https://doi.org/10.53656/ped2025-1.08

Research Insights
Изследователски проникновения

METHODOLOGICAL BASICS OF THE EXPERIMENT IN PEDAGOGY

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Abstract. Pedagogy is a field of science in which some characteristics of both social studies and humanities intersect. This has the greatest impact on the philosophical and methodological basis on which various educational studies are carried out, particularly the ones where the main research method is the experiment. In this context, positivism and hermeneutics are most influential. Taking all this into account, this article focuses not so much on the separate examination of these epistemological schools, but on the peculiarities of their simultaneous application. The main goal is to find an answer to the question of how positivism and hermeneutics converge in the experimental educational study. The main research method is philosophical and methodological analysis.

Keywords: educational experiment; methodology; methodological pluralism; positivism; hermeneutics

Pedagogy is a "science that combines fundamental (strictly theoretical) and applied aspects" (Radev 2003, p. 1). This means that both theory and practice are essential for its development, as well as ***the specific ways of conveying knowledge between them***. The latter aspect significantly concerns the philosophical and methodological issues related to the ways, i.e. the methods of establishing different but sustainable and quality relationships between educational theory and practice, so as to provide an effective solution to the scientific problems.

All this directly influences the research activity of scholars in pedagogy, obliging them to constantly seek evidence that they are investigating real scientific problems, to strive for a continuous link with practice, etc. So, in the modern context, the unwritten rule is confirmed for the contributions of almost every educational study (save for theoretical and historico-theoretical studies, of course) to be attested through empirical methods, especially when it comes to new author approaches, methods, technologies, etc. For this purpose, observation and experiment are applied, which are deemed to ensure the highest reliability of the results obtained. In this sense, Anol Bhattacherjee states that an experiment-based study

is perceived as a "'gold standard' in research designs" and as "one of the most rigorous of all research designs" (Bhattacherjee 2012, p. 83).

Given all of the above, this paper draws attention to the philosophical and methodological basis for applying the experiment method in pedagogy. In view of the very specific scientific status of pedagogy, "which lies between social studies and humanities" (Radev 2001, p. 9), this issue gains particular importance, as the educational experiment brings together various epistemological theories, concepts, and approaches.

With regard to the outlined object of research, it is crucial to emphasize that it is approached with profound reverence and with the full awareness that the issue is extremely complex, comprehensive, and almost boundless, not suggesting any clear and unambiguous answers. Due to all of these factors, the main goal is only to present a possible view on how positivism and hermeneutics (probably two of the most influential philosophical and methodological teachings) cross paths in the experimental activity of pedagogy.

The methods employed to achieve the above-mentioned goal include research and review of scholarly literature, as well as philosophical and methodological analysis of the basic concepts in the epistemological fields in question.

In one of his main works titled *Obshta Pedagogika. Filosofia na Obrazovanieto* (*General Pedagogy: Philosophy of Education*), Dimitar Tsvetkov pays serious attention to the methodological foundations of pedagogy. After presenting the nature of various epistemological aspects, he points out:

"The aforementioned cognitive methodologies as an expression of modern methodological pluralism are not mutually exclusive. The preference of any of them does not imply ignoring the others. Even if this disregard takes place consciously, the interaction of the others manifests itself unconsciously. There are no good or bad cognitive methodologies. There is also no true (reliable) methodology" (Tsvetkov 1994, p. 171).

There is hardly a modern scholar in the field of pedagogy who does not support this view. This is also confirmed in the sources studied for the purpose of this work, in which (the former), however, this idea seems to remain theoretically underdeveloped. And indeed, scholars are convinced of this pluralism in modern science, but the question of how exactly it manifests itself remains open. Also, where do the various cognitive methodologies intersect? Despite the attempts of some scholars to seek answers to these particular questions, the dominant approach continues to be primarily the separate presentation of their main characteristics, without looking for interrelations between them.

In this sense, I will make a modest attempt here to derive some peculiarities of the methodological pluralism of experimental educational research. For this purpose, I will try not to examine the methodological schools themselves – something that has already been done in a number of studies, but their intertwining in educational research based on experiment.

The most frequently mentioned philosophical and methodological areas in scientific literature concerning the field of pedagogy include positivism and its development into neo- and postpositivism; hermeneutics; phenomenology; structuralism; functionalism and so on, which refer to a lesser extent to the theory of knowledge in this field. This can be seen in the works of Dimitar Tsvetkov (Tsvetkov 1994), Plamen Radev (Radev 2001), Louis Cohen et al. (Cohen et al. 2007), Christoph Wulf (Wulf 2003), etc. Nonetheless, positivism, its predecessor called 'empiricism,' and hermeneutics are indicated as the most important approaches for the development of social studies and humanities, and pedagogy respectively.

According to Auguste Comte, the founder of positivism, the knowledge of reality can have three "theoretical conditions: the Theological, or fictitious; the Metaphysical, or abstract, and the Scientific, or positive" (Comte 1896, p. 2). In terms of the latter, he argues as follows:

"In the final, the positive state, the mind has given over the vain search after Absolute notions, the origin and destination of the universe, and the causes of phenomena, and applies itself to the study of their laws – that is, their invariable relations of succession and resemblance. Reasoning and observation, duly combined, are the means of this knowledge. What is now understood when we speak of an explanation of facts is simply the establishment of a connection between single phenomena and some general facts, the number of which continually diminishes with the progress of science." (Comte 1896, p. 2).

Bearing this summarized version of Comte's concept in mind, we can start by abstaining from the idea of an experimental educational study in which the researcher seeks to establish causal links between a particular learning method and how it affects students' ability to solve textual math problems. According to the doctrine of empiricism, this should be achieved via the basic empirical methods of observation and experiment. John Stuart Mill, who was one of the leading 19th-century philosophers, a continuer of Francis Bacon's work, and a contemporary of Auguste Comte (the founder of positivism), thoroughly explores the issues of cause-and-effect relationships. In his view, social sciences are inherently deductive (Mill 1882). In this context, "when we set out the definitions and axioms used in evidence, we outline the basis which each proof rests on; the reasoning process is fully based on combining and transforming definitions and axioms provided at the outset" (Baranets 2013, p. 95). In this regard, Mill wrote the following:

"Thus, if the subject be social or historical phenomena, the premises of the Deductive Method must be the laws of the causes which determine that class of phenomena; and those causes are human actions, together with the general outward circumstances under the influence of which mankind are placed, and which constitute man's position on the earth. The Deductive Method, applied to social phenomena, must begin, therefore, by investigating, or must supposed to have been already investigated, the laws of human action, and those properties of outward

things by which the actions of human beings in society are determined. Some of these general truths will naturally be obtained by observation and experiment, others by deduction" (Mill 1882, p. 563).

After discussing the nature of his four inductive methods in detail, which are always achieved through experiment, Mill also sets out a number of significant disadvantages of these methods when applied in the field of social sciences and of those that shape the character, as he calls them. Therefore, with regard to the experiment from our example, two leading findings can be presented: first, it is necessary to lay out one or more theories, in the context of which all terms and concepts related to the development of mathematical competence, and particularly of the skills to solve textual problems; second, proving causal links is possible, but not with complete certainty due to the limitations of the inductive methods pointed out by Mill, and to the axioms which the theory/theories is/are based on.

Nevertheless, Auguste Comte definitively introduced the use of the experiment in social sciences. If Mill considers social phenomena multi-component and almost inseparable, then one can say the following about Comte's methodological doctrine:

"The legacy of Comtean positivism to the process of social inquiry has revealed a series of interrelated assumptions and methodological commitments. These are, namely, that theory is to be universal rather than specific or context-bound and principally concerned with the generation of scientific laws. Such laws are affirmed on predictions derived from the study of social phenomena, whose interrelated variables may be examined independently so as to provide plausible theories and conditionally predictable outcomes" (Somekh et al. 2005, p. 199).

It is evident that, according to Comte, it is possible to break social reality down into relatively independent phenomena, and to examine them through their manifestations. The latter finding proves essential for experimental research in pedagogy, since all the phenomena studied become ideal constructs, which can be explored only through their manifestations; the ability to solve textual problems is a construct that can be measured and evaluated only when it manifests itself in some form.

Taking all of the above into account, we should raise the following important question: ***What is the scope of the positivist doctrine (based on empiricism) in a given experimental educational study from the perspective of accepting only empirically obtained knowledge as reliable through observation of and experiment with phenomena that can be objectively ascertained, measured, and evaluated?*** Let us get back to the example we provided. The ability to solve textual math problems is part of the students' mathematical competence. There are different theories about its formation and development. On the other hand, the author's approach, applied through experiment, has also been developed on the basis of certain concepts and theories. There are a number of factors that affect the actual implementation of the experiment, such as the motivation of the students, their personality traits, etc. It is obvious that the tools of the study cannot account for all these factors in

unity. ***The scholar focuses primarily on the manifestations of a limited number of constructs, accepting the other factors as secondary.***

Let me reiterate that, from the perspective of positivism, cause-and-effect relationships are only sought between a limited number of constructs, indicated by the scholar as the most relevant for the purposes of the study. The question is how the other components, which are also aspects of the object of study, are related to them. In this line of thought, the researcher should not only explain, but also "enter" the data obtained in the field of theories which the study is based on, i.e. to interpret them. This is the moment when positivism and hermeneutics cross paths, with the latter defined primarily by Wilhelm Dilthey and Hans-Georg Gadamer as a basic cognitive doctrine in the humanities.

Gadamer substantiates the need for applying hermeneutics in the following way:

"But the specific problem that the human sciences present to thought is that one has not rightly grasped their nature if one measures them by the yardstick of a progressive knowledge of regularity. The experience of the sociohistorical world cannot be raised to a science by the inductive procedure of the natural sciences. Whatever "science" may mean here, and even if all historical knowledge includes the application of experimental universals to the particular object of investigation, historical research does not endeavor to grasp the concrete phenomenon as an instance of a universal rule. The individual case does not serve only to confirm a law from which practical predictions can be made. Its ideal is rather to understand the phenomenon itself in its unique and historical concreteness. However much experimental universals are involved, the aim is not to confirm and extend these universalized experiences in order to attain knowledge of a law – e.g. how men, peoples, and states evolve – but to understand how this man, this people, or this state is what it has become or, more generally, how it happened that it is" (Gadamer 2004, p. 4).

With reference to pedagogy and the example I put forward above, all this means that, through hermeneutics, the issue of the development of mathematical competence in students should be considered situationally, contextually, and even historically. This may include factors such as family environment, a wider social environment, ethnicity, and many others. Of course, the research task is to clarify interrelationships – not causal ones in the sense of positivism, i.e. experimentally, but those that need to be understood in terms of meaning and conceptually, in the context of a scientific idea, theory, or conception. These factors cannot and, as Gadamer argues, should not be regarded as conditioned by strict regularities, but as individual, specific from the perspective of a broader historical, cultural, education, or other context, or as he puts it:

"An example will make this clear: a psychic structure, say an individual, acquires his individuality by developing his talents and at the same time experiencing the conditioning effect of circumstances. What emerges, the actual 'individuality' – i.e., the character of the individual – is not a mere consequence of the causal

factors nor to be understood only in terms of these causes, but it constitutes a unity that is intelligible in itself, a unity of life that is expressed in every one of its manifestations and hence can be understood in each of them. Something becomes fused here to form a unique configuration, independently of the system of cause and effect. This is what Dilthey meant by 'structural continuity' and what, with Husserl, he now calls 'significance'" (Gadamer 2004, p. 220).

In the same vein, Dilthey suggests that "we explain nature, while humans need to be understood" (Kostadinov 2012, p. 249). These are actually the two cognitive objectives of the doctrines of positivism and hermeneutics. Through the methods of the first doctrine, the scholar strives to explain, and through the second one to understand. All this poses another essential question, to which this study can hardly provide an exhaustive answer: ***Which aspects of the research object should be approached positivistically and which hermeneutically, given the pluralism between the two doctrines within the framework of experimental educational research?*** In other words, where will the researcher look for causal links through observation and experiment, and where will he/she try to examine the phenomena contextually, individually, etc., i.e., to comprehend them?

Supposedly, Dimitar Tsvetkov gives a partial answer to these questions:

*"Experimentally obtained **objective knowledge** mentioned above cannot give a satisfactory explanation of the real pedagogical phenomena, but only help us to **interpret** and **understand** them; There are subjects acting and interacting in educational reality, the spiritual manifestations of which are unpredictable and inexplicable in many ways, and which do not fit into ready-made theoretical schemes and average objective dependencies"* (Tsvetkov 1994, p. 182).

Again, with regard to the questions raised above, it can be said that we apply the positivist approach to what is universal, i.e., to what proves unchangeable in all aspects of the study and even in various studies. As for what is particular, single and not universal, and in terms of which no causal link can be established, scholars should try to understand and interpret it, because, as Gadamer puts it:

"Interpretation is necessary where the meaning of a text cannot be immediately understood. It is necessary wherever one is not prepared to trust what a phenomenon immediately presents to us." (Gadamer 2004, p. 332).

In this sense, in the experimental study of the ability to solve textual problems in mathematics, the researcher will seek causal relationships between phenomena which are universal, i.e., which occur in all students more or less, such as the difficulty in composing a numerical expression for solving the problem. When it comes to phenomena which are found to be single or which do not always manifest themselves, the researcher should try to interpret them, and thus to understand their origin.

The next important moment has to do with the analysis as a research method used in every scientific study; the specifics and orientation of this method are deter-

mined with a view to the philosophical and methodological basis which the study rests upon. Therefore, I will try to outline the pluralism between the positivist and the hermeneutic analysis in the broadest terms.

In carrying out any type of analysis, the researcher always uses two main categories, namely 'part' and 'whole.' The main objective in applying the method is to elucidate the content of these categories, as well as the interrelationships between them. These are actually the basic features of the analysis as a scientific research method, which recur in each of its definitions. I have explored this in another work of mine (Penchev 2022).

In the ***positivistic analysis,*** causal links are sought between separate parts of the whole, as well as their relation to the whole itself. It can be said that this analysis ***'works' above all within the research object and regards it as one that can be 'broken down' into components or parts***. For example, the ability to solve textual math problems can be broken down into its building blocks, such as abstract thinking, distinguishing the essential from the non-essential in the text of the problem, etc. So, the researcher can look for interconnections between these parts of the whole, as well as for links between the degree of their formation and the qualitative manifestation of the whole (the ability to solve textual math problems).

On the other hand, according to Christoph Wulf, one of the two main tasks of the hermeneutic analysis is "the historico-hermeneutic examination of the (historical) texts pertinent to educational science and the hermeneutic study of educational research" (Wulf 2003, p. 26). Within the hermeneutic circle, this can be achieved, bearing in mind that "understanding the whole requires us to understand its parts, and that the latter understanding requires us to have an idea of the meaning of the whole" (Radev 2001, p. 25). The main difference between this type of analysis and the positivist one lies in what is considered a whole and what a part/parts of it.

In this sense, the part is the object of study, which has to be analyzed, interpreted and understood by referring to the whole which is a certain concept or theory. In terms of the example we are following, this means the ability to solve textual math problems (the object of this study), which is regarded as one of the manifestations of the student's personality in his/her learning activities, and as related, for example, to the theories of his/her ethnic, cultural, sexual, and other conditionalities (appearing as a whole). So, in the hermeneutic analysis, the object of study cannot be broken down into components. It is perceived as a whole, the artificial breakdown of which would destroy its essential characteristics. The aim is to interpret and understand the object in a broader social and historical context, i.e., to reveal its place in and importance for the whole.

It should also be noted that, in the hermeneutic analysis, the relations between 'part' and 'whole' are not causal, but above all semantic.

Donatella Della Porta and Michael Keating clearly present all this in their reflections:

"In the positivist tradition, research aims at singling out causal explanations, on the assumption of a cause-effect relationship between variables. Researchers aim at an explanation that is structural and context-free, allowing generalization and the discovery of universal laws of behavior. (…) By contrast, interpretive/qualitative research aims at understanding events by discovering the meanings human beings attribute to their behavior and the external world. The focus is not on discovering laws about causal relationships between variables, but on understanding human nature, including the diversity of societies and cultures. (…) Cases are not broken down into variables but considered as interdependent wholes; generalization is achieved by assigning cases to classes and approximation them to ideal types. Context is considered as most important since research on human activity must consider an individual's situational self-interpretation. Predictability is impossible since human beings change in time and space…" (Della Porta et al. 2008, p. 26 – 27).

In terms of the two types of analysis, emphasis should be put on the issue concerning the reliability of their results. This topic is extremely extensive, but here I will point out what I consider most important. With a view to the positivist concept, this issue is thoroughly dealt with by Karl Popper (Popper 2005) in his fundamental work *The Logic of Scientific Discovery*, as well as by other researchers from his period and later. In a nutshell, they introduced concepts such as 'verification,' 'falsification,' etc., which represent specific procedures. Through them, researchers can test the plausibility and reliability of their conclusions. By contrast, the hermeneutic analysis is unable to derive such rules, and the conclusions can be verified in a much more complex and sometimes lengthy way, which appears as a separate stage of the hermeneutic circle. Yordan Doykov (Doykov 2019) describes the latter in several separate steps.

The methodological pluralism in educational studies is a topic that requires lengthy and in-depth research. In the context of its aspect which I tried to address in this section, I could outline the relationship between the specifics of the analysis as one of the main scientific methods which both epistemological fields work with. This is illustrated in Figure 1.

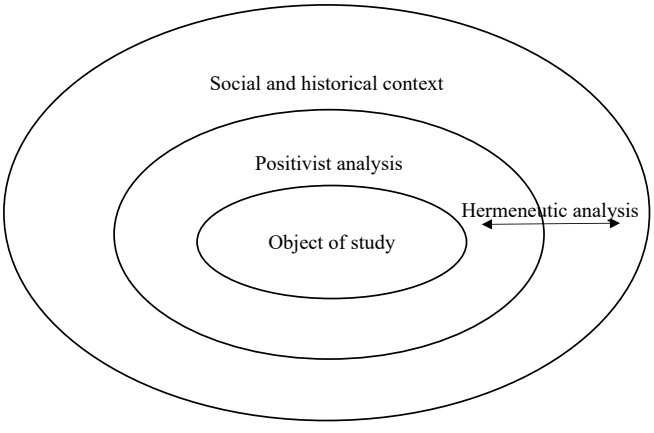

Figure 1. Pluralism between positivist and hermeneutic analysis

I should point out the fact that, in a sense, the approaches of positivism and hermeneutics can also be regarded as determinants of the nature of the two main types of research in pedagogy – quantitative and qualitative. As I remarked above, causal relationships are sought not in one or several individual cases of manifestation, but in the majority of such cases. The common features of their manifestation in the object of study are sought. On the other hand, in hermeneutic research, the individual cases and the unique in them are more important than what is common. At the same time, it is difficult to completely distinguish between the two types of research. From this point of view, the methodology of pedagogy deals with a particular type of research, which combines the quantitative and qualitative approach. An example of this could be "an experimental study in which the experiment yields useful information about outcomes, but the additional collection of qualitative data develops a more in-depth understanding of how the experimental intervention actually worked" (Creswell 2012, p. 535). According to the same scholar:

"Mixed methods designs are procedures for collecting, analyzing, and mixing both quantitative and qualitative data in a single study or in a multiphase series of studies. In this process, you need to decide on the emphasis you will give to each form of data (priority), which form of data you will collect first (concurrent or sequential), how you will 'mix' the data (integrating or connecting), and whether you will use theory to guide the study (e.g. advocacy or social science theory)" (Creswell 2012, p. 22).

Based on presented point of view towards methodological basics of the experiment in pedagogy it can be formulated the following important conclusions some of which can be converted in object of future scientific researches:

– almost every contemporary pedagogical research is based on methodological pluralism which is due to specific status of pedagogy as a science and the processes of integration among different sciences and scientific spheres;

– most important role for methodological basics of pedagogical experiment has positivism and hermeneutics – the first concerns mainly quantitative and the second – qualitative researches;

– more often in contemporary pedagogical researches the scientists imply mixed method design. In Bulgarian scientific literature these types of researches are poorly studied.

It is important to be pointed out that analyses end conclusions made in this article only refer to basics of methodological pluralism in pedagogical researches in which the experiment is the main scientific method. More thoroughly investigation of this sphere can be realized in future scientific researches which could focus on specific cases of experiment in pedagogy.

Due to all of the above, the methodological pluralism at both the philosophical and technological level of conducting various educational studies is becoming more and more important for the development of pedagogy as a science.

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