HEURISTIC METHODS FOR SOLVING THE CREATIVE PROBLEMS

E.R. Gazizov
Kazan Federal University, gazizov.e@bk.ru;
S.E. Gazizova
Kazan Federal University, silmaril92@mail.ru;
N. G. Kiseleva
Kazan State Agrarian University, tng1975@mail.ru
A. N. Zinnatullina
Kazan State Agrarian University, zinnatullina-alsu @mail.ru

Abstract. The development of non-standard thinking helps in solving creative problems. People who think formally can not come up with anything new, thereby destroying creativity. The creative task is an excellent way of revealing the personal abilities of each person. The development of creative thinking allows people to realize their creative potential, their individuality. Heuristic methods in solving problems allow us to express creative thoughts and to activate the creative possibilities of man. Creative thinking is very closely related to the imagination, which is important in any profession. Features of creative thinking consist in the fact that it contributes to the non-standard solution of certain tasks. An unconventional thinking person is able to offer bright ideas in any field of activity, that is, creative activity generates something new, different in originality, originality, and uniqueness. The system of heuristic methods of solving problems is based on logic, sound mind and experience, and the result of all this is new significant information. When solving creative problems, various heuristic methods are used. This is a method of brainstorming, a method of heuristic questions, a method of multidimensional matrices, a method of free association, a method of inversion, a method of empathy, a method of synectics. The work reveals the essence of each heuristic method, as well as the merits and demerits of each of them. We consider various forms of employment in heuristic ways of teaching, such as the olympiad, heuristic exercises, business games, interactive forms.

Keywords: creative task, heuristic methods, methods, non-standard questions, forms.

1. Introduction

Each of us at least once in his life met a man who possesses an amazingly developed imagination. A man who surprised with his original ideas and non-standard thinking. We used to call these people creative people. Creative people are completely unique. They never stop searching for new solutions, this is the difference between a creative person and an ordinary person. They are next to us, but it seems that they seem to be on another planet. Eureka (from Greek means "found") - the famous exclamation of Archimedes' joy, about the genius thought that came to mind. Heuristics (from Greek means "to find", "to discover") is a science that studies creative work, methods used to invent new concepts, thoughts and connections between objects and sets of subjects, as well as methods of the learning process. The author of the heuristic is Socrates. This science originated in ancient Greece. Methods of heuristics began to be developed relatively recently, and at first were designed to solve industrial problems. To date, heuristic methods find their application in various areas of management: in business, in advertising, in the practice of a modern leader, and even in art (in the preparation of theater productions). The method of solving non-standard questions is an effective algorithm that allows us to rationalize the various aspects of the search work. These methods rely on the activation of the creative activity of man and form his creative possibilities [1-12].

2. Methods

Consider the heuristic methods that are commonly used to solve creative problems. Heuristic methods imply such characteristic techniques that are used to solve certain problems and are smoothly more or less consciously transferred to the solution of other tasks. A characteristic feature of heuristic methods is that they are aimed at explaining and understanding current events. Heuristic methods allow you to provide more independence, creative search, that is, a system of heuristic methods for solving problems is an open type system. Define their advantages and disadvantages, as well as consider the forms of employment with heuristic methods of teaching. The way of brainstorming. Here is the formulation of the method, which was proposed by an American journalist and businessman Alex Osborn. Brainstorming is one of the effective ways to solve creative issues. At its core, brainstorming is a group generation of ideas. In a short period of time, you need to come up with as many different ideas as possible, even if they seem insane or clearly erroneous. This is when you are going to a team and jointly find a solution to a task that faces you, regardless of what area this task is from. Any expressed thought should be encouraged. Such support should stimulate the creative process. Brainstorming is the most free form of discussion. This method has one important rule: a strict ban on criticism, even in the form of a skeptical smile. The method is divided into two stages: 1) the team gives out their thoughts, then the proposed ideas are written down, even if these ideas are complete nonsense; 2) the group evaluates and develops ideas, and in the end selects the best ideas. The success of the brainstorming process depends on these two stages, because a joint discussion of the idea gives rise to an idea of a better, higher quality than the work of the same people individually, and the idea becomes more suitable for implementation. If the participants in the discussion are in a state of generating people, then the process of creative thinking that dominates at the moment can not be inhibited by a premature subjective evaluation of these ideas, which is the principal difference of brainstorming from

any other method. Advantages of this method are: 1) all members of the group are equal to each other; 2) non-standard thinking is valued; 3) the whole team participates in finding the answer; 4) the proposed thoughts are not rejected, but are refined. Disadvantages of the method are: 1) the solution of fairly easy tasks; 2) lack of a guarantee of finding really useful ideas, since a large number of any ideas, even fantastic ones, lead team members away from the real problem; 3) a high degree of involvement of team members bears the responsibility of all participants for the final result and since there are ideas for everyone, then the time spent on discussing all ideas increases.

The next is the method of heuristic questions. The method is also referred to as the method of "key issues". This method is used to find additional data. It is aimed at using the collected additional information or streamlining the information already collected in the process of solving creative tasks. Heuristic questions are intended for additional stimulation, formation of tactics for solving a creative problem. Who? What? Where? Why? Than? How? When? These suggestive questions guide the participant to the thought of a solution and the correct answer.

Method of multidimensional matrices. This method is also called a "morphological box". This method name is not entirely successful, since the very name "morphological box" does not reveal the essence of the method, but creates only mystery. The essence of this method lies in the system analysis of the latest interrelations, manifested in the course of the matrix analysis of the problem being investigated. A new combination of popular elements of the initial or a combination of the well-known with not yet known. There is no trial-and-error method, but only a study of relationships that can be calculated through matrix analysis. The advantage of the method is that it makes it possible to resolve complex creative problems and to find many new, unique ideas. The disadvantage of this method is the emergence of a variety of solutions, even when solving problems of medium difficulty, the choice of the optimal solution is difficult. This method does not guarantee that all characteristics of the system under investigation will be taken into account. The application of this method implies the potential of a certain skill and skill.

The way of free associations. During the emergence of associations, non-standard links are established between the elements of the problem being solved and the details of the outside world. Creative thoughts of solving the problem arise as a result of the process of the emergence of new associative connections. In order to increase anti-conformism, every member of the team should try to offer and express their ideas and opinions. This method is based on the use of associations in the creative process, as well as metaphors and randomly taken concepts. Between the two different concepts it is possible to establish a logical connection: there are two different conceptual words "wood" and "ball". Let's establish a logical connection between them: wood → forest, forest → field, field → football, football → ball. Thus, as a result of building logical associative links, creative ideas appear to solve problems.

Method of inversion. This is a method that is aimed at finding solutions for creative tasks in the newest, unexpected directions. Of course, this method is the opposite of ordinary views and beliefs, dictated by logic and reason. The method of inversion is based on the belief of dualism, the rational application of the reverse operations of creative thinking. A regularity has been revealed that when solving certain problems and research, situations often arise when logical thinking leads to a deadlock, then it is more expedient to apply the solution from the opposite one. If the solution from the beginning to the end does not give a result from the beginning, you need to reverse it from the end to the beginning: instead of reducing the object to try to increase it, instead of examining the outer surface, consider the inner side, instead of getting condensation, try to get evaporation. The advantages of the method is that it allows you to improve the dialectic of thinking and allows you to find a way out of difficult situations. The downside is that using it requires a fairly high level of creative capabilities.

Method of empathy. The essence of this method is to compare ourselves with the object and subject of creative work. When the method of empathy is used, the object is attributed emotions, feelings of the person himself (the person defines goals, functions, abilities, pluses and minuses). It turns out that the basis of the method of empathy is the law of substitution of the studied object or process. The advantage of using this method is the need for rapprochement with the object of research through imagination and imagination, which leads to the removal of limitations of common sense and the search for original ideas. The disadvantage and limitation of the method is that with its application there are many distractions, since the method is not taken seriously at first, it takes a lot of time and as a result allows you to get only the idea of solving a problem more often.

Method of Synectics. The goal is to create an option based on the knowledge of each participant. The essence of the method is a careful step-by-step selection of team members, which includes an analysis of their knowledge, capabilities, skills, creativity and communication opportunities. The method of the synectics was proposed by the scientist W. Gordon. When applying the method of synectics, it is not necessary to clearly formulate the problem in advance, as this makes it difficult to find a solution further. It is advisable to start the discussion not with the problem itself, but with an analysis of some common features, as they will help describe the situation of posing the problem. It is recommended to analyze the situation from the external and internal sides, past, present, future tense; when using the production, scientific, political approach, etc. In the base of the synectics enters a brainstorm. Storm is conducted by a professional or semi-professional team, which continuously accumulates the skill of solving issues. Using this method, a small criticism is allowed. In addition, special methods based on analogy to those to which direct equality belong (investigation of ways of solving a problem similar to this problem), personal equality (the desire to enter the position of the subject of the given problem), symbolic equality (detection in two words figurative determination of the essence of the problem), fantastic equality (resolution of the given problem by invented characters). To the pluses of the method of the synectics belong everything that is inherent in the heuristic methods on the basis of which it is developed. Its drawbacks include the fact that it does not provide an opportunity to solve specific creative problems, but provides a

chance to find predominantly more unique thought solutions and that when using the method for a long time. the effectiveness of generating new thoughts is falling.

3. Summary

Heuristic ways of teaching mean the following forms of lessons:

1) The Olympics. Thanks to her they give an assessment of the level of creativity of students.

2) Heuristic exercises, which involve the fulfillment of tasks aimed at the creative process, by students.

3) A business game that allows you to move closer to reality.

4) Interactive forms of study, which are implemented through computer programs.

5) Remote projects. Between the educational institutions heuristic Olympiads, creative projects are arranged.

6) Creative activity. Students are given a creative task.

7) The way of "survival". The student tries to get involved in the subject of research, to comprehend and feel it from within.

8) The method of imagery. Students look, for example, in a flaming candle and try to notice and depict those figures that they saw.

9) The way of inventing. In this case, a fresh, unfamiliar product is formed. For example, an unpredictable plot twist of some legend is invented.

10) Method of agglutination. Learners are asked to combine incompatible in reality characteristics, properties, parts of objects and display, for example, the top of the abyss, salted sugar and the like.

4. Conclusions

Thus, one of the main methods that allow to manifest creative activity in the learning process is the heuristic method. And the main purpose of the heuristic method of teaching is the formation of new thinking in the students, the ability to analyze and create.

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References

1. Kiseleva N.G., Zinnatullina A.N. Technology of problematic education in the university *Materialy II Mezhdunarodnoy nauchno-prakticheskoy konferentsii* «*Aktual'nyye problemy fiziko-matematicheskogo obrazovaniya*» [Materials of the II International Scientific and Practical Conference «Actual problems of physics and mathematics education»]. Nab. Chelny, 2017, pp. 122-124. (In Russian).
2. Khutorskoy A.V. *Didakticheskaya evristika. Teoriya i tekhnologiya kreativnogo obucheniya* [Didactic heuristics. Theory and technology of creative learning]. Moscow. MSU Publishing House, 2003. 416p.
3. Kiseleva N.G., Zinnatullina A.N. Interactive learning technologies *Materialy mezhdunarodnoy nauchno-prakticheskoy konferentsii* «*Agrarnaya nauka XXI veka. Aktual'nyye issledovaniya i perspektivy*» [Materials of the international scientific and practical conference "Agrarian science of the XXI century. Actual research and prospects »]. Kazan, 2016, pp. 288 (In Russian).
4. Kiseleva N.G., Zinnatullina A.N. Distance education of students *Materialy nauchno-prakticheskoy konferentsii* «*Ustoychivoye razvitiye sel'skogo khozyaystva v usloviyakh global'nykh riskov*» [Materials of the scientific-practical conference "Sustainable development of agriculture in the context of global risks"]. Kazan, 2016, pp. 608. (In Russian).
5. Panfilova A.P. *Mozgovyye shturmy v kollektivnom prinyatii resheniy* [Brainstorming in collective decision-making]. Izvestiya IVESEP St. Petersburg, 2005. 320p.
6. Cropley, A.J., More Ways than One: Fostering Creativity [Text] / A.J. Cropley. – USA Ablex Publishing Corporation, 1997. – Fourth Publishing. – 134 pp. – ISBN 089391939X, 9780893919399
7. Fogler, H.S., LeBlanc, S.E. Strategies for Creative Problem Solving [Text] H.S. Fogler, S.E. LeBlanc. – New Jersey: Prentice-Hall Inc., 1995. – 203 pp. – ISBN 0-13-179318-7
8. Lucas, R.W. The Creative Training Idea Book: Inspired Tips and Techniques for Engaging and Effective Learning [Text] R.W. Lucas. – NY: AMACOM, 2003. – 470 pp. - ISBN 0-8144-0733-1
9. Wegerif, R. Mind Expanding. Teaching for Thinking and Creativity in Primary Education [Text] R. Wegerif. – Glasgow, UK: Bell and Bain Ltd, 2010. – 167pp. - ISBN10: 0-33-523373-2 (pb) 0-33-523374-0 (hb), ISBN13: 978-0-33-523373-1 (pb) 978-0-33-523374-8 (hb)
10. Starko, A.J. Creativity in the Classroom: Schools of Curious Delight [Text] / A.J. Starko. – London: Lawrence Erlbaum Associates, 2005. – Third Edition. – 499 pp. – ISBN 0-8058-4791-X
11. Nefyodov O.V. Student motivation in learning a foreign language // Humanities and Social Sciences in Europe: Achievements and erspectives, 1st International symposium Vienna, 2013. PP. 259 - 264.
12. Romero, Juan Bautista Abello, and Claudio Mancilla. "Análisis multi-teórico de los gobiernos corporativos universitarios sobre la divulgación de información." Opción 34.86 (2018): 358-392.
13. Yuvarajan, D., Babu, M. D., BeemKumar, N., & Kishore, P. A. (2018). Experimental investigation on the influence of titanium dioxide nanofluid on emission pattern of biodiesel in a diesel engine. Atmospheric Pollution Research, 9(1), 47-52.