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# THE TECHNIQUE OF EFFECTIVE EDUCATIONAL TECHNOLOGIES CHOICE IN THE SYSTEM OF HIGHER EDUCATION

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The paper is relevant due to the need to improve the educational process in the context of the transformation of higher education: the adaptation of content, methods, forms of vocational training to the social order. The paper is aimed at development of a universal technique for selecting educational technologies that contribute to the improvement of the process of designing vocational training for university students at the subject level. The authors analyzed the most commonly used educational technologies for the disciplines of the natural-science cycle, taking into account its specifics and the selection of significant criteria for multiple choices. The authors show the advantage of the matrix method in solving the problem of choosing the educational technology of teaching, the essence of which consists in analyzing the parameters of the technology through the standardization of its qualitative and quantitative indicators. On the example of the discipline "Life activity Safety", a criterion ranking of teaching technologies was realized and the selection of the most effective educational technologies was carried out. This paper is intended for educators, researchers, heads of educational organizations engaged in the design of the educational process in the university, content of disciplines and the organization of independent work of students in the university.

***Keywords:*** higher education, educational technologies, the selection method, matrix method, criteria ranking

## INTRODUCTION

Designing educational technology is seen as a pedagogical problem; methodological approaches are substantiated, the use of which will allow adapting the process of designing and implementing educational technologies to the conditions of the university. Pedagogical design, incorporating many fruitful ideas of technical design, allows optimizing the activity of the teacher, and its result is an information model or a didactic project of interaction between the teacher and students, conditioned by a specific pedagogical plan. The studies of V.P. Bespal'ko (1977), A.A. Verbitsky (1991), G.I. Ibragimov (2007), V.V. Karpov (2007), M.A. Tchoshanov *et al.* (2017); A.R. Kamaleeva and L.Yu. Mukhametzyanova (2016);

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A.M. Kalimullin & V.V. Utemov (2016); T.T. Sidelnikova (2016) and others are devoted to the problems of the design of educational technologies. The analysis of the pedagogical literature on this problem made it possible to single out a generalized algorithm for the design of teaching technologies in the university, which presupposes the following procedures: based on the analysis of the order for a specialist, a model of professional activity is built; a model of vocational training is developed, its priority goal is identified as the expected result; educational technology is designed to develop the professional competence of the graduate of the university. Correction of all stages is possible both on the basis of the results of control in the university, and on the assessment of the quality of the specialist by the customer - the enterprise of the industry.

We believe that in modern conditions the process of designing and implementing educational technologies in a university environment should be adaptive in nature, allowing to respond quickly to any changes - both internal and external, while preserving the integrity and efficiency of the technology, the conformity of the result with the requirements of consumers and the labor market. The mechanism of adaptation to the conditions of the university is manifested at several interrelated levels: educational technology; educational process; educational curriculum; educational services. Adaptability of educational services assumes the integration of all elements of educational activity, adapted to the demands of the labor market, and as a result, increasing the efficiency and competitiveness of the graduate of the university in the market of educational services.

The development of pedagogical knowledge, the growth of the number of methods, means, forms of organization of instruction, the identification of an increasing number of factors influencing the effectiveness of the teaching and upbringing process make the pedagogical activity excessively complex (Bespalko, 1995; Verbitsky,1991; Ibragimov, 2007; Choshanov, 1997; Ermolaeva, 2016; Rakhimova *et al.*, 2017). Educational technology is a necessary, mandatory condition for an innovative educational process. In the system of higher education, all generalized educational technologies are used to some extent. By now, it is already clear that no technology in the process of its design and implementation into the practice of the university retain its "sterility", full compliance with the basic idea. Specific pedagogical conditions, leaving their imprint, make it complex, poly-technological. Teachers, focusing on the most often encountered pedagogical situations in their practice, select various elements from several generalized technologies that are most suitable from their point of view, thus creating their own, new, specific technology for teaching this subject.

The technological development of vocational education opens the possibility of minimizing the negative consequences of pedagogical impromptu, translates pedagogical practice into the way of preliminary design of the educational process, and allows solving the problems of improving the quality of education.

## METHODOLOGICAL FRAMEWORK

The concept "pedagogical technology" is defined in different ways: "pedagogical technology is a set of psychological and pedagogical attitudes determining a certain set and composition of forms, methods, ways, techniques of teaching, educational means ..." (Likhachev, 1993); "pedagogical technology is a description of the process of achieving planned learning outcomes" (Volkova, 2005), etc. Traditional educational technologies provide a sustainable assimilation of basic knowledge, abilities, skills, which are the basis for the formation of skills of creative use, necessary in innovative professional activity. One of the important means for improving the quality and effectiveness of the pedagogical process in the system of higher education is the integration of pedagogical technologies (Prokofieva, 2016).

When studying the features and components of educational technology, we agree with O.G. Starikova (2010), who believes that in pedagogy there is no single classification of either traditional or innovative technologies, which makes it difficult to effectively use them; moreover, it is quite difficult now to draw a line between the method and the technology.

By pedagogical technology we mean an integral pedagogical system oriented to the effective achievement of training and educational tasks and presented in the form of goals, objectives, and conceptual foundations, and principles, features of content construction, methods and algorithms for organizing the pedagogical process. Modern conditions of pedagogical activity, normative time allocated for the mastery of discipline, presuppose an analysis of the diversity of teaching technologies, the formation of such a technological community that contributes to the most productive formation of the competences of students.

We propose the following classification of modern pedagogical technologies:

- on ensuring differentiation and personal orientation of education;
- on the degree of activity and independence of trainees;
- by the size of the supervised didactic units;
- on integration with information and communication technologies.

The implementation of an integrated approach to the selection of pedagogical technologies in accordance with this classification allows us to consider that different technologies can be used on the same training lesson or unit of studies. For example, at the lesson one can use both the technology of personal-oriented learning, and the technology of computer training, and traditional technology. This is possible in connection with the use of the new technology -"integral", which is based on a holistic unity of the basic ideas of its constituent technologies "(Bezrukova, 1994). Integral technology includes all the best components of its technologies, including providing motivation for trainees, independent search and research activities of students, realizes differentiation and individualization of teaching, provides an

opportunity to define individual trajectories of students' learning and development, to provide reflection and comprehensive monitoring of the quality of the educational process, its results and resources, to carry out distance learning.

*The key goals of the integrated technology:* effective training based on the developed curriculum; development of individual cognitive abilities of the trainee; formation of skills to work with information, development of meta-subjective universal educational activities (communicative, regulatory, cognitive); the formation of research skills, the ability to make optimal decisions; mastering by the students of maximum of educational information (as much as they can absorb).

*Concepts of integrated technology:* the students' awareness of the educational problem and the orientation toward achieving meaningful educational goals and a "tangible" final product; independent search, research activities of trainees with the assistance of a teacher; high rate and management in training (ensures the maintenance of a purposeful information process and the provision of each trainee the opportunity to advance in the teaching with the maximum speed, which is optimal for his cognitive powers); use of computers in the study of disciplines associated with search, research, diagnostic and analytical activities, the development of certain personality traits of students; saving time requires the provision of a time reserve for individual and independent group work of students; provision of distance learning.

*Principles of integral technology:* motivation (stimulation) of educational and cognitive activity; controllability of the educational process (at any time, the teacher can correct the educational process); the optimal combination of forms of educational work (individual, group and frontal); adaptability of the educational process (including the mode of operation of the computer) to the individual characteristics of students; dialogue nature of learning.

The flexibility of integrated technology can be defined as the ability to respond quickly and adapt to changing scientific, technical and socio-economic conditions.

## RESULTS

### Multi-criteria choice of educational technology

Obviously, the diversity of existing pedagogical technologies confronts the teacher with the choice and preferences, combining the elements of technology. There are no single criteria for choosing such a universal technology, the conditions of choice are: the ability of the teacher and students; resource maintenance of discipline and educational organization; content and specifics of the subject area and many other criteria. Schematically, the process of selecting alternatives to pedagogical technologies is presented in Fig. 1.

Teaching technology involves the way to achieve training and / or educational goals within the educational process through the organization of the educational

process, the broadcasting of the content of training, monitoring the achievement of the required level of knowledge, skills, and competences. Innovation in this aspect means achieving fundamentally improved results with the help of a system of pedagogical measures and methods of communication.

We have singled out the following important aspects (advantages, opportunities) of pedagogical technology: ensuring or not ensuring the activity, independence of students; ensuring or not ensuring the differentiation, individualization, personal orientation of trainees; the comprehensive use or non-use of computer facilities (Choshanov, 1996).

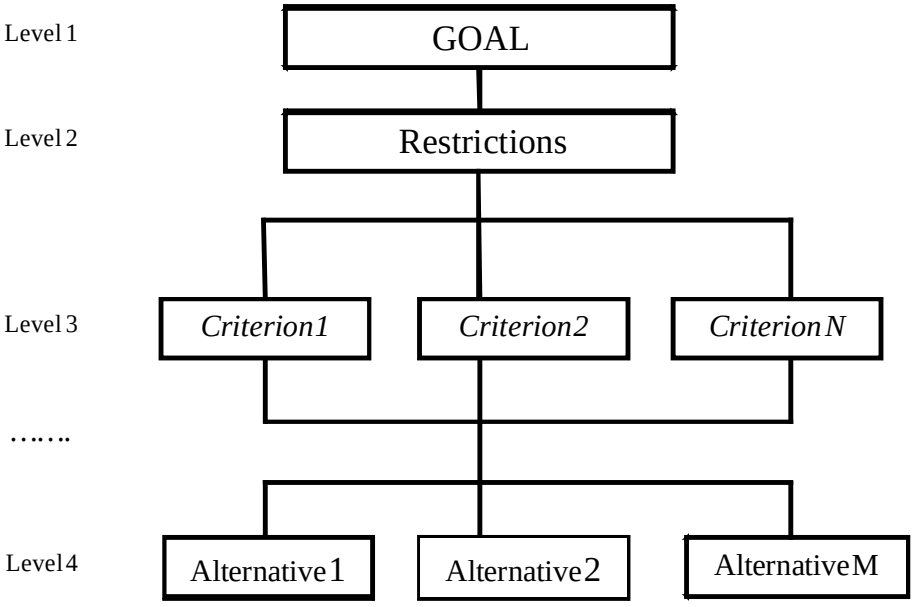


**Figure 1:** The scheme of multicriteria choice of educational technology

### Matrix method in the choice of learning technologies

Relying on the research of V.T. Volov (2008), where it is proposed to use a matrix method for deciding on the choice of teaching technology, the essence of which is to determine the effectiveness of technology by its qualitative and quantitative parameters through the standardization of qualitative and quantitative indicators by its average value under the selected conditions.

With regard to our homogeneity conditions (one discipline, one educational level), this method will look like this: let there be a set of {zi} technologies or learning forms, each of the elements of the set {zi} has sj parameters of a quantitative and (or) qualitative nature.

A vector for a set of indicators of each technology will look like this (with 0 - lack of quality of technology, 1- availability of quality of technology):

$$\{Zi\}= \{S11S12\ldots\ldots\ldots\ldots S1n\},\ i=1..m.$$

*The matrix of technologies' choice in this case can be represented as follows***:**

$$\{Zi\} = \begin{matrix} S_{11}\, S_{12}.....S_{1n} \\ S_{21} \\ S_{j1}S_{j2}.....S_{jn} \end{matrix} \left\{ \begin{matrix} \\ S_{22}.....S_{2n} \\ \\ \end{matrix} \right\}$$

$$i = 1..\ m,\ j = 1..n$$

It should be noted that under other conditions (for example, the multiplicity of disciplines), it is necessary to normalize the matrix (Volov & Zaichikov, 2016).

Each of these components of pedagogical technologies provides an increase in the effectiveness of the pedagogical process on the basis of the implementation of certain achievements in pedagogy and technology.

**Algorithm for selecting priority technologies**

We propose the following algorithm for selecting the priority technology (Fig. 2).

We use this formalized method when choosing technologies based on the example of teaching the discipline "Life-activity Safety" in the university. The analysis of scientific research, educational materials, and a survey of teachers of the university allowed us to highlight the most commonly used technologies for teaching the discipline "Life-activity Safety"(Prokofieva, 2016):

*The technologies of the educational dialogue* are considered not only as a special organizational form of the process of educational and professional interaction in the "teacher-student-student group" system, but also as a factor of actualization of the critical and reflective personality function. The experience of dialogical educational and professional communication is accumulated gradually (both by students and the teacher);

*Technologies of vital education are based on actualization*, demanding of life experience and intellectual-psychological potential of the student for educational (didactic) purposes. The inclusion in the educational material of the theoretically sensible subjective life experience of the student (educational, social, professional and other experience) generates a new psycho-didactical reality that gives the acquired knowledge and skills a personal, individually significant meaning and enriches the student's life experience on a new theoretically meaningful level;

*Gaming technology* is a didactic means of developing the theoretical and practical professional thinking and professional behavior of a future specialist. The didactic game removes the contradictions between the abstract character of the academic discipline and the real nature of the professional activity, the systemic

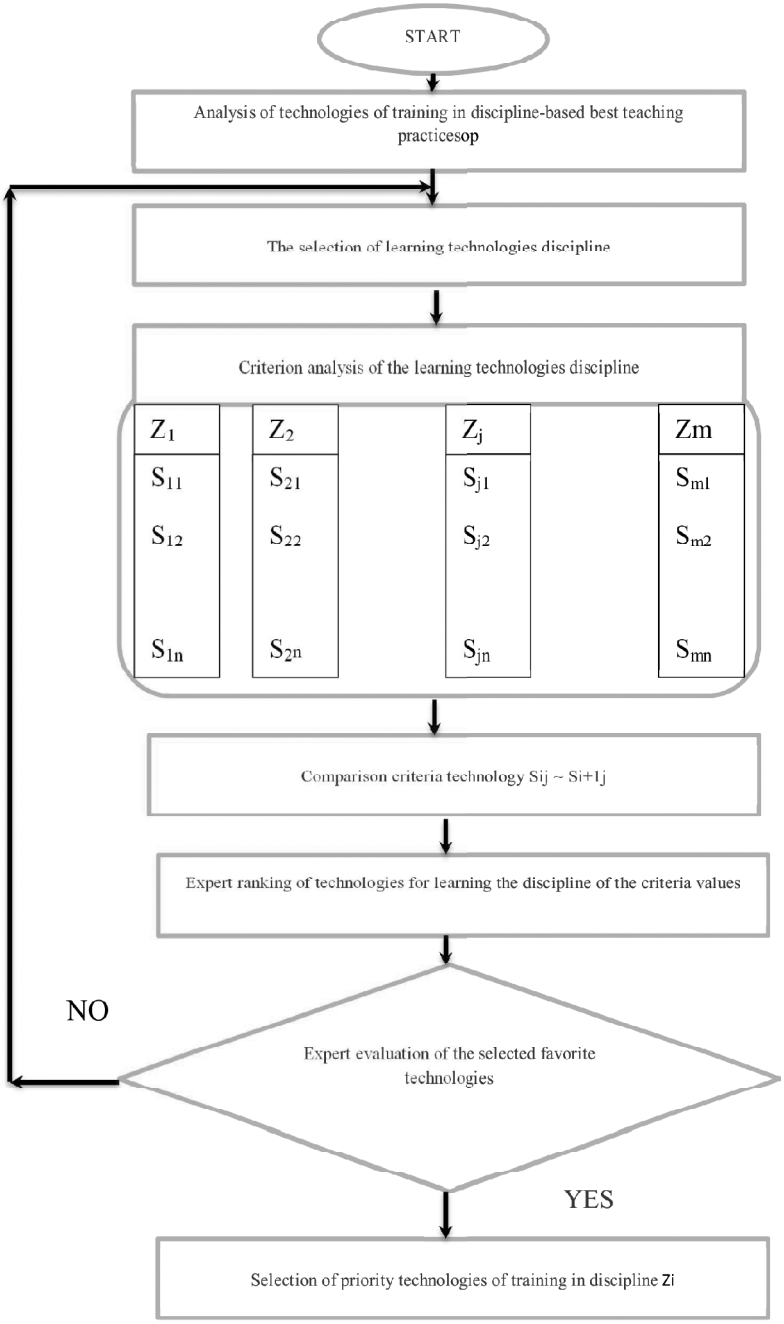


**Figure 2:** Algorithm for selecting priority technology

nature of the knowledge used in professional activity and their belonging to different disciplines during college years;

*Contextual training* is based on the fact that the students' purposeful mastering of professional activities is impossible outside the context of their life situation, which includes not only them, but also external conditions, other people with whom they are in interpersonal relationships;

*Moderation technology* is an interactive technology for conducting training sessions (or professional meetings), which is a group discussion process structured by certain rules to identify problems, find ways to resolve them, make a common decision, that each participant in the discussion perceives as their own;

*Design and research technology* is the integration of design and research technologies, this is a technology which is based on independent teaching and cognitive activity of students under the guidance of a teacher, integrated with search and research activities and aimed at achieving meaningful educational goals and a specific "tangible" product, starting from the problem (problem situation, idea) to its solution (implementation) (Mukhametzyanova, Kamaleeva & Russkova, 2016; Volkovskaya, 2015; Kuznetsova, 2013);

*The technology of personal-oriented learning* is a technology based on the principles of individualization of learning and the realization of subject experience of trainees;

*The technology of computer training is a technology where an important training* means is a computer equipped with training curricula.

Obviously, the diversity of existing pedagogical technologies confronts the teacher with the choice and preferences, combining the elements of technology.

We have ranked these technologies on a 10-point scale based on their criteria components. As criteria for teaching technology, we selected: transferability, the complexity for teaching of teachers, interactivity, scientific and methodical maintenance, resource maintenance, diagnostic nature, productivity of application. Experts were teachers of the discipline of life-activity safety of educational organizations of the Republic of Tatarstan, totally - 125 people. The data were tabulated and systematized on the basis of the obtained ranks.

## DISCUSSIONS

The variety of applied and pedagogical technologies, their integration on the basis of the analysis of the studies of V.S. Bezrukova (1994), V.P. Bespal'ko (1995), A.A. Verbitsky (1991), V.M. Monakhov (1997), etc. (as a rule, on the basis of information technologies ), the need to use active teaching methods in order to form students' competences "in practice" (quasi-professional activity) sets before the teacher the task of multi-criterion choice of pedagogical technology, conditionally solved on the basis of the following sequence of actions: setting the pedagogical goal of the educational process (within the framework of the lesson,

TABLE 1: CRITERIAL RANKING OF TECHNOLOGIES FOR TEACHING THE SUBJECT "LIFE ACTIVITY SAFETY"*

| *Technologies / Criteria* | *Transfera-bility* | *Comple-xity in Teachers' training* | *Interacti-vity* | *Scientific and metho-dical mainte-nance* | *Resource provision* | *Diagn-ostic nature* | *TOTAL* | *Produc-tivity of appli-cation* | *Remark* |
|---|---|---|---|---|---|---|---|---|---|
| Training dialogue | 10 | 2 | 4 | 3 | 0 | 3 | 22 | 6 | Simplicity of use<br>Insufficient efficiency of application, complexity of work in large groups |
| Vital training | 6 | 5 | 5 | 8 | 10 | 8 | 42 | 6 | Sufficiently high complexity of application, insufficient productivity of application |
| Gaming | 10 | 6 | 10 | 10 | 10 | 10 | 56 | 10 | High complexity and high application efficiency, teacher training is required |
| Contextual training | 4 | 8 | 8 | 8 | 8 | 5 | 41 | 6 | Insufficiently high efficiency of use, requires psychological and pedagogical training of the teacher |
| Moderations | 3 | 5 | 10 | 10 | 3 | 5 | 36 | 4 | Insufficiently high efficiency of application, special preparation and a sufficiently high level of the student are required |
| Project-research | 10 | 4 | 10 | 3 | 3 | 10 | 40 | 10 | The average complexity and high efficiency of the application require a sufficiently high level of student preparation |
| Technology of personality-oriented | 10 | 6 | 10 | 10 | 10 | 10 | 56 | 10 | High complexity and high application efficiency, teacher training is required |
| Technology of computer training | 10 | 6 | 10 | 10 | 10 | 10 | 56 | 10 | High complexity and high application efficiency, teacher training is required |

* Expert evaluation in points 0-10, 0-low score, 10-high score, the table shows the average Rounded values).

topic, discipline); analysis of limitations (resource, time, personal); setting priority criteria for selecting technologies depending on the planned result; creation of alternatives to pedagogical technologies; selection of pedagogical technologies on the basis of analysis of available resource constraints (Vatolkina, 2009; Prokofieva, 2016; Romanova, 2016; Starikova, 2010).

## CONCLUSIONS

On the basis of the analysis of the most frequently used pedagogical technologies the following selection criteria are determined: *versatility of technology* - the possibility of its transfer in different subject areas and organizational conditions; *the complexity of the technology,* driven by the need of teachers training for its implementation, development of special organizational-pedagogical conditions for its implementation in the educational process; *the interactivity of technology* – the possibility of establishing a technology through a subject-subject relations in educational activities, a variety of forms for the "inclusion" of the learner in a process requiring active participation; *scientific and methodological maintenance of technology,* which presupposes the existence of scientifically based instructional materials for teacher and student governing technology within the subject of education; *resource provision of technology* that defines the necessity of certain resources for the implementation of the technology (organizational, personnel, material-technological); *diagnostic nature of technology* suggests the existence of tools for assessing the achievements of students during the educational process in its implementation, regardless of the form of implementation (individual, group); *productivity of technology* based on the analysis of previously conducted pedagogical research in the same subject area and one's own teaching experience.

The developed procedure for assessing the effectiveness of innovative technologies can be transformed for any taught discipline, taking into account its specificity and selecting significant criteria for multiple choices. Undoubtedly, the advantage of any technology in modern conditions determines its integrative nature, the multiplicity of combinations of various elements within the framework of active forms and subject-subject learning. It should be emphasized that the same teaching technology in the "performance" of different teachers can look different, because in real pedagogical practice, the presence of the teacher's personal component, the features of the student contingent, and the specific of psychological climate in the training group are inevitable.

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