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Philosophical and methodological bases of pedagogical research

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ABSTRACT

Currently, according to the terms of acceptance of scientific pluralism and also in pedagogy, theories based on different philosophical foundations are applied - from the uniquely humanistic, student-oriented, to the behavioural and techno-cyber ones, orientated towards the efficiency of education. The most confident is the “golden mean” that allows the application of scientific and phenomenological approaches in a complementary manner. A teacher should have an overview of broader philosophical and methodological contexts relating to the subject of research.

Keywords: Philosophy and methodology; methodology in educational research; research into the effectiveness of education

1. INTRODUCTION

The development of any science and its discipline has always been closely connected to the relationships between the definition, its unambiguous delimitation and understanding, its subject and content of research and research methods. If among these elements some discrepancy occurs it may be reflected in various theoretical problems, in extreme cases it may trigger even doubts about the “scientism” of the discipline. From the history, a constant debate about scientism of pedagogy which is actually related to its methodology can be mentioned as an example and this also applies to its inclusion into the science system. Doubts

about pedagogy as a science arose mainly from doubts about “scientism” and its methods of investigation, when it relied mainly on empirical research that did not study education as a whole, but was flowing in a confusing number of partial studies. Currently, according to the terms of acceptance of scientific pluralism and also in pedagogy, different theories are applied - from the uniquely humanistic, student-oriented, to the behavioural and techno-cyber ones, orientated towards the efficiency of education. The most confident is the “golden mean” that allows the application of scientific and phenomenological approaches in a complementary manner. A teacher researcher should therefore be knowledgeable not only about specific research methods, but he/she should also have an overview of broader philosophical and methodological contexts relating to the subject of research.

2. PHILOSOPHY AND SCIENCE

The development of science was closely connected with the development of various philosophical systems – e.g. those elaborated by Descartes, Spinoza, Leibnitz, Kant and Hegel that represented ontological concepts of the world and at the same time, the relationship of philosophy and science was also addressed by them. Gradually the view was accepted that philosophy deals with investigation of the complex world, while specific sciences explore partial areas of the world and their laws. Philosophy thus preserved its independence and remained the starting point of theoretical discussions about the nature of the world. This opinion was also, for example, shared by *Windelband* (1848 – 1915) who placed Philosophy and Mathematics in the centre of the scientific system as the sciences of sciences. While classifying sciences, he used two basic criteria:

1. The criterion of used methods – quantitative and qualitative methods.
2. The criterion of ontological distinctiveness of the subject of study – the subject is either substance (matter, energy) or the subject of study is a sign or information.

The post-modern era – the era of doubts and the revitalisation of everything also called science into question. Postmodernists argue that scientific methods are a continuation of the religious story, but it is already about a “rational God”. *Jelinek* states that this is manifested as follows:

1. Any explanation of reality is understood only as an interpretation that is useful although not objectively true.
2. Man cannot go beyond his interpretations of reality.
3. Our theories and arguments cannot be compared to the objective, external world, but on the contrary – our created theories construct different worlds that we inhabit. (*Jelinek, 2002: 11*).

For the post-modern era thus the epistemological paradigm of relativism is typical. (Relativism in science means that no researchers can be totally free of their socio-cultural and historical framework, or the context in which they grew up and in which they exist.)

3. PHILOSOPHY AND METHODOLOGY

The scientific community shares the opinion that science differentiates from other socio-cultural activities of man through the scientific method that is mostly understood as a certain procedure of research leading to a predetermined objective. However, is this method based on an exact algorithm or is it the result of intuition and heuristics? The answers to this question are various. The views of proponents of the two basic ontological streams – empiricism and rationalism can be considered critical.

Empiricism considers experience as the basis of knowledge, perception, and recognition of reality through our senses. In the research, induction replaced the previously used method – deduction, because empiricists saw the nature of scientific knowledge by revealing casual relations that can be reached through an inductive way. Rationalism, on the other hand, considers mind as the only reliable basis of knowledge. An important representative of classical rationalism was *René Descartes* (1596-1650), who attributed the deficiencies of knowledge to the absence of an appropriate method; therefore he placed emphasis on the development and use of correct methods of true knowledge. In his work *Discours de la méthode* he describes the methodological procedure of his Cartesian analysis. According to him, knowledge always begins with doubts – we should investigate everything that can be doubted because doubt is the basis of our existence: “*Dubito ergo sum*” – I doubt, therefore I am.

With the development of more scientific disciplines, the topical question is whether the characteristics common for all scientific disciplines (regardless of the subject of research) is not exactly the currently used methodology. To make this possible, the scientific methods must be objective (inter-subjective, i.e. independent of the entity / researcher), repeatable and verifiable in scientific practice.

Gradually, therefore, a single theory about scientific methods – methodology began to be formed that, however could be understood in multiple meanings. Thus, the general methodology of science dealing with all methods (including praxeological ones) must be differentiated from special methodologies of specific scientific disciplines.

The general methodology of science seeks answers to the questions: How does science reveal new knowledge? What methods, processes and procedures are used to obtain, verify and explain it?

Philosophy, methodology and epistemology of science share an interest in the problems relating to:

- a) analysis and interpretation of basic scientific notions,
- b) the relationship between theory and observation / empirical evidence,
- c) criteria for evaluation of alternative theories,
- d) the nature of scientific progress.

In epistemology, it is principally examined to what extent the three basic conditions of knowledge are met: the condition of the truth (it is relativized), the condition of acceptance (conviction of the truth), the condition of justification (justified conviction is a necessary and sufficient condition of knowledge).

The work by *Karl R. Popper* (1997) is important to the new epistemology. Popper, in contrast to the positivists, did not understand empirical data as pure facts, he refused induction

as a way leading to the formation of hypotheses and theories, and in accordance with *D. Hume* he pointed out that enumerative induction is based on the faulty assumption that the future will be similar to the past. Therefore, he introduced a reverse method of testing – the hypothetic – deductive method: firstly, a hypothesis is formulated (we have to observe so that we can conclude and formulate a hypothesis), then it is tested, not through verification but through falsification. (*Salomon, 1991*)

With the advent of post-modernism, the criticism of Popper's falsification became stronger. *Feyerabend* and *Kuhn* argue that the scientific theory cannot definitely be confirmed or refuted, since both procedures assume independence of facts from theories; this is, however impossible according to the principles of relativism.

In the 1960s, under the influence of the criticism of the so-called Frankfurt school, Habermas' requirement of logical rules of discourse, which can ideally be implemented into scientific debate, was introduced into methodology. The end of the 20th century was marked by post-modernism, relativism and a striking inclination towards scientific pluralism. At present, in the theory of knowledge, the so-called critical epistemology is preferred. The conflicts between scientific and phenomenological paradigms and corresponding methodological approaches are no longer discussed, but rather an increased interest in qualitative methods and in particular a mixed paradigmatic methodology in which quantitative and qualitative methods are applied equally is now the subject matter. (*Poláková & Spálová, 2009: 22*)

4. IMPLEMENTATION OF A JOINT RESEARCH STRATEGY IN EDUCATIONAL RESEARCH

In modern pedagogy, *J. Průcha* (2009) assumes that despite the inconsistency of opinions, a sort of mainstream scientific work approaching positivism, which is also enriched with other competing and hermeneutically oriented paradigms, is what dominates. The principle of complementarity has also begun to be increasingly applied in the framework of scientific plurality within pedagogy.

This means that teachers are aware of the fact that the chosen paradigm only allows the investigation and description of only a part of reality, and on the basis of such research the final picture of reality is not definitely correct. It is necessary to realize that here is also space for other even contradictory ways of knowing reality which ultimately enable one to also know the whole. The principle of complementarity in Slovak pedagogy is strongly promoted by *Š. Švec*, who in his work *Methodology of educational sciences* writes that currently “two complementary cultures – scientific and humanistic” are applied in educational sciences (*Švec, 1998*).

While examining the subject of these sciences the methodology of research, development and evaluation should be developed equally and a systematic approach should particularly be applied. A systematic approach is suitable and can especially be used in the research of efficiency of education and its elements. In examining individual elements and in various stages of research, quantitative and qualitative methods (compare *Bryman, 2006, Johnson & Christensen, 2000, Windham, 1998*) can be used – according to the needs and successfully used methods of triangulation and complementarity.

4. 1. Triangulation

Triangulation is largely understood as a means of blurring limits between quantitative and qualitative methods. It is used equally in quantitative and qualitative types of research; it helps the researchers examine the object of research from various angles of view so that they can increase their objective knowledge. Triangulation, as a combination of different procedures and methods, allows one to examine whether the hypotheses will stand up to a series of complementary testing methods. In quantitative research it is also understood as mutual validation of results obtained through various methods.

We speak about triangulation through the following various methods:

1. the same object of research is examined (a phenomenon or a certain aspect),
2. different objects of research (different phenomena or different aspects of the same phenomenon) are examined.

N. Denzin (2005, 2006) puts triangulation into the role of a valid strategy in qualitative research and he distinguishes several types of triangulation:

Data triangulation attaches a lot of importance to different data sources. Diversity can be achieved through examination of the phenomenon at different times, different places and with different people.

Investigator triangulation (triangulation of researchers) is achieved when the same object is examined through the same tool by several researchers.

Methodological triangulation is triangulation by the methods (questionnaire and structured interview) but it can also be triangulation within one method (e.g. different types of scaling in a questionnaire).

Triangulation of theories is applied in the interpretation of the research results. When the valid (chosen) theoretical basis is important, it is necessary to take into consideration the compatibility of epistemological assumptions of the used methods. These may include the following combinations:

- methods should be combined within the chosen approach,
- different methodological approaches are applied for data analysis and possible convergences and divergences are considered,
- data must be reviewed from different angles of view and new sides of the examined phenomenon are discovered.

4. 2. Complementarity

Complementarity means a combination of methods in quantitative and qualitative research when a deficiency of either one is outweighed. There is no concurrent application of QN and QL methods but there is an appropriate inclusion of them into the process of research so that results provide a suitable basis for individual stages of research. In practice, qualitative research usually precedes the quantitative one and QN research, on the contrary, at the same time properly complements the condition of QL research. Following such a procedure, however still keeps the question open as to what is the common principle that should guide the summarization of individual partial results; numerical and non numerical data achieved

using QN or QL methods. Although complementarity does not provide an unambiguous solution of methodological problems in social sciences, we consider (in accordance with several methodologists *Marsh, Roche 1997, Windham 1988* and others) justified methodological individualism and at the same time realistic pragmatism resulting in a consensus between qualitatively and quantitatively oriented researchers.

4. SELECTED PRAXEOLOGICAL PROBLEMS OF PEDAGOGICAL RESEARCH

The problems in the research into effectiveness of education

Researchers in the field of education will confirm that they experience the most difficult methodological and methodical problems in the research of education effectivity and its respective parts.

The research of education effectivity concentrates mainly on the measurement of the educational results (i.e. what a learner has learnt) in the sphere of knowledge, skills and affective characteristics of learners. These measurements can be carried out at all educational levels, i.e. at micro- (learning), mezzo- (teaching) and macro- (educational system) – levels and the results are synthesized and compared (compare *Windham, 1988*).

Four priority trends of the pedagogical research in the West Europe were identified by the analysis of the research publications (Průcha, 2009:46) according to the content of the published research: the relationship between education and work, the social aspects of education, the explanation and intensification of teaching (through other media) and the evaluative research (the measurement of results and educational effects). It is clear that the research of education evaluation in all its components is still topical and prospective. In the following part we will concentrate only on the problems related mainly to the educational practice.

The problems of the variables determination

While studying the effectivity of education, particularly of tuition (teaching, learning), we have to take into account many elements, which influence the education. In the research it is necessary to determine the constants, which depend on the given conditions and those, which cannot be changed (independent or “given”). The validity of our measurement depends on this elementary assumption. The decision can be made easier by e.g. the application of the Cartesian partition of the complete real situation of the teaching system, which was divided by Heimann as soon as in 1962 into 6 components: P – psychostructure (the inner state of the learning system), S – sociostructure (the outer conditions of teaching), C – curriculum (content of teaching/learning), O – the objective of tuition, L – the way of tuition (logorithm of a method, form), M – medium (operation objects). We can imagine the teaching situation as a point in the six-dimensional pedagogical space with the coordinates (L, C, M, P, S, O), where each of them can be a function of the other five variables. (Heimann, 1976) In the practice it is important to minimize the number of the dependent variables and the results should be tested statistically depending on the correlative relations, or the contingent tests.

The problems of the educational performance testing

As we have mentioned above, the educational quality is being evaluated by the measure of the achievement of the planned educational performances, which should be measured in some way. According to the 4-scale qualification of the educational objectives into affective, cognitive, psychomotoric and creative, it is clear that not all planned objectives (i.e. the measure of the achieved educational performances) can be evaluated objectively by the measurable criteria and standards, defined in the concepts of a performance (through answers, tasks solving, activity results, etc.). It is even more difficult when the achieved performances (mainly in research) are being evaluated according to our traditional school habits – by using a certain numerical scale. Each of those scales, independently on the selected range (e.g.: 1 – 5, 1 – 3, or passed – failed) and the sort of the measured performance (written, oral, practical) can have the significant shortcomings: it is impossible to determine objectively the scope of the interval between the particular marks. It is possible only to express the comparison of the relations $>$, $<$ or better, worse. This is the discrete variable, where the identification of the average value does not have the practical meaning. In spite of that, the teachers and researchers enumerate the average value of a mark quite often and they use it for the evaluation, which will be, according to this scale, mostly subjective. If two teachers will evaluate by using the numerically same scale, but distributed differently, the same average mark will not have the same objective value.

When the teachers use the average marks from the quantitative different inputs the evaluation is even more subjective. It is clear that not only a mark but mainly “an average mark” is considerably subjective and it is not the appropriate measure for the evaluation of the learning performances of a learner.

We should not pay attention to the questions referring to the evaluation of the measure of the achievement of the affective and creative goals, as there is also the problem of the setting of the performance criteria, because the performance is difficult to measure. Within psychomotor goals, the performance of the students can be evaluated on the basis of actual results of their activities, which we are tuition within a theme (e.g. making of a particular product) – but even here the evaluation cannot be fully objective because together with performance we also evaluate the number of effective and creative elements.

Let's concentrate on possible problems during measuring the degree of achieved cognitive goals, which mostly occur during written examinations.

1. In open written questions with free answers, it is often unclear what the student meant to express.
2. On the other hand – also some questions, which were formulated by the teacher are not explicit and evoke doubts in a student, who does not exactly know what the teacher wanted to know.
3. In closed questions (form of a test), we cannot exclude doubts that the student just guessed the answer without knowing it exactly.
4. If the test is not standardized, we can doubt, if the questions are, according to the single parts of the curriculum, proportionally correctly distributed in the test.
5. It is also doubtful, whether the questions equally formally evaluated are of the same difficulty level and equally important from the point of view of the curriculum content.

We offer following possibilities how to eliminate some of the abovementioned doubts:

The researcher decides, that he uses in a test questions with several equally probable answers, from which only one is correct. During evaluation, he has to make a mathematical correction according to the probability of guessing the right answer that means, he has to reduce the result by the possible incorrect result because of guessing.

He can decide to use non-standardized tests with selective answer (to eliminate problems mentioned in 1 and 2). He has then to reduce also the doubts resulting from 3 and 4 in a way that he includes enough questions into the test, which will be the content negation of the correct answer. The correlation between such differently formulated questions expressing the same knowledge will show us whether the student has just guessed the answer, or whether he really has the knowledge.

A partial solution could be the standardized didactic tests, which expert creation has been stopped, but is in process again. However, the evaluation of such test should also be improved. It is because of the fact that the application of Gaus curve of normal taking apart is still the most used in evaluation, although grades and knowledge are not continuous parameters. Therefore, we think that if we want to eliminate the problem of evaluating the performance of students at schools connected with grading, we have to put our minds not only to creation of “optimal standards” and performance criteria but also to creation of standardized test with an objective and formally correct grading scale.

5. MEASURING OF E-LEARNING EFFECTIVITY

E-learning, compared to classic forms and methods, has significant advantages in the possibility of objective evaluation of students' performance and measuring the effectivity of education product itself (in the sense of replacing personal factors with non-personal ones). We have already mentioned certain problems with traditional evaluation of students, for example insufficient complex analysis of success and failure and undervaluing exact methods of evaluation. Quality and objectivity of evaluation can be ensured by effective and unified information system, but objective indicators are often missing in application of tracking and evaluating of students' results. All software platforms for e-learning now contains sets of feed-back tests and other tools for evaluation of the learner. The program can be combined or complemented with mathematical tools that would directly evaluate not only the effectivity of the respective elements but of the whole product and the final success rate of studying. Despite these technological possibilities in the practice we often face another problem when using these evaluating tools: How can an individual precondition for studying be taken into account? The answer may be found via quantitative “method of working with preconditions”.

5. 1. The essence of method of working with preconditions

The method of working with learning preconditions of students is based on defining objective abilities of every student. It enables to constantly compare his or her results with learning preconditions (*Benčo, 2002*). Such confrontation will show whether the student works within his abilities or less, whether he has some reserves in his learning efforts and how large his reserves are. This method is grounded in the basic hypothesis: *If the known learning precondition is expressed as a certain mathematical quantity of student's or group's*

results, then the actual performance against this precondition makes a difference that directly indicates the reserves in studying.

The hypothesis can be expressed by mathematical relation:

$$\mathbf{PS} - \mathbf{MS} = \mathbf{R} , \text{ or } \mathbf{PS} = \mathbf{MS} + \mathbf{R} \quad (1)$$

where: **MS** - precondition, **PS** – results, **R** – learning reserves.

Several hypothetical questions are related to the main hypothesis:

- Does the definition of hypothesis equal relation: **PS = MS · A** (2)

where A expresses the level of positive motivation and activities which determine the relationship towards learning?

Can the basic relations (1) and (2) be used to deduce other characteristics which could contribute to diagnostic analysis of learner's results?

The method of working with preconditions is based on exact, mathematical and statistical methods and therefore can be considered very objective and, moreover, could be directly complemented into LMS (learning management system).

Overall we observe that examining education effectivity, all its forms and parts, is difficult economically, technically and also in terms of personnel, so the need for such analysis has to be justified. The importance of diagnostic analysis is founded on ensuring regulating education processes via optimal pedagogical, organizational and material measures that serve to ensure certain corrections of the education process. If society wants to use education as an intensive factor of economic growth, we have to know how and by what forms and tools, and with what intensity and in what circumstances we have to influence the learner so that the desired education result is reached. We have to predict the kind, manner and optimal quality of education but also calculate whether the costs are used effectively.

6. CONCLUSION

The paper illustrates the basic philosophical and methodological foundation and some problems of pedagogical research. It often happens in pedagogy that some researchers do not sufficiently identify paradigmatic foundation of their work at the beginning of their research or they focus only on partial problems that they generalise in not an objective manner. To objectivise the research, it is important to define the theoretical and methodological foundation and then to select the adequate methodology and concrete methods. We provide some selected problems connected to effective education research.

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