THE IMPORTANCE OF MENTAL OPERATIONS IN FORMING NOTIONS

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Abstract: *In almost every moment of our existence we are engaged in a process of problem solving. Thinking functions as a process of "problematical continuum". The process of problems solving consists of chaining together reasonings (comprised of judgments which are in turn made up of notions), which when linked together based on the operations of thinking, permit an understanding.*

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This work addresses the role of mental operations in forming notions. Such an approach is necessary in order to understand more efficiently the place that the highest ranked cognitive processes within man's intellectual structure occupy in regard to forming notions, which form the basis of the human rational process.

Human beings as well as animals have several levels of functionality. At the primary level, biological systems exist because of the brain's control of physiological functions. Cognitive processes, on the other hand, are linked to cortically-controlled functions. Cognizance[1] is more linked to conscious than unconscious processes, as well as voluntary responses as opposed to involuntary ones. The information processed through thinking is that which is received through analyzers or stored in memory as a result of prior experience.

Thinking is defined as[2] the cognitive process of highest meaning in reflecting the real through mental operations which extract and process

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[1] Malin, Tony, *Cognitive processes*, translated by Gina Ilie, Bucharest, Editura Tehnica, 1999, p. 161.

[2] Stănculescu, Elena, *The Psychology of education: from theory to pracice*, Bucharest, Editura Universitară, 2008, p. 157.

information in the form of notions, reasoning and judgments. Thinking is comprised of two large components, information and operational. The informational side is made up of the totality of notions and conceptions as generalized forms of reflecting the properties of objects and phenomena. The operational side is made up of the operations and mental procedures of transforming, linking and processing, combining and recombining information in order to obtain new knowledge or to solve problems.

Thinking utilizes two categories of operations: some are fundamental, basic, and are present in any thinking act, constituting its framework (analysis, synthesis, comparison, abstractization, generalization, concretization), while others are instrumental, being used only in certain acts of thought, particularizing themselves depending on the area of knowledge in which thinking is taking place.

The main operations of thinking are[1]: analysis, synthesis, comparison, generalization, abstracting and concretization. Analysis is the operation of mentally taking apart an object into its component parts. Analysis begins as the practical operation of decomposing a real object and ends up being realized only mentally. Synthesis is the operation opposite of analysis; it consists on mentally joining parts so that the result is a whole. Synthesis can also be accomplished in the practical action plane. Comparison is an operation which consists in establishing the differences and similarities between an object and other objects. It too can be undertaken both really and mentally. Generalization is the operation through which the common traits of the objects and other objects within a class emerge. The abstracting is the operation through which particular, individual object traits are set aside so that only the traits obtained through generalization are retained. Only the common trait is mentally retained as a result of abstraction. Concretization is the operation which, based on abstract object traits, the mental reconstruction of the concrete is undertaking. If through synthesis we reach a mental concrete which is mostly abstract, the concrete, being a result of its operation, is a logical one: a concrete is mostly the result of assembling abstract traits. The concrete as a result of the synthesis operation is rich in detail whereas logical concrete is poor in detail but rich in general traits.

Thinking is not a mechanical undertaking of "pure" operations. As a process of knowledge with reflecting and information modeling functions, it is mandatory that it presupposes the existence of specific contents upon

[1] Stănculescu, Elena, *op. cit.,* pp. 159-164.

which operations are applied. The primary source of the contents is located within the external world, and its wellspring is represented by sensory data. These are not incorporated raw into the internal thinking structure but is successively filtered and processed at various levels of generality, abstraction, and essentiality.

The constituting element of thought is THE NOTION, and the higher ranking cognitive elements are reasoning and judgment. The notion[1] is that internal informational entity which integrates those determinants (traits) which are significant, essential, necessary and common to a larger or smaller number of objects or phenomena both real and imaginary. The notion is not a given, it is the result of an evolutionary process.

Research carried out by A. Svacikin (1937) under the guidance of L. S. Vagotski[2] has proven that before reaching the actual notional stage, thinking must go through a series of intermediate stages:

1. the pre-notional stage (sensory images are the absolute dominant)
2. the notional complex stage (qualitatively different objects such as beings and items are placed together within the same category based on accidental traits)
3. the pseudo-notional stage (narrowing the sphere of a notion until it comprises a single object)
4. the concrete notion stage
5. the abstract notion stage

The stages of forming notions reflect and are symmetrical to the stages of forming operations of thinking. A notion, once realized, is included into the thinking's established content structure, providing qualitatively superior working material for the operation bloc. In this way the epistemic attitude and behavior in relation to real life will have different traits when they are based on notional mediation as compared to when a situation is primarily sensorial mediated. From a certain point of view the notion can be taken as the significance of words. This means that it denotes a word (or more), its semantic content and the idea we draw from it. The word in turn is merely a shell for the notion, being able to vary depending on the language (copil-child-enfant-kinder). Integrating the notion into the verbal pattern (words) does not occur spontaneously and

[1] Mihai, Golu, *Fundamentals of psychology*, Bucharest, Editura Fundației România de Mâine, 2000, p. 151.

[2] Mihai, Golu, *op. cit.*, p. 152.

all at once, but gradually during a long process of ontogenetic evolution and learning.

Based on the nature of their contents, notions have been divided into concrete and abstract.[1] A notion is considered concrete if it is possessed of a direct imagistic support, being capable of representation (house, flower, car etc.) The abstract notion contains traits removed and detached of their sensory context and support, their representation being impossible (freedom, wisdom, development etc.). We cannot state that a notion is true or false, but with the aid of notion we can formulate a series of judgments regarding a specific class of phenomena and objects. The first way of revealing and introducing a notion into a cognitive cycle is the definition.

A different classification of notions divides them into empirical and scientific[2]. Empirical notions reflect concrete, particular, random and non-essential traits and their source is sensory perception. On the other hand scientific notions reflect general, essential traits which are the same for all individuals, and are based on knowledge.

Within thinking, notions are not randomly disposed but are systemically ordered, elaborating the pyramid of notions[3]. It is vertically structured vertically with generality as its criterion and horizontally based on its modal semantic coordination. Toward the pyramid's base are notions with the smallest sphere and greatest volume (individual notions); following them on the higher levels are notions with wider and wider spheres and increasingly smaller volume (particular and general notions), and at the top of the pyramid are the notions with the highest degree of generality (systematized categories such as existence, matter, reality). When the internal organization of the pyramid is good, thinking flows freely, easily and coherently, both from the individual to the particular, from the general to the categorical and in reverse.

Another different aspect in regards to establishing the role of mental operations in the formation of notions is understanding the essential function of thinking. Old information is linked to old through it. A good understanding entails:

- a pre-existing knowledge base
- a selection and systematization of older knowledge which must be understood

[1] Golu, M., *op. cit.,* p. 154.

[2] Malin, Tony, *op. cit.,* p. 172 [8] M. Golu, *op. cit.,* p. 155.

[3] Golu, M., *op. cit.*, p. 155.

- a specialization (a profound study of a science, area)

Depending on their degree of difficulty[1] there are

1. Spontaneous understanding (connections are easily established between present and past information: for example when we perceive an object we immediately understand what it is and what it's used for)

2. discursive understanding (it is accomplished gradually, sometimes over a long time, the relations are numerous and require incursions into various directions: for example, after one year of studying history a child states that history is "the recounting of wars", this being a quite empirical understanding of the notion).

The impossibility of understanding reveals the emergence of a problem which gives rise to the process of problem solving. O problem is a cognitive obstacle in the relations between the subject and its world, a theoretical or practical difficulty, a lack of knowledge, a system of questions pertaining to an unknown. For the problem to be real as opposed to false, it has to contain both known and unknown data. For example, finding a cure for ADIS does not constitute a real problem for a high school student but it does for a medical researcher.

Conclusions

Problem solving[2] represents the process of mobilizing one's mental resources in order to overcome the encountered cognitive obstacle. The stages of solving a problem are as follows: stating the problem, formulating hypotheses and testing them, choosing the optimal solving model, execution, and not least, verifying.

In almost every moment of our existence we are engaged in a process of problem solving. Thinking functions as a process of "problematical continuum". The process of problems solving consists of chaining together reasoning (comprised of judgments which are in turn made up of notions), which when linked together based on the operations of thinking, permit an understanding.

Presenting the information in the previous pages allows us to state that mental operations occupy the central role in forming notions, without which more complex thinking processes (judgment, reasoning) would not be possible.

[1] Salavástru, Donna, *The Psychology of education*, Iaşi, Editura Polirom, 2004, p. 126.

[2] Salavastru, Donna, *op. cit.*, p. 129.

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