show both its creative imagination and, to some extent, the art of presenting the maximum of information with the minimum of volume.

The annual material of a discipline (physics, mathematics, etc.) takes only 30–40 pages of a compendium. These supportive signals are then issued in a mass circulation as teaching guides, and teachers of the relevant disciplines may use them without spending much time on similar work.

Having such a supportive sheet in hands, a teacher begins a lesson with its detailed decoding, unfolding a condensed abstract into the full text. At the same time, if necessary, the teacher repeats the course of its reasoning twice or thrice at a rapid pace, without fear of repetition, while students would not see clearly a logical scheme of a question being posed.

Students independently, holding this supportive sheet before itself, recall the teacher's story and, naturally, using the textbook recommended to it, mentally unfold the scheme into the full text. Then, simultaneously, it again folds it into the supportive signal, whereupon, it does not remember and does not "cram," but works with its mind.

Here, a completely new kind of educational mental activity is proposed: folding and unfolding of a text concerning a material under study become a visual process of thinking and mastering the material.

Principles of compilation of supporting compendia:

1. *Conciseness*. Information complex (IC) in terms of perception should contain 350–500 bits. If 6–8 ICs are reflected in a compendium, the total amount of information of the supportive compendium should not be more than 3000–4000 bits or 600–800 characters. The second aspect of this principle requires a teacher to be able to tell a material on IC in 20–25 minutes. In other words, the material of a 2-hour lecture on the supporting compendium should be stated in 20–25 minutes.
2. *Structural properties*. When drawing up supportive compendia, the method of integration of didactic units of information assimilation is used, which allows presenting a material with the entire blocks and bundles. A supportive compendium contains about 4–5 blocks, the structure of which should be convenient for reproduction and memorization; that is, supportive signals are not necessarily arranged in rows but in a variety of ways.
3. *Emphasis*. The material of a supportive compendium is made "relief" by enclosing it in the framework of the most unusual configuration, using different fonts, colors, and arrangement of words (vertically, diagonally, etc.).
4. *Unification*. Symbols used as supportive signals must be unified. A situation, when in different blocks, the same symbol by inscription would have different contents, is not allowed. It is convenient to introduce certain icon symbols to indicate key or frequently repeated words (or whole combinations).
5. *Independence*. Each of the 4–5 blocks of a supportive compendium is displayed separately, with little or no link to other blocks. Thus, if one of the blocks is forgotten, the rest can be easily reproduced without it.
6. *Familiar associations and stereotypes*. Ability to skillfully select keywords is necessary. A good joke, an image, an anecdote, a drawing, etc. make it possible to revive an entire story in memory.
7. *Otherness*. Very often, when drawing up supportive compendia, the same mistake is made: they are similar as two peas in a pod. Infinite tables, circles, triangles, squares, blocks etc., as a result, are difficult to save in long-term memory. Supportive compendia should be diversified by form, structure, and graphic expression.
8. *Simplicity*. A supportive compendium should be simple for both memorization and reproduction. It is necessary to avoid fanciful fonts, complex drawings, pictures, charts, diagrams, etc.

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9. *Accuracy and clarity*. Accuracy, clarity, readability, and simplicity of graphic forms from the point of view of psychophysiological properties of a person allow to "capture" with an eye a group of letters or even words simultaneously, to increase the speed of recognizing letters and comprehending visuals.

10. *Color harmony*. Supportive compendia should preferably be in a color, the psychological aspect of which consists in influencing the mental state, which can either slow down the processes of assimilation or, conversely, promote them. First, color design of a compendium should provide a clear and comfortable perception; second, it should promote creation of an emotional uplift.

After a supportive compendium has been created, it is necessary to transfer it to a poster or make a slide and multiply it.

The next lesson in this discipline begins with the students (usually sitting with their backs to the board) on separate sheets reproducing from memory the compendium of the material from the previous lesson. At this time, four to five students are writing this compendium on the blackboards.

At the second stage, when everyone returns their test papers, an oral presentation of the material is practiced by a listener invited to the blackboard. Each student checks itself and compares its answers in its mind with the answers he has heard.

Obviously, within two training days, the compendium emerges before the eyes of a listener so many times, and the material is coded/decoded so many times that it becomes impossible to forget it.

A teacher checks knowledge in full, without spending a single minute of its off-hour time. The control is provided every day and concerns all students, because knowledge is checked in a folded form.

If the study of a material was a homework, then, at the beginning of the next lesson, students at a fast pace write a list of signals from memory and after 10–15 minutes pass it to a teacher. A teacher immediately sorts them into piles (marks five, marks four, and marks three) and announces the undeniable marks to the whole class. Those, who did not cope with the task or who did not manage it without any reproaches and edifications, get a dash in the class register, and they will have to learn and write a list of signals again.

A teacher is treated differently with tasks and examples: it does not give marks for their resolution and does not conduct any tests until the end of an academic year. As a rule, two to three typical tasks, which are mandatory for all, are solved on a lesson. A single listener solves a task at the blackboard, but the others do not write anything; they follow the blackboard, think, reason, and help. At home, each of them should solve this task again, solely, so that even the weakest student can cope. It is important that every student individually receives a set of tasks of varying degrees of difficulty for independent work.

The author of this training technology believes that everyone should study with fun, courage, and triumph. He himself leads them to victory by immensely increasing the measure of help and control. The usage of this technique confirms that it provides an increase in intensity of training by 1.2–1.5 times.

Shatalov's method has been widely used and spread in many schools in Russia and a number of other countries. It was successfully mastered and used by secondary school teachers and university professors but taking into account the specifics of vocational education.

The process of developing a specific pedagogical technology in pedagogy was called pedagogical design. It is carried out taking into account such didactic principles as scientificity, systematic character, systematicity, strength of teaching, unity of training, upbringing, and development of a student, considering individual abilities trained in the collective nature of the learning process. At the same time, the design of training technology relies on such principles of modern education as integrity, fundamentality, cultural conformity, humanitarization and humanization, connection between teaching and research, continuity of education, and link between learning and practice.

To succeed in this direction, a teacher should have certain qualities. Such qualities, first of all, are professional knowledge and pedagogical abilities.

Professional knowledge is the fundamental basis. This knowledge of a taught subject, pedagogy and psychology, forms and methods of teaching, technological organization of the educational process, and material and technical support. At the base of the teacher's work, enthusiasm concerning the subject and need for communication with students should be clearly seen.

Pedagogical abilities are individual prerequisites for successful activity and stimulators of professional growth. They point out the specifics of implementation of psychological processes and capability to find such technological approaches to the learning process that would contribute to successful pedagogical activity.

Evaluation of effectiveness of a training technology consists of the following components:

- Evaluation of completeness of presentation of educational information, which is revealed in the course of objective control of training lessons and inspection (final control)
- Evaluation of training results, which is made in the course of the current progress control
- Intermediate attestation of students
- Final state attestation
- Reviews on graduates

Given the increase in the level of knowledge, skills, and abilities, it is difficult to evaluate assimilability of a material theoretically. It is possible to analyze this only on extensive empirical material, comparing the average scores of students' progress by traditional and innovative technologies.

Therefore, training technology is a scientifically based system of methods, ways, techniques, and technical means that provides training with specified indicators of a certain category of students with respect to this subject in conditions that take into account temporary and financial and economic constraints.

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8. Conclusion

Any science including pedagogy is most commonly defined as the scope of human activity. Development and theoretical systematization of objective knowledge of reality take place in it. In general, *pedagogy* as a field of scientific disciplines on upbringing, training, and education of a person reveals laws of the pedagogical process, as well as formation and development of a personality in it. The main categories of pedagogy reflect its essence. Significant categories are self-education, self-improvement, pedagogical process, and pedagogical interaction. Creative application of various technologies in pedagogy is of particular importance now.

The application of teaching technologies presupposes an organizational arrangement of all the dependencies of the learning process, the alignment of its stages, the identification of the conditions for their implementation, and the correlation of methods, forms, methods, and means of instruction in conducting classes, with the abilities of the instructor and students. Modern educational technologies allow us to consider pedagogy with the modern realities of learning, education, and human development.

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References

[1] Bolotin AE, Bakaev VV. Structure and content of the educational technology of managing students' healthy lifestyle. Journal of Physical Education and Sport. 2015;**15**(3):362-364. DOI: 10.7752/jpes.2015.03054

[2] Bakayev V, Bolotin A. Pedagogical model of children swimming training with the use of method of substitution of hydrogenous locomotion. In: Proceedings of Faculty of Kinesiology, University of Zagreb (8th International Scientific Conference on Kinesiology); 10-14 May 2017; Faculty of Kinesiology, University of Zagreb, Croatia. Opatija; 2017. pp. 763-767

[3] Bolotin AE, Bakayev VV, Vazhenin SA. Educational technology of using the system of Pilates for the prevention of spine disorders of female students. Journal of Physical Education and Sport. 2015;**15**(4):724-729. DOI: 10.7752/jpes.2015.04110

[4] Bolotin AE, Schegolev VA, Bakaev VV. Educational technology of use of means of physical culture to adapt students for future professional work. Teoriya i Praktika Fizicheskoy Kultury; 2014;**14**(7):5-6

[5] Osipov A, Kudryavtsev M, Kuzmin V, Salyamova P, Gavrilyuk O, Struchkov V, Galimov G, Zakharova L. Methods of operative and informative control of the muscle loading level used during the training of sambo wrestlers. Journal of Physical Education and Sport. 2016;**16**(4):1247-1252. DOI: 10.7752/jpes.2016.04198

[6] Bolotin AE, Bakayev VV, Vazhenin SA. Pedagogical model for developing skills required by cadets of higher education institutions of the Aerospace Forces to organize their kettlebell self-training. Journal of Physical Education and Sport. 2016;**16**(1):177-186. DOI: 10.7752/jpes.2016.01028

[7] Bolotin A, Bakayev V. Pedagogical conditions necessary for effective speed-strength training of young football players (15-17 years old). Journal of Human Sport and Exercise. 2017;**12**(2):405-413. DOI: 10.14198/jhse.2017.122.17

[8] Bolotin A, Bakayev V. Educational technology for teaching survival skills to pilots using training routines. Journal of Physical Education and Sport. 2016;**16**(2):413-417. DOI: 10.7752/jpes.2016.02064

[9] Bakaev VV, Bolotin AE, Aganov SS. Physical training complex application technology to prepare rescuers for highland operations. Teoriya i Praktika Fizicheskoy Kultury. 2016;**16**(6):6-8

[10] Osipov A, Starova O, Malakhova A, Vonog V, Zhavner T, Salyamova P, Struchkov V, Kudryavtsev M. Modernization process of physical education of students in the framework of implementation of the state strategy for the development of physical culture, sport and tourism in the Russian Federation. Journal of Physical Education and Sport. 2016;**16**(4):1236-1241. DOI: 10.7752/jpes.2016.04196

[11] Bolotin A, Bakayev V. Factors that determine high efficiency in developing speed and strength abilities of female hurdlers. Journal of Physical Education and Sport. 2016;**16**(3):910-913. DOI: 10.7752/jpes.2016.03143

[12] Bolotin A, Bakayev V. Peripheral circulation indicators in veteran trail runners. Journal of Physical Therapy Science. 2017;**29**(8):1092-1094. DOI: 10.1589/jpts.29.1092

[13] Bolotin A, Bakayev V, Orlova N, Kozulko A. Peculiarities of time structure and of biomechanical organization of a construction of motor actions in the hammer throw. In: Proceedings of Faculty of Kinesiology, University of Zagreb (8th International Scientific Conference on Kinesiology); 10-14 May 2017; Faculty of Kinesiology, University of Zagreb, Croatia. Opatija; 2017. pp. 137-141

[14] Bolotin A, Bakayev V. Efficacy of using isometric exercises to prevent basketball injuries. Journal of Physical Education and Sport. 2016;**16**(4):1177-1185. DOI: 10.7752/jpes.2016.04188

[15] Bakayev V. Determining the significance of practical military skills applied by the special purpose regiments of the Internal Troops of the Russian Ministry of Internal Affairs to deliver combat objectives. Journal of Physical Education and Sport. 2015;**15**(4):615-618. DOI: 10.7752/jpes.2015.04093

[16] Bolotin AE, Bakayev VV, Vazhenin SA. Factors that determine the necessity for developing skills required by cadets in higher education institutions of the Aerospace Forces to organize their kettlebell self-training. Journal of Physical Education and Sport. 2016;**16**(1):102-108. DOI: 10.7752/jpes.2016.01017

[17] Bakaev VV, Bolotin AE, Vasil'eva VS. Factors determining sports specialization of cross-country skiers. Teoriya i Praktika Fizicheskoy Kultury. 2015;**15**(2):40-41

[18] Bolotin A, Bakayev V. Pedagogical conditions required to improve the speed-strength training of young football players. Journal of Physical Education and Sport. 2017; **17**(2):638-642. DOI: 10.7752/jpes.2017.02095

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