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The Nature of Methodological Principles and Approaches

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ABSTRACT

The methodological principles (approaches) of pedagogy highlighted in the course of work as a branch of humanitarian knowledge make it possible, firstly, to isolate not imaginary but actual problems and thereby determine the strategy and the main ways to resolve them. The article discusses methodological principles and approaches which allow to obtain objective knowledge and get away from previously prevailing pedagogical stereotypes.

KEYWORDS: *methodological principles, the principle of compatibility, the principle of complementarity, the principle of verification, falsifiability principle, the principle of integrity, the principle of modeling, the principle of historicity.*

Methodological principles cannot provide a clear path to new knowledge. In this respect, they are more abstract. However, unlike heuristics, methodological principles can be defined in a clear, coherent way. These approaches to knowledge have been used since ancient times even before they were described in the form of principles, but their reflection, specification, and detailed analysis of their areas of application were mainly carried out in the methodology of the 20th century.

There is so much literature on each principle that it would make a mountain if you put them together. However, reading them gives the researcher very little methodological information compared to a brief description of these principles. Detailed studies are useful for professional methodologists to define and defend their views.

The principle of compatibility. Systematization of knowledge in this field of scientific knowledge on the basis of new principles (ideas, concepts, theories) should include "old" knowledge in this field as an element of this system (as a special phenomenon, as the latest phenomenon, etc.). For example, relativistic mechanics transitions to classical Newtonian mechanics when objects move at low speeds.

The formation of the principle of conformity in the methodology of scientific knowledge is usually connects with the name Bohr. However, the ideas of the principle of compatibility were put forward in different forms before that. In the literature it is stated, among other things: "Niels Bohr in 1913 described the famous "principle of compatibility". This principle established a legal relationship between the classical theory of radiation and the quantum theory. It played such an important role in the development of atomic theory that A.N.Sommerfeld. Bohr described the "consistency principle" as a "magic wand". Nevertheless, if we look at the last century, we can find similar ideas in Butlerov. Among other things, he writes: "If we understand the nature of chemical energy and the movement of atoms, and the laws of mechanics begin to apply here, the doctrine of chemical structure will lose its importance, like the old theories of chemistry. But it loses its importance not only in order to disappear, but in a changed form to take place of new, broader views.[1]

This principle helps to distinguish between scientific and non-scientific knowledge in most cases.

The principle of complementarity. Many objects of research (from the simplest objects of the

[1] Бутлеров А.М. Сочинения. М., 1953. Т.1. -С 640.

microworld like elementary particles to complex objects like man and society) are relatively fully described on the basis of combining different, even contradictory knowledge (theories, concepts, approaches). Corpuscular-wave dualism in physics or the doctrine of soul and body (religion), the doctrine of the duality of reality (Ibn Rushd), material and spiritual substances in the description of man (Descartes), synchronic and diachronic approaches in linguistics and cultural studies, internalist and externalist approaches in the methodology and history of science among them. As you can see, the idea of complementarity of different knowledge about the same object has been known since ancient times. It is connected with the name of Bohr: "In order to better understand the twin concepts of classical physics, Niels Bohr introduced the concept of "complementarity" into scientific circulation. He saw the particle landscape and the wave landscape as complementary descriptions of the same reality. Each of them is only partially valid and has limited application[2].

The principle of profiling scientific theories (or P.Feyerabend's anarchist theory of scientific knowledge). This principle, which implies that the possibility of perfect knowledge of an object increases with the number and variety of theoretical ideas, can be called the "principle of complementarity multiplied by the square". Although this principle resembles the principle of complementarity carried to an absurd level, it shows its ability in knowing complex objects (for example, if we take the problem of "Man and all existing approaches, theories, directions, schools, doctrines").

The principle of verification is essentially a counterpart of the principle of adequate justification of formal logic. Its main content is very simple - it should be based on the rules to be included in the scientific knowledge system. But it is difficult to say the same about the problem of choosing generally accepted criteria of true or valid scientific knowledge. Unfortunately, there is no consensus among scientists here. In logical positivism, the ability to empirically substantiate any knowledge by connecting it to the simplest atomic empirical judgments, notes, serves as such a criterion.

Falsifiability principle - according to this principle, only knowledge that can be verified by refutation can be scientific knowledge. The principle of falsification is particularly effective in distinguishing traditional scientific knowledge from false, mystical, esoteric, and other similar teachings. For example, if someone says that he saw a flying saucer in the sky with aliens looking through its portholes, in order to consider this knowledge from a scientific point of view, it should be possible to critically check its falsity or authenticity (witnesses, photographs, recorded radio signals, etc.).

This principle was described by K.Popper. But its main idea has been explored before, more or less clearly. For example, F.Nietzsche in "Beyond Good and Evil": "The impossibility of denying a theory is one of its most important aspects. It is with this aspect that he attracts the owners of the most elegant minds."

The principle of reduction is to know a certain wholeness, system, "complexity" through its relatively simple components, elements. In other words, the principle of reduction is to know certain integral properties of the studied objects (entities, systems) through the components of these objects. This principle is more specific to the scientific knowledge of certain objects of animate and inanimate nature, social systems, socio-natural systems. For example, some properties of an atom can be derived from the properties of its nucleus and electrons, the properties of a living cell can be derived from its organoids, the properties of society can be derived from the social classes, economy, geo-political situation, etc.

The principle of integrity is to know the individual integral properties of the researched objects in interaction with other objects (integrity, etc.). Simply put, the whole is greater than the sum of its

[2] Капра Ф. Дао физики. СПб. «Орис», 1994. -С 304.

parts. More precisely, any system, as a whole, has properties that cannot be attributed (reduced) to the total properties of components, elements. For example, the properties of molecules are not limited to the properties of their constituent atoms; the properties of living cells are not limited to the properties of molecules and organoids contained in them; the properties of populations are not limited to the properties of the organisms that are part of it; language properties are not limited to the properties of lexical units, grammar rules, and semiotic details that make up it.

In the principle of ***counterreduction***, it is recognized that the existence of higher immanent "meta-whole" properties and the integrity of this system can be studied from an epistemological point of view as a component, an element of a more highly organized system. It is specially noted here that we are talking about immanent, i.e. properties inherent to this whole. The principle of counterreduction applies to all natural objects, from elementary particles to social-natural systems, including natural language.

So, the principle of counterreduction means knowing the "meta-whole" properties of objects (wholeness, system) as components of relatively highly organized systems, including as components of gradually developing natural systems. The immanent "meta-complete" properties identified as a result of the application of the principle of counterreduction to the studied objects can also be called the immanent "memory" of higher things and the future.

The principle of counterreduction is not only based on the well-known rule that "the properties of the whole are greater than the sum of the properties of its components", but also separates the higher (meta-whole) properties of natural structures (wholenesses). Defined holistic properties of a particular object may not be "meta-holistic properties" if they do not depend on the properties of its components.

The systematic approach is a branched field of general scientific knowledge, and its subject includes methodological problems of reduction, totality and counterreduction. At this point, it should be noted that the principles of reduction, totality and counterreduction allow to see the same object at different levels. The properties identified in this should be viewed from the point of view of the principle of complementarity, if the object is fully described as a whole added to the unified system of the developing Universe.

The principle of modeling and the method of analogy are based on the fact that some properties of objects can be known by studying tangible or intangible (based on conceptual understanding, logical-mathematical) constructions similar to them. It is essentially a comparative way of knowing. Concepts of "comparison", "analogy", "model" are similar in many ways from a methodological point of view. In this regard, to facilitate the understanding of the principle of modeling (comparative knowledge). It is appropriate to quote the following words of Kant: "...Comparative knowledge...means not the imperfect similarity of two things, but the absolute similarity of two relations between two absolutely dissimilar things"[3].

Logically, comparative arguments are among the weakest arguments. There are also problems of choosing an appropriate model or similar object that corresponds to the object under study. Such problems can be explained, among other things, by the following episodes in the history of the formation of new scientific knowledge: "The debate between Proust and Bertolle on the composition of chemical compounds is a vivid example of the debates in the history of science that were born on the basis of making wrong comparative conclusions. Proust summarized the cases of clear manifestation of multiple weight ratios and concluded that the composition of chemical compounds is known. In this, he relied on relatively complex chemical compounds, the composition of which is almost imperceptible. And Bertolle defended the idea of the unknown composition. Each of them

[3] Кант И. Пролегомены ко всякой будущей метафизики, могущей возникнуть в смысле науки. М.: 1993. -С 210.

was right in his own field. But the dispute arose as a result of two scientists interfering in each other's field. Proust won this argument because he relied on the relatively general atomistic doctrine that was gaining ground at the time (the first decades of the 19th century). At the beginning of the 20th century, the contrast between the wave and corpuscular views in the theory of thermal radiation was completely reversed. The reason for this is the existence of a relatively general concept - the concept of corpuscular-wave dualism of matter"[4].

The rule of overcoming paradigms - the rule of overcoming paradigms (examples, models, stereotypes, schemas, dogmas, interpretations and ways of thinking) that have arisen in the scientific community is an important factor in putting scientific knowledge on the path of completely new discoveries and accepting new ideas created on the basis of established concepts.

The problems of denial of all new ideas in connection with the stagnation of thinking and the "paradigms" that have arisen in the scientific community are discussed in detail in T.Kun's work "Structure of Scientific Revolutions".

The principle of historicity - it is possible to study it in detail by connecting the origin and development of the object. The formation and essence of this principle is discussed in a special section.

Methods of abstraction, idealization and formalization - in the process of scientific research, the representation of real objects in the form of objects with limited properties (abstraction), as well as imaginary ones based on their clearly defined properties ("ideal gas", "material point", "absolute black body") it is convenient to create images. It is very easy to express the properties of these objects and them in the form of symbols, signs, that is, to formalize them. This makes it much easier to manage their imaginary images and mathematical representations (using mathematical formalism).

The nature of methodological principles and approaches is different. For example, the principles of reduction, integrity, and counterreduction represent the nature of natural objects of research: the principle of verification, falsification, and the laws of logic represent the forms of cognitive and thinking activity: complementarity, the principles of historicity, and the systematic approach represent the objects of research and the properties of cognitive and thinking activity.

The list of methodological principles is open-ended and continues to grow. We did not see anything important for the methodology of scientific knowledge of nature in the "anthropic principle", which is often mentioned in recent times. It may be useful to distinguish it specifically, but also to integrate various anthropocentric teachings dating back to antiquity. The main idea of the anthropic principle, with its essence, is based on the view that all the objects that exist in the Universe should not contradict other objects that exist in this Universe with their existence. From this point of view, instead of the anthropic principle, it is possible to talk about the "electron principle" or the "crocodile principle".

Normative methodology, in addition to clearly defined principles, in the "semi-normative" form, at the same time in the "semi-descriptive" form, ideals and norms of scientific knowledge, interaction of sciences, formation and justification of scientific theories, principles of experimental activity, problems of combining and synthesizing knowledge, possibilities and limits of scientific knowledge can also be in the language of scientific knowledge. In addition, the specific features of the special methodology are reflected in the methodologies developed in a certain way in certain fields of science: mathematics, physics, chemistry, biology, technique and technology, evolutionary processes, ecology, etc.

[4] Вяльцев А.Н. Открытие элементарных частиц. М.: 1984. -С 272.

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