ADAPTIVE TECHNOLOGY DEVELOPMENT ALGORITHM

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Abstract. *The article, based on the analysis and generalization of the experience of using pedagogical technologies in the educational process, presents the adaptive technology development algorithm, which allows managing and structuring the process of training students in a higher educational establishment in constantly changing internal and external environment. It is argued that the process of technologization in higher education is purposeful, structured and algorithmic, takes place on the basis of joint interaction between the subjects of education, has its elements, specific features, criteria and structure. Eventually, adaptability becomes the dominant characteristic of the teacher's activity, means the transition to a qualitatively new level of knowledge-intensity and optimality, as well as shapes the style of modern scientific and practical thinking. At the same time it makes it possible to increase the mastering of training material by students and to switch the teacher's attention to the individual development and creative thinking of students. Adaptability in education and adaptive approach is given special priority in the article. It is emphasized that the basis of the adaptive approach are provisions of the concept of directed self-organization, which contributes to the achievement in a changing environment of a predetermined intended goal. It is defined that adaptability involves aligning the goals and results of the educational process with market demand and personal goals of the individual with the requirements of society. The concept of "adaptive technologies" has been considered, as well as the approaches on which adaptive technologies are based have been presented: systemic, synergetic, active, humanistic, personality-oriented, differentiated, and adaptive. The result of the research is the structure of adaptive technology proposed by the author, which has been developed on the basis of known pedagogical technologies and includes conceptual, content, procedural-adaptive and resulting components. The adaptive technology development algorithm has been defined, which allows maximizing the mechanism of directing the joint activity of students and the teacher towards the achievement of a feasible target, increasing the extent of freedom between the subjects of the educational process, mobilizing them for the desired result.*

Keywords: technology; pedagogical technology; adaptability; adaptive technology; adaptive technology algorithm.

Problem statement. The technological approach has become an integral part of the organization of the educational process in a higher education establishment. The use of modern technologies helps the teacher to involve all components of the pedagogical process, to structure the material, to algorithmize the consistency of educational activities, to manage complex pedagogical systems and processes, and to ensure the achievement of the set educational goal. However, this approach is not well structured for the higher education process.

Analysis of recent studies. Since the 60's of the 20th century, the technologization of the educational process has been given considerable attention, but it still remains relevant. The analysis of modern scientific works and publications shows that there is no less interest in this issue. Thus, adherents of pedagogical technologies are O. Antonova [1], O. Zagika [6], D. Lup'yak [9], M. Rostoka [10], O. Ryabova [11], V. Strelnikov [13], G. Shatvokska [14] and others. However, insufficient attention has been given to the development of adaptive technologies in higher education.

The purpose of the article is to find out the adaptive technology development algorithm based on the experience of pedagogical science in the technologization of educational process.

Statement of basic material. In modern literature, the term "technology" has been studied very carefully. Currently, there are several positions in the interpretation of the concept of "technology". Thus, according to the explanatory dictionary of information and pedagogical technologies, the concept of "technology" is viewed as a set of techniques used in any practice, skill, art [7].

In the pedagogical field G. Selevko [12] outlines four approaches to defining the essence of this concept, namely technology: as a means, development and application of organizational and methodological tools; as a communication process, a model of joint activity for designing, organizing and conducting the educational process; as a large field of knowledge that relies on data from the social, management and natural sciences and is engaged in designing optimal training systems; as a multidimensional, comprehensible integrative process. We agree with the scientist that technology is the system of functioning of all components of the pedagogical process. It is based on science, programmed in time and space and leads to certain results.

In considering the essence of the concept of "technology", we turned to the scientific study of G. Shatkovska [14]. The scientist reveals a variety of definitions of the concept of "technology" and notes that it can be defined as: skill, a set of processing methods, change of state; set of knowledge about methods of carrying out any processes; purposeful, pedagogical view and influence on the educational process; a meaningful technique for achieving the teaching goals and a description of the process; a project of a particular pedagogical system that is implemented in practice.

In our view, the concept of technology has been more fully defined by scientist B. Likhachev [8], who states that pedagogical technology is a set of psychological and pedagogical goals that determine a special set and arrangement of forms, methods, practices, techniques of teaching, educational means. According to him, this includes organizational and methodological tools of the pedagogical process.

According to the UNESCO's definition [2], pedagogical technology is a systematic method of creating, applying and defining the whole process of teaching and learning, taking into account technical and human resources and their interaction, the objective of which is optimization of the education forms.

By analysing and generalizing the above definitions, we view pedagogical technology as a purposeful, structured and algorithm-driven process of joint interaction of subjects of education using specially designed didactic tools.

V. Bespalko outlined the *elements* of pedagogical technology: clear, consistent, pedagogical, didactic development of goals of training, education; structuring, ordering, summarizing of content, information to be learnt; comprehensive application of didactic, technical, including computer, training and control tools; enhancing of diagnostic functions of training and education; guaranteed sufficiently high level of quality of training [3].

Scientists V. Bespalko, D. Levites, G. Selevko and others [12] also identify *specific features* of pedagogical technologies, which include the development of diagnostically set goals of education and training (goals that describe the result and the achievement of which can be verified); orientation of all procedures to the guaranteed achievement of the set goals; prompt feedback, assessment of current and final results; repeatability of pedagogical procedures.

Scientists assert that any pedagogical technology must meet the basic *criteria* of adaptability:

1. *Conceptuality* – each pedagogical technology must be supported by a certain scientific concept, which includes philosophical, psychological, didactic and socio-pedagogical justification for the achievement of educational goals.
2. *Systematic nature* – pedagogical technology must have all features of the system: the logic of the process, the interconnection of all its parts, integrity.
3. *Manageability* – an option of diagnostic goal-setting, planning, designing the educative process, step-by-step diagnostics, varying of means and methods to correct the results.
4. *Efficiency* – modern pedagogical technologies exist in a competitive environment and must be effective in results and cost-effective, ensuring the achievement of a certain education standard.
5. *Repeatability* – an option of applying (repeating, reproducing) pedagogical technology in other types of educational institutions, by other subjects.

In our view, G. Selevko revealed the structure of pedagogical technology in more precise terms. He identified:

a) conceptual basis describing the predominate idea, hypothesis, principles, laws of technology, scientific concept of learning;

b) content component of training: the goals of training are general and specific, corresponding to the main purpose of education and social mandate; content of educational information;

c) procedural component: technological process; organization of the educational process; methods and forms of learning activity of students; methods and forms of teacher's work; teacher's activity to manage the learning process; diagnostics of educational process [12].

Activities to develop pedagogical technology will be shown schematically as follows (Fig.1):

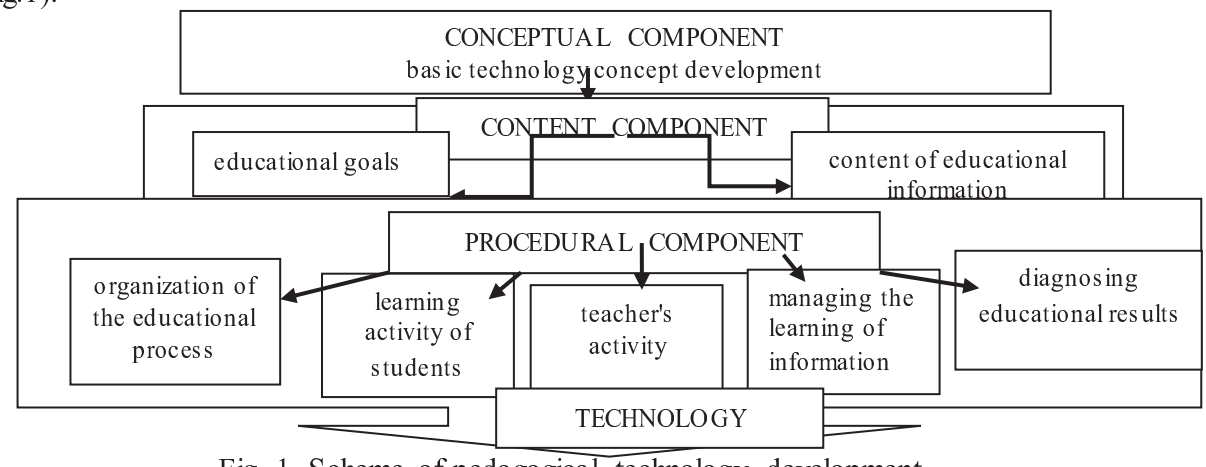

Fig. 1. Scheme of pedagogical technology development

The same technology can be implemented by different performers in different ways: strictly by the book, more or less faithfully or creatively. This performance inevitably involves a personal component of the master, a certain specificity that characterizes patterns of learning information, composition and sequence of students' actions. Certainly, the results will be different, but close to some average value characteristic specific to this technology. Therefore, technology can be considered as an algorithm for obtaining the intended result.

Eventually adaptability becomes the dominant characteristic of the teacher's activity, means the transition to a qualitatively new level of efficiency, optimality, knowledge intensity, and forms the style of modern scientific and practical thinking.

There are many pedagogical technologies in pedagogical science: pedagogical support, differentiation and individualization, computer, health-saving, interactive, technology of gifted education, collaboration and more. The use of pedagogical technologies allows, on the one hand, improving the learning of teaching material by students, and on the other hand, shifting the teacher's attention to the individual development and creative thinking of students.

Insufficient teacher's awareness about the real level of knowledge of the student, constant change of external and internal environment, circumstances, instability of situations in education caused the advent of adaptive technologies.

Adaptive means adapted. An adaptive approach involves considering the system from the perspective of its preservation and development under unstable conditions, which determines the ongoing changes to achieve the initial goal and preserve the system itself. As a result, there are certain system transformations in its structure and operation. The change of personal behaviour occurs in response to changing processes, constant adaptation to the requirements of the environment.

The term "adaptation" originates in biological science, where it denotes the process of adaptation and functions of organisms and their organs to certain environmental conditions. But now the concept of "adaptation" went beyond biology and began to be used in other sciences: technical, natural, humanities. Adaptation in pedagogy should be viewed as a process of adjusting the potential of the individual and an integral part of its formation, which results in an increase in the degree of universality of the system. The innate or acquired aptitude for adaptation is called adaptability.

Adaptability in education is to align the goals and results of the educational process with market demand and the personal goals of the individual with the demands of society.

In identifying the concept of "adaptive technologies", it should be noted that these are technologies the implementation of which activates adaptive processes to achieve the original goal in changing environment, circumstances, situations [4].

It should be emphasized that adaptive technologies are based on the following approaches:

1. Systematic – which focuses on studying certain objects as complex systems. In this case, the structural analysis goes from whole to part.

2. Synergistic – the basis for considering complex systems that are self-organizing and self-developing.

3. Practical – which shifts students into the position of subjects of cognition, cooperation and communication based on the use of pedagogical methods of "teacher and student equality", as well as carries out reflective (analysis of joint activity) training of students.

4. Humanistic – promotes the development and improvement of a whole person on the basis of self-organization of the training process.

5. Person-centered, which allows creating the most adapted educational environment for the student, in view of the peculiarity of his or her individual development.

6. Differentiated – provides an opportunity to adapt learning environment to the characteristics of different levels of student development.

7. Adaptive – provides priority to the development of actors and is carried out through self-organization processes.

As shown by practice, adaptive technologies are a powerful tool in student training. The use of them enables a high school teacher to interact with them taking into account their real potential. Adaptive technologies allow responding more quickly to changes, while maintaining the optimum balance between student capabilities and the external educational environment, to take into account feedbacks, to make joint decisions aimed at self-development and self-organization, and to automatically provide individual support for each student.

We share the opinion of scientist O. Zagika that adaptive technology is "a systematic pedagogical process that achieves a scientifically grounded educational goal, implements didactic set (principles, pedagogical conditions, educational environment), involves subjects and complex pedagogical technologies (forms, methods, means) of organization of students' educational activities, ensures the achievement of the intended result through flexible response to changes in the requirements of socio-cultural and industrial environment through optimal selection and allocation of resources and has more efficient, reliable and guaranteed result than it comes with traditional teaching technologies" [6].

As noted above, pedagogical technologies include a certain algorithm, a sequence of pre-designed stages that take place in an innovative pedagogical environment. Therefore, further consideration will focus on the adaptive technology development algorithm.

In view of the previous description of pedagogical technologies, we identify the following components of adaptive technology: *conceptual* (definition of educational feasible goals and objectives); *content* (didactic set: methodological approaches, principles and pedagogical conditions; didactic tasks); *procedural-adaptive* (procedural: subjects of the training process, analysis of experience, diagnostics of the state, setting of diagnostic goals, creation of appropriate educational environment: selection of forms, methods, means, diagnostic tools of the initial level of students' knowledge and further educational results; adaptive: variability, adaptivity to factors of change, influence); *resulting* (reflection, result analysis, correction).

Schematically, the adaptive technology development algorithm can be represented as follows:

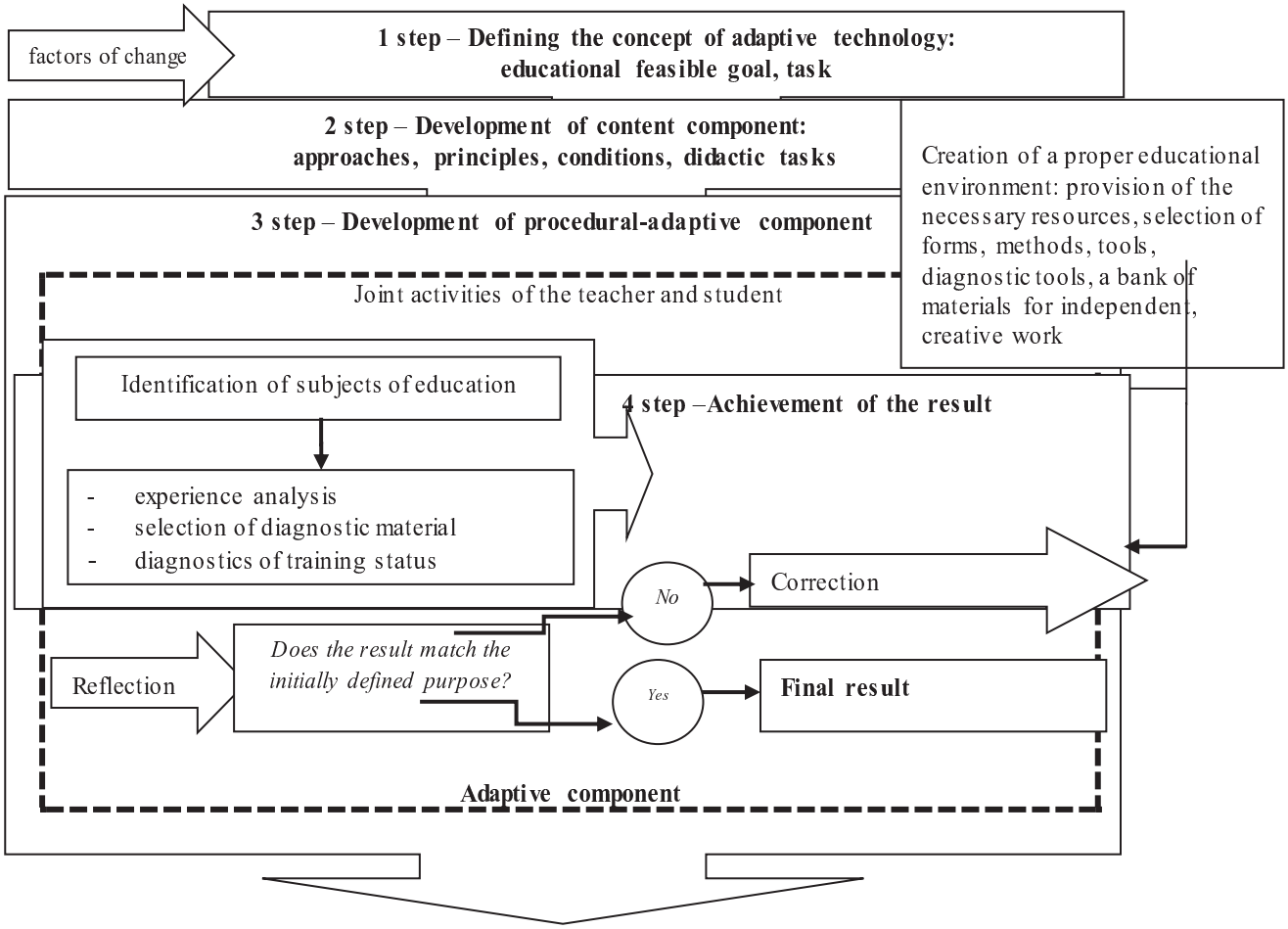

Fig. 2. Scheme of the adaptive technology development algorithm

The adaptive technology development algorithm that we have proposed is based on an adaptive approach, the main provisions of which are the concept of directed self-organization, developed by G. Yelnikova. According to the scientist, directed organization refers to the self-direction of the object of own actions towards the achievement of a conscious goal [5]. Through self-organization processes, a common goal can be achieved, taking into account the requirements of the environment and the balance of interests of all participants in the educational process.

The first component of our algorithm is the definition of conceptual provisions of adaptive technology under development. Conceptualism is identified from the standpoint of alternative and adaptability. Targets and tasks to be achieved and solved through technology are characterized. In designing the goal, it is necessary to take into account the factors of change which influence the determination of its feasibility. These factors can be innovations at the government and administrative levels, requirements and needs of participants in the educational process, their priorities for development, real circumstances that can accelerate or, on the contrary, impede development.

The second, content component, reveals the content of the educational process participants' activity, its didactic set: methodological approaches, principles and pedagogical conditions, didactic tasks, that is, fills the adaptive educational environment with the adequate necessary resources.

The third component of our algorithm is the procedural-adaptive one. It has the function of adaptability and involves the process of joint activity of participants in the educational process (teacher, student). It describes the features of application of forms, methods, and means, adequate to the tasks. It should be noted that here the variable models of the educational process subjects' activity are created: first, the "input" training status of students, their expertise with the help of selected diagnostic means (for example, qualimetric models) is studied. Then, depending on the results of diagnostics, the further course of work is coordinated by the students themselves, and adequate forms, methods of work are jointly determined. Students make their own choices. The teacher selects the "initial" diagnostic tools of the educational results. Such steps help to shift the work into a mode of cooperation, to individualize the process of student training, to develop an individual adaptive scenario and to activate directed self-organization and independent activity of students.

The fourth component is a resulting profile which includes reflection - analysis of the joint activity, analysis of the results obtained, their "initial" measurement, subsequent correction and, if necessary, a step back to the procedural-adaptive level with subsequent joint updating of actions.

Conclusions. Thus, the adaptive technology development algorithm described herein allows maximizing the mechanism of directing the joint activity of students and the teacher to achieve a feasible goal, increasing the extent of freedom between the subjects of educational process, mobilizing them for the desired result. The technological chain of pedagogical actions, operations and communications is arranged strictly in accordance with the targets, have the form of a specific expected result. An organic part of adaptive pedagogical technology is diagnostic procedures containing criteria, indicators and tools for measuring performance. The use of adaptive tools further emphasizes the role of the teacher. Now it is not a mechanical assessment of knowledge, but the development of various practical and creative tasks, the creation of projects and assistance to students in the organization of independent work.

Prospects for further research. Prospective areas for further research are development of the author's adaptive technology for Master's training.

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