

Didactic Principles of University Information Educational Systems Designing

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ABSTRACT

The attention of all parts of perspective education system should be focused on promising information technologies - a catalyst for development. Presenting information as a new resource for society development, the authors determine the didactic basis for designing effective information educational systems. Universal didactic principles for information educational systems design have been developed, the details of which for discipline and for the subject adapt them to the university organizational and pedagogical conditions. The pedagogical management functions in modern educational conditions that determine the students' motivation and stimulation initiation mechanism for mastering a knowledge new system to develop the individual's creative abilities, self-development are revealed. The paper is intended for researchers, teachers, and specialists in the field of information educational technologies.

Keywords: information technologies, information educational systems, didactic principles, pedagogical management functions, designing

INTRODUCTION

In modern higher education, there has been a shift in emphasis on educational paradigms, oriented towards designing new knowledge obtaining ways, i.e. those knowledge that are absent in the learner subjective experience, but which are necessary for solving the task or overcoming the problem situation facing him, but not only academic, but also social ones. The education new paradigm vector is the conditions provision to bring up, educate and develop a free, critically thinking person who meets the life requirements in a market economy that is capable of continually raising his or her own education and culture level, that is cosmopolitan and integrated into the global information space. The education priority goal is the formation in a person of such qualities that would help him quickly to adapt to modern living conditions, to form the needs of continuous self-improvement and critical attitude to life. Therefore, today more than ever the issues designing of people's comprehensive training for life, in which an important place should take the technology of self-study and not only on a specific subject or topic, but the development of the most technological cycle for searching, analyzing, evaluating and applying new information on the interested problem, development of self-education technology [1, 2, 3, 4, 5].

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The educational activity effectiveness, differentiated by the diverse processes totality, depends to a considerable extent on the actors' actions realizing it - teachers and students. For a teacher, management is a systematic, predictable and technologically-provided process to influence a managed system with the aim to maximize its effective functioning by creating conditions for transition to a qualitatively new state that contributes to the goals set attainment. The forms', methods', and trajectories' choice to achieve educational goals depends fully on the learning process pedagogical management. In the information flow rapid growth conditions circulating in educational systems, it becomes necessary to design models for presenting information that are adequate to the current state of information technologies, to create and introduce new methods for managing the learning process that promote educational activities' organizational and pedagogical management, professional competencies' formation, students' self-management and self-development [6, 7, 8, 9].

Such projecting result in some way to a modern information educational environment, as a means to implement an educational curriculum set. The educational environment numerous studies in the educational and upbringing tasks context demonstrate that it has a typology, structure, leading functions and the conditions for its creation and functioning [10, 11, 12]. Describing it as a person socio-cultural environment, which includes education content and various means that ensure the students productive activity and guide the personality development through the creation favorable conditions for this [13, 14, 15, 16] the authors practically do not touch upon the issue of the environment managing tasks realizing. Not considering the educational environment to be a system (with its obvious basic system properties presence), there is no question of managing the given, of course, the system construct. This gap is able to be filled by the informational learning system understanding and implementation. In our opinion, the center of the university educational environment is an informational educational system with clearly expressed functions for managing the students educational activities, and, possibly, for managing all kinds of educational processes.

The consideration subject is the informational educational system's main characteristics and didactic possibilities as a pedagogical system in the comparison and interaction of teaching didactics and learning didactics.

METHODOLOGICAL FRAMEWORK

System Approach as the Informational Educational System Basis

The systemic approach essence and significance in the reality's various areas study are quite fully and profoundly disclosed in the scientific, philosophical [17, 18, 19] and pedagogical literature [20, 21, 22, 23]. It is that relatively independent components are not considered in isolation, but in their interrelationship, development and movement. The above studies analysis shows that pedagogical systems have the following main features characteristic which are common for any social system: composition (elements presence), structure (elements interrelation), function (system's specific goal implementation). Pedagogical systems are created and function with specific goals, in which, first of all, they reflect the society needs in the children and youth education and upbringing. Unlike production and natural systems, the leading function in the pedagogical system is the formation of the individual's personality with socially assigned qualities (purposeful systems [24]). The system functional purpose is decisive one when subordination elements selecting, information flows' movement and interacting ways between elements. For this research, the theoretical and methodological significance is the results of the study on the pedagogical systems essence and their structure. V. P. Bepalko [25] and L. V. Zagrekova [26] ([Figure 1](#)).

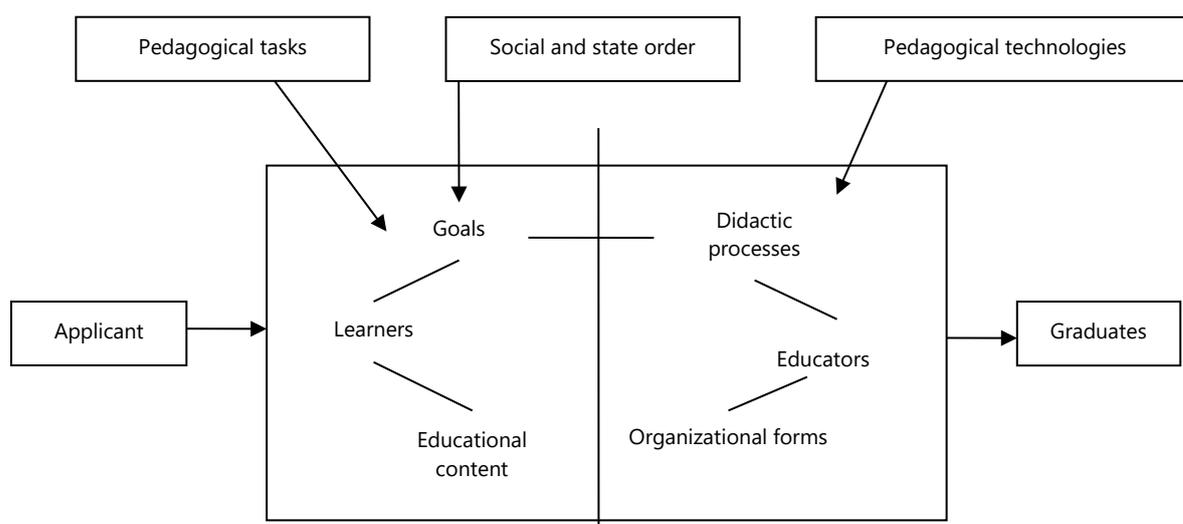


Figure 1. The pedagogical system structure by V.P. Bespalko [25]

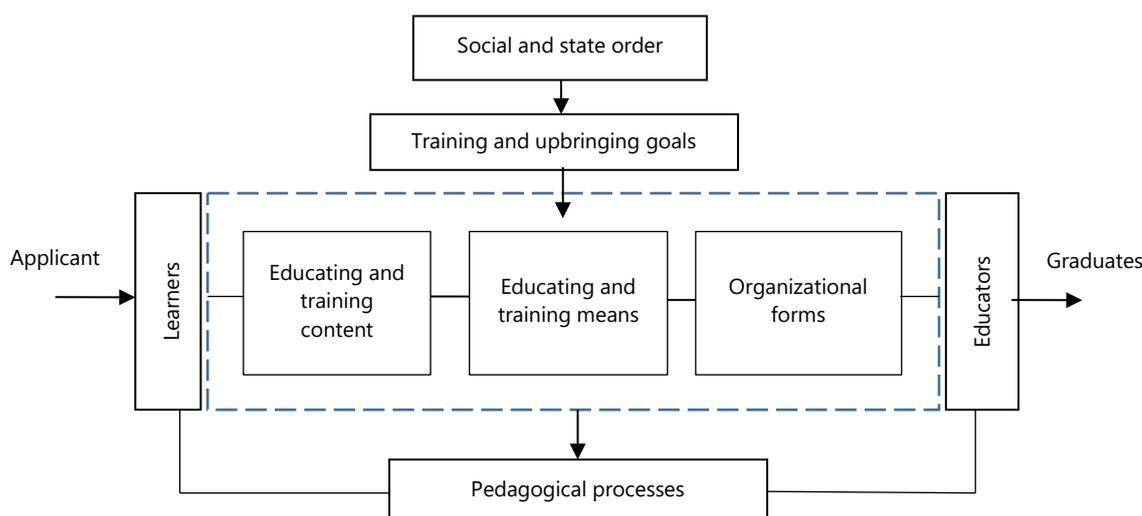


Figure 2. The pedagogical system structure by L.V. Zagrekova [26]

According to the concept of V. P. Bespalko [25], there are two initial concepts of any scientific theory are clearly seen in the pedagogical system structure: its tasks and the technologies for their solution. Each didactic task is solved by teaching's technology means, the integrity of which is ensured by its three components interrelated development and use: the organizational form, the didactic process and the teacher's qualification. L.V. Zagrekova [26] proposes her own structure of the pedagogical system, shown in **Figure 2**. Such a component appears in this structure as the educating and upbringing means.

The system each element performs a certain function, while the main components are pupils (students) and teachers as socially organized entities, setting themselves certain goals and striving for their implementation. Teachers and students form the basis on which, above all, the pedagogical system [26] is maintained.

Following the research of V. P. Bespalko [25] and L. V. Zagrekova [26], and based on a comparative historical analysis, the system-component aspect of any pedagogical system (antique, medieval, bourgeois, socialist or democratic) includes the following invariant elements: 1) the learning objectives; 2) students (students); 3) teachers; 4) the educating and upbringing content; 5) educating and upbringing means; 6) organization forms; 7) pedagogical processes (teaching and upbringing processes).

The pedagogical system structure is determined by the interrelations way, the system components interrelationships, determine its integrity, the pedagogical system existence as a whole. The pedagogical system structure is diverse; it should be borne in mind that whatever the components are connected in the social and

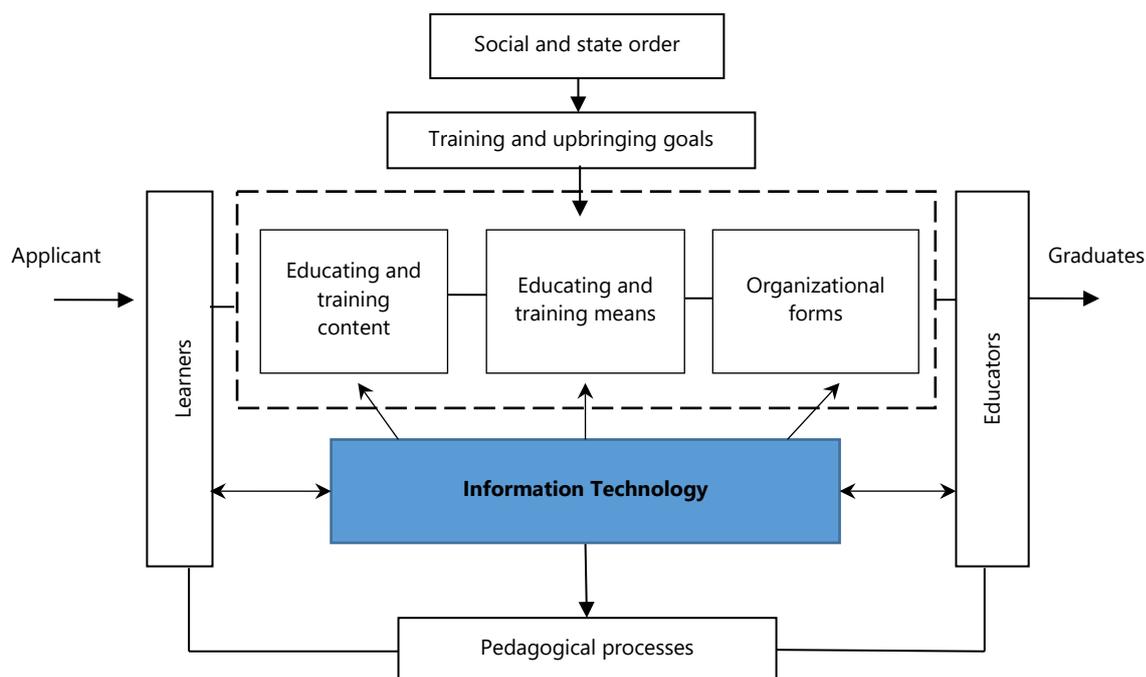


Figure 3. The pedagogical system structure in the informational society

pedagogical integrity, in whatever form they appear, the structure is ultimately manifested through the people activities.

Changes in the pedagogical system, its restructuring and adaptation are dependent on society impact on a definite element or elements. As such an activator for pedagogical system transformation serve informational and communicational technologies, which significantly change the teachers role, forms, means and teaching methods (Figure 3).

The university informational environment is purposefully created for the educational process implementation and is an open structured set of informational, educational, methodological, technological support [27, 28, 29, 30]. The university educational environment center is an informational educational system with clearly defined functions for managing the students' educational activities, and possibly managing all kinds of educational processes [31].

The concept of the informational educational environment is obviously broader than the concept of an informational educational system because of attracting various "environments": social, scientific, technological, financial, professional, etc. However, it is the informational educational system that determines the pedagogical mechanisms, communications and educational activities management. First of all, from the informational view point, there is an information exchange between the pedagogical system and other social systems: new scientific achievements that should be reflected in the education curricula and content, methodological novelties, etc. There is an ongoing exchange with the external environment and people: students, teachers, specialists who provide the educational process in pedagogical systems.

The informational educational system has the system's all the leading features, as specific entities:

- The integrative qualities presence (systemic nature), i.e. such qualities that none of the individual elements forming the system possesses;
- The constituent elements', components' and parts' presence from which the system is formed;
- The structure presence, i.e. certain relationships and relationships between parts and elements;
- The system functional characteristics presence as a whole and its individual components;
- the system communicative properties presence, manifested in two forms: in the form of interaction with the environment and in the form of this system's with sub- and super-systems interaction, i.e. systems of lower or higher order, in relation to which it acts as part (subsystem) or as a whole;
- Historicity, continuity or connection of the past, present and future in the system and its components.

Dedicated common system properties make it possible to approach the pedagogical systems description from the most general positions. Various representation variants of the university informational educational system [32, 33] processive [34], managerial [35] define methodological approaches variety to its implementation. These representations' common denominator is their systemic nature and target focus.

So, the pedagogical systems are *real* (by origin), *social* (by the substantiality feature), *complex* (in terms of complexity), *open* (by the interaction nature with higher-level systems), *dynamic* (by variability feature), *probabilistic* (by the determination method), *purposeful* (by the goals presence), *self-governing* (by the manageability feature), *holistic* (by the integrative nature). All these characteristics can be fully applied to the informational educational system.

Proceeding from the management general analysis and the pedagogical process analysis, one can single out the pedagogical management functions in the informational educational system.

The methodological function provides the scientific nature of the general approach to the management process, which enables it to realize objectively existing regularities. The management methodological basis is the doctrine of social society regularities, the conditioning of social, spiritual and other life spheres by material processes. In pedagogical systems case, this function consists in the methodological justification of the education's and upbringing's epistemological aspects, determining the higher education system conformity with the state's, employers', the individual's and society's needs and requirements in the projected future aspect. *The goal-setting function* in the pedagogical management system defines the goal as a forecast, an ideally anticipated result of the pedagogical system activity. The goal is a system-forming factor of the pedagogical system itself and determines its effective implementation. The goal in the modern educational process fulfills the following important functions: 1) integrative (human activity integration on the knowledge basis); 2) incentive (encourages to activity); 3) constructive (build activity).

At the same time, several aspects are distinguished:

- goals and goal-setting in the students activities;
- goals and goal-setting in the teacher activities;
- transition of the teacher's goals into the student activity.

The function of making management decisions is designed to provide ways' and means' scientifically based choice to achieve goals from alternatives variety. When choosing means and methods, there are two main questions: 1) the identification of the chosen means and methods correspondence to objective pedagogical regularities; 2) the definition not only the means and methods totality, but also their limitation, i.e. the necessity and sufficiency establishment.

The organizational function assumes carrying out organizational actions for the accepted decisions' practical realization. This pedagogical system function is examined in sufficient detail in pedagogical studies [36, 37].

The regulating function determines the real pedagogical process correspondence to the planned plans and curricula through pedagogical regularities, which, as a rule, have a regulatory nature.

Regulation regulates the sequence, pedagogical actions order and the pedagogical system elements relations.

Monitoring function. Control is one of the means to verify the people activities, the programs and plans implementation for the goal realization. The control necessary element is accounting, i.e. fixing information about the processes, the system's status, etc. The received pedagogical diagnosis is the basis for the educational activities monitoring implementation, and, if necessary, its correction.

The main stages for informational education systems constructing, taking place in accordance with the main regularities adopted for the models, are the following:

- Stage of the goals awareness and ways to achieve them.
- Stage of means formulation to achieve the designated goal.
- The pedagogical system optimal structure determination stage.
- The stage of pedagogical system immediate results forecasting (both positive and negative).

These conceptual ideas were the basis of the university information educational system designing.

RESULTS AND DISCUSSIONS

One of the goals of the informational educational system's development and implementation is to achieve the necessary degree of mobility in the university management through the resources redistribution and their use control. This will allow organizing the work in such a way as to meet timely new needs and quickly assess the emerging opportunities, as well as increase efficiency, manageability, coordination of university all structural units activities. The informational educational system management unit should include not only document circulation and final reporting modules, but also elements that make it possible to use a complex of the newest forms, ways, methods, techniques and teaching means that correspond to the goals of the informational society's educational

paradigm. All this will make it possible to achieve the graduates' training real quality, increasing the labor productivity when training and ensuring the learning process intensification.

The education form using informational and communicational technologies involves the following conceptual provisions implementation:

- 1) The learning process is based mainly on the student independent cognitive activity, determining the learning process entities and the teacher's role in the learning process. The teacher's role consists in:
 - creation the educational and methodical support of the student's learning process;
 - pedagogical management providing and educational and methodical support for the student's learning process;
 - education's upbringing functions realization through pedagogical communication (real, network).
- 2) Student's cognitive activity should be active by nature. Therefore, it is necessary to use such methods and technologies that contribute to the ability independently to extract the necessary information, to isolate problems and ways for their rational solution, critically to analyze the received knowledge and apply them in practice and to obtain new knowledge. A special place here is occupied by productive methods, based on the student active participation in the educational process. Active participation is determined primarily by internal motivation, expressed as a desire to learn.
- 3) Training should be personal-oriented, which presupposes the instruction differentiation and individualization, depending on the trainee's psychological-pedagogical properties. It is clear that training with the informational and communication technologies use leads, ultimately, to a change in the education paradigm, the core of which is individualized learning in a distributed educational and communicative environment.

The didactic principles are understood as the starting points underlying the content selection, the learning process's organization and implementation. These are the normative foundations that are based on the learning process known regularities and reflect the teaching and learning processes organization features within the framework, taking into account the of the trainees' psychology. The plurality of private didactic principles basically are supplemented, refined, elaborated or developed by the traditional didactics principles in relation to certain conditions: for example, the university resources, certain informational technology, the subject area specifics.

The existing approaches evaluation allows doubting in this direction correctness, since it is not possible to develop one's principles for each newly created learning tool based on informational and computer technologies.

The authors consider it expedient to revise and fill the educational process's didactic bases with such content that would allow them to be used constructively in the changed conditions.

As a basis for this, the general didactic principles will be adopted, as well as individual ideas proposed in the theories of the step-by-step mental actions formation, programmed, modular and problem-activity learning. This approach is due to the fact that it is the latter theories are currently used as the basic ones in the informational and communicational technologies implementation in education.

The note should be done that the proposed principles for informational educational system constructing, their essential content, are relevant to the didactic system (methods system, education means and forms).

The principle of the didactic process's and the didactic system's correspondence to the teaching regularities is leading with respect to all other principles that are part of the group under consideration. It defines the basis on which the didactic process should be built, since it indicates the need for the students' educational and cognitive activity organization in accordance with its objective regularities-specific links, stable dependencies between teaching, learning and the content of education (see [Figure 4](#)).

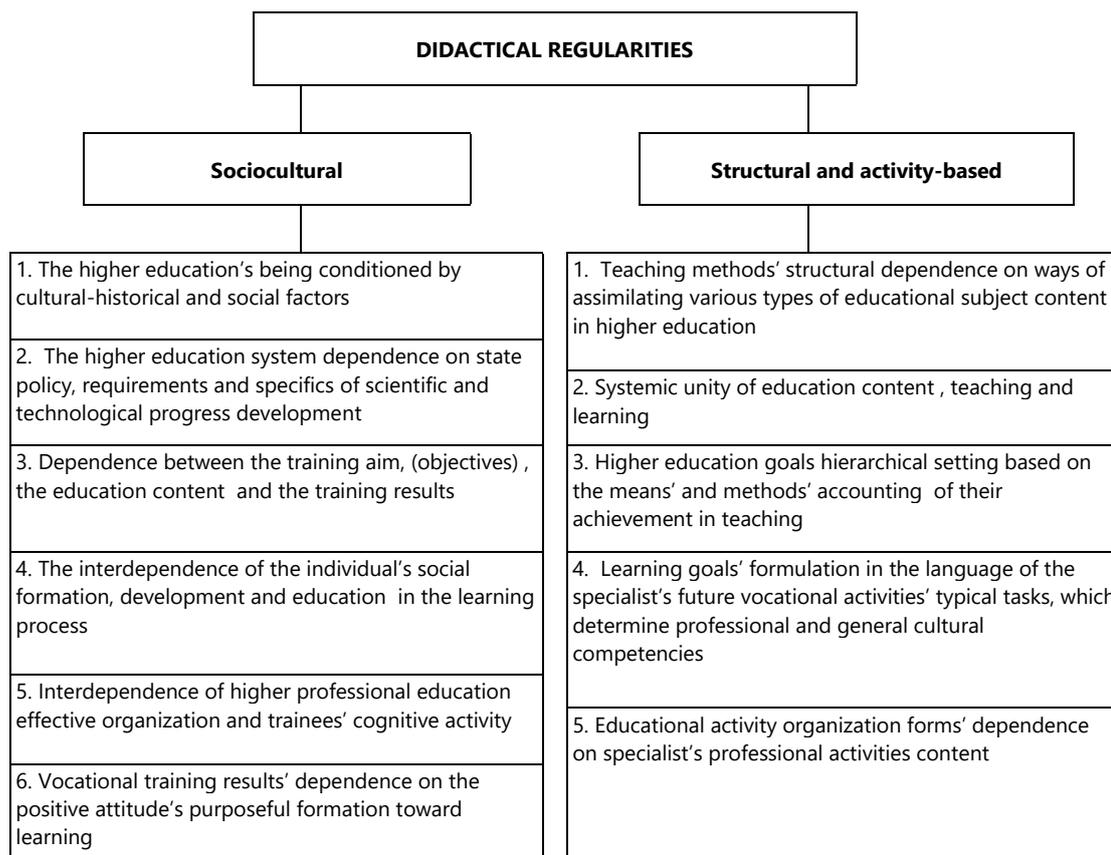


Figure 4. The teaching basic regularities

The main essence of the teaching regularities manifestation consists in the phased mastering by the students of the academic discipline's scientific content, the carrier of which is the computer training program. It follows that the training goal in the informational and communicational technologies use should be achieved in stages, by solving a number of particular didactic tasks. The teacher's main guideline is that the informational and communicational technologies use ensures the didactic process progress in accordance with the teaching regularities and thus allows achieving the guaranteed learning goals.

The principle of theoretical knowledge leading role points to the advisability of didactic process's such an organization using informational and communicational technologies, in which the sufficiently large educational content study, for example topics, was carried out so that at the first stages the students got an idea about the theoretical content of the topic as a whole, then at intermediate stages, they learned certain types of content on each academic question, and at the final stages the study of the whole topic, its content all types, to assimilation desired level. The unity principle of teaching's educational, upbringing and developing functions reflects the really existing regular links between all the learning functions indicated in its title. It speaks about the need for such an informational and communicational technologies application, so that teaching as a didactic process would perform not only educational but also upbringing, as well as developing functions.

The possibility to implement this principle is laid directly in the teaching methods choice, as well as in the teaching aids development and creation (electronic complexes, textbooks, training tests and programs. Being transformed into educational material they implement not only the procedural, but also the target and content aspects of the teaching educational, developmental and upbringing functions, it affects the students' feelings and emotions. This principle is extremely important and relevant for the learning tools development, creation and application based on informational and communicational technologies. Its implementation will ensure the knowledge transfer through feelings and emotions into beliefs.

The principle of stimulating and motivating the students' positive attitude toward learning reflects a logical connection between their educational and cognitive activity success and the interest excitement in it. He points to the need for a continuous urge to master the instruction content. Compliance with this principle is one of the most important conditions for the informational and communicational technologies effective application, focusing on the consideration three groups of motives for learning: social, professional, cognitive. They are recommended to be taken into account when designing at the stage of setting the didactic task, and also directly during the didactic

process. This is achieved by clearly setting the systems of learning goals through a skills system that the learner must master. In this case, each of the skills is represented as an action (activity) that has a vital meaning for the learner, the success of which depends on the mastering level of the learning materials studied content.

Setting a didactic task, the teacher should clearly imagine what the learner should receive as a result of the academic discipline studying or its semantic part and why it is necessary for him and determine the initiation vector.

The principle of problem reflects the regularity relating to the creative activity experience assimilation, as well as the knowledge and activities' modes creative assimilation. The regularity essence is that the experience mastering as one of the types of learning content and creative assimilation is impossible without including the entity in the solution a specially developed system of problems and problematic tasks that allow creating problematic situations that require the learner's creative activity at an accessible level. This principle requires the teacher to ensure the problematic situations creation and thereby intensifying the teaching, giving it the features of creative, search activity.

The principle of combining collective learning with an individual approach to learning requires that the teacher appropriately combine the appropriate forms of instruction. It aims to design the training informational system in such a way that it is possible to use it both in conducting scheduled classes under the teacher guidance, where the latter will play the role of the leading managing entity, and in the part of students' self-training without the teacher participation.

The principle of combining abstract thinking with visualization concerns not only visual, but also auditory, tactile and olfactory visibility, considered in their organic interconnection. In this manifestation, the principle reflects the natural connection between the sensory perceptions diversity of the educational material content and the possibility of its understanding, memorization, and storage in memory, reproduction and application. At the same time, it should be noted that visualization cannot be identified with illustration. The requirement to this principle to combine all kinds of visibility in teaching with the informational and communicational technologies use, if possible, has a deep psychological and physiological basis.

According to *the principle of learning orientation on the individual's activity*, the educational informational system designing in the didactic aspect should initially be aimed at the personality development, the trainee's features identification (abilities, interests, needs) as a subject, his subjective experience recognition as an identity and self-worth, building pedagogical influences with a maximum reliance on this experience (constant coordination during the training of experience-public and individual types), individual identity disclosure in acquiring knowledge through the study methods analysis. The teacher, relying on the trainee's identified interests and subjective experience, forms the training content (scientific knowledge), which must be accepted by the learner as a personally-significant, perceived through his own subjective experience. This content is learned by the future specialist with the help of forms, methods and means of active learning.

The principle of the educational and informational base correspondence to the teaching content and the didactic system expresses the requirements for the educational and scientific conditions for teachers and students effective work. This principle's main requirement is formulated in its very name, and its meaning is that the university infrastructure (department, faculty) should correspond to the labor specifics, determined by the training content and the didactic process nature. Practical implementation of this principle's requirements is possible only if the educational and information base creation will be carried out on the basis of scientific and pedagogical requirements developed by teachers.

The education general democratic principles application and the specified requirements implementation for education informational technologies use in the university educational process will contribute to improving the specialists training quality. Therefore, they should be considered in the context of the education goals and educational activities practice's scientific understanding.

Despite the independent work's determining role in teaching with the informational and communicational technologies use, the main entities in the educational process are a student and a teacher. Student participation in cognitive activity on a par with the teacher is one of the conditions for quality education. The above formulated principles use in the informational educational systems development makes it possible to meet these requirements to the maximum extent.

Attempts to create a specialist's models is the pedagogy's that branch development that tried to reflect the pedagogical activity result at first in the form of requirements to a specialist, then in the form of a qualification characteristic with the aim of obtaining some "ideal" product of the pedagogical process. Along with the approach's undoubted advantages: attempts maximally to concretize the final result, to identify the optimal combination of personal and professional qualities for specialists in a particular profession, to study ways to develop these qualities, some problems are also seen.

Pedagogical systems emerged and function as purposeful. The goals in these systems reflect the society's needs in a particular person: a specialist, a citizen in which the society needs, and for pedagogical systems act as a "social order". Within the system, they are transformed, being formed in the pedagogical language and, at the same time, gaining independence and self-worth. Another significant difference between pedagogical systems and other social systems is the goals multiplicity that generates the multi-functionality of such systems. This introduces certain difficulties in the criteria for assessing the effectiveness of systems.

Let us also emphasize the pedagogical systems dynamic character, since they function in continuous variability conditions of the external environment, as well as internal changes in the system generated by these conditions. In addition, the system dynamics is observed in the change of goals, the content, teaching aids, depending on the age, psychological and other characteristics of students.

CONCLUSION

So, education informatization gives a new impetus to the personality development - a new type of value, information culture, freedom to choose development and self-development, the formation of increasing the responsibility of the individual for his own choice, development, self-development - in fact, the "image of the self" is born!

The basis of the new education paradigm is the purposeful independent, but guided work of the student over the continuous increase in his culture level, education and ability to self-development, adaptation in the production's new conditions and society development. The change in teaching technologies, absorbing the entire positive from the previous stages of development, should ensure the needs of each person and society concerned. Training of critically thinking individuals, able to work creatively to realize their interests and interests of society is, in our opinion, the main requirement for a modern education system.

As an original catalyst by which the educational process can be made more effective, informational educational systems act with the main advantages: achieving high results with the least physical, mental and time costs; certain stability of positive results in the activity of the university teacher.

The university education informational systems application allows you more effectively to learn the future profession basics, gain deeper knowledge, skills, and make them more solid; creates conditions for the creative and students active participation in the learning process and at the same time reduce the time of assimilation of information due to the optimal combination of informational technologies, methods, environments.

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