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HEURISTICS IN THE PROCESS OF SOLVING MATHEMATICALLY PROBLEMATIC SITUATIONS IN PRIMARY SCHOOL

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Abstract: This article is devoted to the presence of heuristics in the process of solving mathematically problematic situations.Solving mathematical problems is a complex cognitive activity involving a number of processes and strategies. This is an attempt to find the right action to produce the desired result. The very specificity of problem situations requires that certain knowledge already acquired should be applied in an atypical system of data and relationships to reach new knowledge. The process of solving does not relate only to knowledge, but also to the way this knowledge will be applied.Methods by which students can solve non-standard tasks are defined as heuristic. In primary school mathematics training, much of the task is solved on the basis of rules already learned, which are automated through skills. The significance of these standard rules is that they target the student in the relationship between the objects through which the solution will be found. Knowing what links are needed to solve a particular task does not lead to a new discovery.
The process is algorithmized and leads to a quick and accurate response. However, there are situations where the specific rules for solving are not known. These non-standard conditions give rise to problems for which a system of operations is needed. The method by which new solutions are found, and non-standard plans are being developed, is called heuristic. The heuristic method for solving mathematically problematic situations requires the presence of heuristics. Heuristics is not a thought-like act like analysis, synthesis, etc., but a set of methods that individual operations shape in the form of strategies.
Keywords: problem situation, mathematical problem situations,heuristics, mind count

1. INTRODUCTION

The problem-solving process that is used in mathematical educational literature refers to a process where students face a problem-a question they can not immediately answer or the solution to implement a ready-made algorithm. Therefore, they need to read the problem carefully, analyze the information, and explore their own mathematical knowledge to see if they can build a strategy that will help them find the solution to the problem. The process requires a reorganization of existing ideas and the emergence of new learners' work on the problem with the help of the teacher to act as an assistant, asking questions to help students recall what they know and construct new relationships. When new knowledge is built into existing cognitive frames, the result is an increase in the network of ideas and understandings.

In his book "How Does This Problem Solve", G.Poyas introduces the idea that solving problems can be considered as a kind of art similar to piano playing or swimming. Poya (1972) considers problem solving as an act of discovery presented by the term "modern heuristics" to describe the abilities needed to successfully explore new problems. He promotes the presentation of mathematics not as a complete set of facts and rules but as an experimental and inductive science.

Speaking of problematic situations, author Pushkin (1965) believes that in order to solve a problem situation "one has to do some action, solve this or that task, but the available conditions do not show him the way to solve it and the whole arsenal of past experience does not contain any ready-made scheme that would be fit for the given conditions. In order to find a way out of such a situation, one has to create a new, missing strategy of action, ie. to perform an act of creativity. Such a situation is called a problem, and the mental process by which the problem is solved is called productive thinking or if the term Archimedes heuristic activity is used "[34]

2. ESSENTIAL CHARACTERISTICS OF THE NOTION "HEURISTIC"

Many scientists from the 17th century draw attention to creative thinking including Descartes, Spinoza, and others. their understanding of heuristics is based on intuition. They think that the thinking activity is not based on logical evidence and reasoning, but on "intellectual visions". Differences between intuition as a means of immediate acquisition of knowledge and knowledge acquired on the basis of a logical apparatus examine Descartes in his work "Rules for the Lead of the Mind". W. Amus defines intuition as a collection of thought and contemplation. Einstein

[34]Pushkin V. N, Heuristics - Science and Creativity M., 1967 v.4

himself shares the importance of intuition in his research. According to Pushkin (1967), logical reasoning alone does not allow the creation of something new, they lead to the establishment of relations in a problematic situation, but they are not enough to solve it.

In modern pedagogy, a comparison between intuitive and logical thinking makes J.Bruner (1960) in his work The Learning Process. In his books Bruner examines the question of intuitive thinking and the heuristic method of solving problems. Heuristic techniques are characterized as some not very accurate ways to solve tasks that can reach or fail to achieve the desired result. Therefore, the use of analogies, the examination of a limited set of conditions, the visual expression of the decision, and so on. Bruner opposes problem-solving techniques by algorithms that ensure that a solution is achieved if the algorithms are followed correctly. Heuristic techniques are often applied in situations where there is no known algorithm to solve. For Bruner, the term "heuristic" serves to characterize only the tools that help solve the task.

The significance of heuristic thinking is also marked by Poia (1972) in his book, "How does this task work?" The author connects heuristics with a process of invention, with the creative process. According to M. Mirsky (1969), heuristically is called this method, which helps to improve the process of solving the task by not targeting a full sort of each solution but using only one of all options.

3. THE PLACE OF HEURISTICS IN PROCESS OF SOLVING MATHEMATICAL PROBLEM SITUATIONS

Methods by which students can solve non-standard tasks are defined as heuristic. In primary school mathematics training, much of the task is solved on the basis of rules already learned, which are automated through skills. The significance of these standard rules is that they target the student in the relationship between the objects through which the solution will be found. Knowing what links are needed to solve a particular task does not lead to a new discovery. The process is algorithmized and leads to a quick and accurate response.

However, there are situations where the specific rules for solving are not known. These non-standard conditions give rise to problems for which a system of operations is needed. The method by which new solutions are found, and non-standard plans are being developed, is called heuristic. The heuristic method for solving mathematically problematic situations requires the presence of heuristics. Heuristics is not a thought-like act like analysis, synthesis, etc., but a set of methods that individual operations form in the form of strategies.Heuristics have two main features:

- The first functional characteristic defines the heuristic method only as a preliminary step in the process of solving a particular task that leads to finding the right solution. This means that heuristic reasoning is not final and extreme, but a kind of pre-discernment, the purpose of which is to point out the direction to be solved. Reflection itself can not lead to verifiable evidence because it is based on predominantly guesswork.
- The second functional characteristic of heuristics concerns the aspect of the study. It is believed that the heuristic method shortens the number of different ways of solving, but does not always guarantee that it reaches the answer.

From the point of view of pedagogy, heuristics are important for the development of methods to manage pupils' mental activity. The merit of developing the heuristic method as a pedagogical problem belongs to Poya (1960). In his work devoted to the study of the process of mathematical solutions, he concludes that mathematics is not a closed deductive system, but one that is constantly upgrading, a definition of a fully characterizing and mathematical task.Mathematical problem problems arising from problem situations are a specific type of tasks that require creative thinking. The process of their solution is creative, mentally active, and to a great extent contradicts the established ways of solving mathematical problems. Heuristic methods help students to realize the creative work necessary to find the right solution. When talking about a mathematical problem, however, the logical in the process of solving can not be ignored. Science mathematics is woven by some or other algorithms to solve which, despite the creative nature of the task, can not be ignored. Therefore, the problem solving process of mathematical nature is a peculiar set of heuristic and algorithmic methods, the combination of which depends on the degree of problem situation.

In general, the heuristic method is the leading method of solving mathematically problematic situations. Heuristic is considered to be the method whereby solving a mathematical task is done through choices in several possible ways. The implementation of the heuristic method of solution is illustrated by a graph (Figure 21)

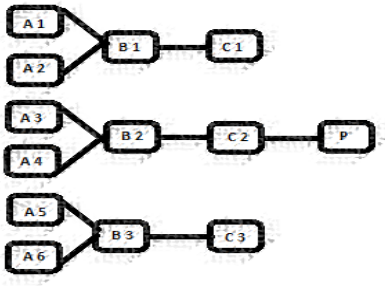

Figure 1. Figure of heuristic problem solving model

The labels A1, A2, ...are the possible ways of solving the problem situation; B1, B2, B3, as well as C1, C2, C3, are the decisions of which the main solutions are divided, and P is the ultimate goal, i. the decision. It is apparent from the image that not every possible solution option can lead to a successful resolution of the problem situation. Sometimes it comes to a decision (C1, C3) that is incomplete or wrong and does not lead to the ultimate goal.The presence of the heuristic method in the process of solving mathematically problematic situations can be done with or without prior orientation. Pre-orientation is given by the teacher and, depending on the complexity of the problem situation, may concern the objects, rules or decision methods. These core components are in dependence on one another and the orientation in one allows the accumulation of information for others. When orientation is made for all three components, full orientation is achieved. Rarely in the educational process, full orientation is recommended, and when it comes to problematic situations, it is absolutely excluded, because its implementation automatically translates a problematic situation into a problem, eliminating the possibility for the students themselves to reach the new knowledge or mode of action.
It has now become clear that the heuristic method of solving is characterized by the existence of a large number of variants to be solved, their quantity depends on the number of objects present in the problem problem. As with the increase of the objects, the options for solving are also increasing, as the number of connections between the objects themselves increases.

4. CONCLUSION

At the beginning of its problem solving was considered a mechanical, systematic and often abstract set of skills for solving mathematical puzzles and equations. These problems often have a correct answer that is based on logical reasoning. But under the influence of cognitive theories of learning, problem solving evolves into a complex mental activity consisting of a set of cognitive skills and actions. Problem solving involves high-class thinking skills such as visualization, abstraction, association, and more.

From what has been said so far it can be concluded that the process of problem-solving situationsrequires the application of a set of methods, among which heuristic is the leading one.

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