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### APPLICATION OF METHODS OF GENERATION OF INNOVATIVE IDEAS IN TRAINING OF STUDENTS OF TECHNICAL SPECIALTIES

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**Abstract.** *The purpose of this study is to systematize the methods of creative thinking and determine the directions of their implementation in the process of teaching students of technical specialties, the development of interest and initiative of students in solving technical problems. The article describes the methods used in different areas of science, such as psychology, design, marketing, allowing to analyze, generate and evaluate innovative ideas. The result of the study was the classification of methods for generating innovative ideas and the development of directions and ways of teaching students creative thinking.*

**Keywords:** *Methods of generating innovative ideas, teaching creative thinking*

**Introduction.** Modern understanding of competitiveness is directly related to the development of the world economy and international markets in the context of deepening globalization processes. For the best functioning of the enterprise it is necessary to put the process of management of innovative development on a systematic basis. Modern science has created a large number of approaches, methodologies and methods for analyzing existing problems and finding new solutions. Different methods can be used both separately and in combination with each other depending on the purpose of innovative development. The purpose of this article is to consider and classify methods of generating innovative ideas, which can be further used in the development of training programs for students.

#### **Teaching students creative thinking as part of Total innovation management.**

The rapid development of equipment and technologies, automated systems of product design and development of technological processes, automation of the production process, the use of modular and standardized approach to design can reduce the time frame for the production of new products and the cost of their production. Total innovation management is becoming a new paradigm of enterprise development and the training of specialists capable of generating and promoting innovative ideas is part of this system. Improving the design and ergonomics of the product should be a continuous process, as well as improving the quality of production and goods, and not a one-time action. Development of technology, design and ergonomics can and should be a part of the know-how of the enterprise.

Different methods can be used both separately and in combination with each other depending on the purpose of innovative development. Accordingly, in each case, the result is obtained, and from a combination of methods, you can get a synergistic effect.

The following approaches can be used for research.

**Methods of psychological activation of creative thinking**, aimed at stimulating creativity, going beyond the generally accepted framework and standards. The group of these methods include:

1. "Brainstorming" method, which is a way of collective creative thinking, unlimited by the limits of conventions, when a group of 5-10 people for about 1.5 hours expresses a variety of ideas.
2. The "Ship's Board" method, which differs from the previous method by a more formal and rigorous approach, where each participant in a strict sequence expresses his ideas [1].
3. Bodystorming – brainstorming in the physical environment with role modeling situations [2].
4. "Reverse brainstorming" is one of the varieties of "brainstorming" and focused on criticism of existing ideas. The process of "reverse brainstorming" is divided into two stages: the stage of identifying the maximum number of shortcomings and the stage of putting forward ideas to eliminate these shortcomings [3].
5. Method of Syntecic (method of analogies), based on associative links with similar objects or situations. In this case, direct, personal, fantastic, symbolic analogies can be used [4].
6. Reframing is looking at a situation or object from a different perspective. A variation of this method is the method of inversion, based on a radically different view of the subject, for example, a vertically operating object is placed horizontally or even inverted "upside down" [1].

7. Mind maps – a way of formulating thoughts and problems with the help of graphic images, rather than conventional text. For example, place a key concept in the center of a sheet, and write all associations that are worth remembering on branches that originate from the center [5].

8. The idea trap is the recording and inventory of emerging ideas [1].

9. The "Six Thinking Hats" method helps to structure both collective and personal mental activity, which contributes to its productivity. This method allows us to divide thinking into six types, each of which corresponds to a "hat" of a certain color. These hats can be six colors: red, yellow, black, green, white, blue. Blue hat is responsible for management, white – for information and facts, red – for emotions and feelings, black – for critical thinking, yellow – for positive thinking, green – for creativity. The idea of this method is as follows: the innovator puts on a hat of the appropriate color and takes on the role that describes this hat, then, removing it, he leaves this type of thinking and moves on to the next. These six hats correspond to the possible problems that an innovator may face in the process of searching for new ideas [6].

10. Collage is the visualization of thoughts, feelings, and other aspects in the analysis and modeling of the situation, it is difficult to convey in words [1].

11. Freeriding – a method that recommends to turn off internal criticism, get access to hidden ideas and knowledge [1].

12. STC method (size, time, cost) – a recommendation to change the dimensional time and cost parameters of the object, reduce them to 0 or increase indefinitely [7].

13. Word cloud – a method of information visualization that allows you to organize text content, highlight words that are important for understanding the problem [1].

14. The method of restrictions – allows you to understand what can interfere with solving the problem, rethink it, find methods to neutralize or bypass restrictions [1].

**Methods that activate the creation and search options** that allow you to move away from the stamp thinking:

15. The method of focal objects is based on establishing links between a problem and a random word [8].

16. The method of morphological analysis is to develop logical associative links between a set of random properties of a particular product [8].

17. The method of "garlands of associations and metaphors" is to identify all possible synonyms of the object, resulting in a garland of synonyms. Then you need to choose random nouns, which in turn forms a garland of nouns. After that, the stage of combining the obtained elements of the garland of synonyms with each element of the garland of random nouns begins [8].

**Simulation methods** allow different ways to model situations, find contradictions and solve them:

18. Business origami – creation of prototypes of interaction of parts of the product, divisions in the organization and other objects with the help of paper and improvised means [1].

19. Role-playing games allow you to reproduce real-world situations, find points of origin and resolve conflicts [1].

20. Simulation exercises – deep immersion in certain conditions and situations, putting yourself in the place of the user or consumer [1].

21. Character creation – modeling based on statistical analysis of different types of users and consumers, testing scenarios of their interaction with each other, objects (products or programs), sellers and other participants in the chain of production and sale of goods [1].

22. Design thinking (Design Thinking), is to solve a variety of problems in a creative way, not analytical. The creative approach assumes finding of harmony between requirements of the consumer, the strategic tasks set at the enterprise and the available technologies [9].

**Methods of systematic search of solutions** are based on a certain algorithm, which allows to determine and find several solutions to the problem:

23. Kano analysis – identifies product characteristics that are important to the customer. All the characteristics are separated into mandatory, desirable, causing admiration, neutral and anti-function. Depending on the combination and availability of these characteristics, you can create a product profile, find ways to improve it [10].

24. The "Five why" method is to search sequentially for the causes of nonconformity by asking – "Why did this happen?", which is usually given five times. Practice has shown that such a number of iterations is enough to find the sources of the problem [11].

25. The method of control questions is one of the most applicable, allowing you to understand the problem, formulate a goal and find ways to achieve it [11].

26. Matrix structuring of problems helps to find a new idea or define new functions of the object by constructing a matrix in the columns of which options (functions) of the goods are described, and in the lines — the market parameters of these goods, as answers to questions. For example: What application can find this product? Where can it be used? What range of consumers is it designed for? [1]

27. Agile development is a method that focuses on the use of iterative development, that is, splitting the process into small components or stages at which changes can be made quickly, which can ultimately reduce various risks [1].

28. Storyboard – visual representation of the project, scenarios of its use. Gives an idea in what context the product can be used [1].

**Deliberate methods of creative problem solving**

29. Theory of inventive problem solving, based on the search for contradictions in the system and their elimination [12,13].

30. Functional-cost analysis, which consists in looking at the subject as a set of functions and allows not only to improve the subject, but also to significantly reduce its cost [14].

31. The method of inventory of characteristics provides a list of the main characteristics of the goods and their search and combination to create a new modification of the goods [1].

**Methods of strategy development** are used in a state of uncertainty and fierce competition. These are methods of developing new ideas such as:

32. Customer-oriented (Customer Focused innovation), which is to study the needs of potential consumers. The peculiarity of this method is that the innovator tries to look at things through the eyes of consumers [15].

33. The method of organized strategies allows you to get away from the most obvious options for strategic planning through the use of functional-target analysis, analysis of contradictions, overcoming barriers, search for new ideas using all the previously obtained information [1].

34. Richard Vaughn's FCB grid allows analyzing the costs and sensory perception of the product, to find a niche in the market [16].

35. Blue ocean strategy, which consists in the avoidance of direct competition and creating new markets (blue oceans), in a radically new perspective on existing products and processes. [17];

The introduction of these methods and their combinations can significantly accelerate the process of innovation.

Teaching students the methods of generating innovative ideas can be carried out as a separate course, and using separate methods in specialized courses. The basis of the study should be primarily practical individual and group classes, where students can realize their intellectual and creative potential, to combine the knowledge gained in school subjects, and while studying at the University, in the implementation of innovative projects. The logical representation of the results of the study of the described methods should be the public presentation of the developed projects, the participation of students in start-up events, scientific conferences.

**Conclusion.** Training specialists in the methods of generating innovative ideas and their further commercialization is part of TIM. For the introduction of these methods in training programs for students and employees of enterprises, a classification of methods was proposed that will systematize knowledge in the field of managing innovative development of enterprises, develop creative thinking, apply the considered honey in various areas of science and production.

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