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Philosophy of Science and Educational Sciences – Models of Explanation

[a]Maria Butucea*

[a] Technical University of Civil Engineering, No.122-124, Lacul Tei Bvd., Bucharest, RO – 72302, Romania

Abstract

In the philosophy of science nowadays there are some models of scientific explanation: syntactic (deductive-nomologic), semantic (functional-teleologic) and pragmatic model of explanation. The last one is related with the concept of paradigm and is obviously shared by theoreticians when we accept the complexity of systems undergoing observation, especially social systems. If the pedagogy is a science of complexity, than we can assume, as working hypothesis, that certain segments of its aria like school culture, might be described and studied with the help of the pragmatic model of explanation.

1.Introduction

The concept of *explanation* became very important for modern science outcomes and it is always present in the processes of self-reflection of any particular science. The question how should be a good explanation, proposed in that particular domain, still stands, maintaining its attractiveness. Answers to such a question will vary, depending on the approach perspectives. Epistemologically speaking, discussions about theory of explanation are made in *logic* paradigm and *contextual* paradigm and each paradigm promote some *models of explanation*. Accepting the existence of different perspectives and a plethora of explicative models, then, a pedagogical research, can also choose which one will offer more chances to achieve its goal:

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* Corresponding author. Tel: +40 21 242 12 08/235; fax: + 40 21 242 02 72 :
E-mail address: marrbu23@gmail.com

to reflect with clarity the specificity of the educational domain or some part of it. Succinctly, proceeding with different scientific models of explanation, settled during the time by philosophers, we assume as a working hypothesis the utility of one explanatory model in pedagogic research: *the pragmatic model*. We claim that it might be used for *school culture* design theory. We can emphasize also that, if educational science is studying a very complex system, we must change the meaning of some concepts and accept knowledge more than explicit declarative information, but also as a tacit, deeply embodied in a particular culture.

2. Paradigms and models of explanation

The concept of theory was working in physic, but it wasn't worked at all for other sciences, especially for social sciences. Sometime, for such anomalies we need strong reconsiderations or choose alternatives. So, it becomes opportune to talk about models of explanation which can better work for them. Epistemologically speaking, when we try to discuss here about theory of explanation, we will find two paradigms and some models of explanation promoted by each paradigm in turn.

A paradigm means a very large conception about nature of theory and explanation, including its models and all practical implications as Kuhn [11] emphasised before Regarding models of explanation, we can say that there is the distinction between two paradigms in the history of sciences and it is made by the procedure of making sciences and evaluate its products: internally, without external influences conducted only by logic, or externally - contextualizing, accepting the influence of social environmental (values) in the body of science. In the logic paradigm, philosophers of science accepted the schema that must be followed by all enterprises which want to be taken seriously as a scientific activity. That model is known as covering model law and is able to provide a strong explicit syntactic procedure. It use the following inference:

$$C_1, C_2................C_n$$
$$L_1, L_2…….........L_n$$
$$\overline{\rule{3cm}{0.4pt}}$$
$$E$$

Premises of this inference *explicans (explicantia)* are assembled by two types of sentences: the first are observational sentences (C), standing for relevant situations as antecedent or connected with phenomenon expressed in conclusive sentences (E) - *explicandum (explicanda),* and the second are universal sentences (L) like laws. Hempel [6]. In this case, the entire epistemological commitment concerning explanation is focused on analyse of logical structures of sentences (law-like) as the core of a theory. That is syntactic-logic model and was called Deductive-Nomologil (D.N.) inference. It can capture the causal principle expressed in closed systems like in physic and astronomy. Hempel [6]; Nagel [12]; Oppenheim and Putnam [14]; Von Wright [19].

There is also a version of Logic model, the Functional-Teleologic or Teleologic-Comprehensive model, because it is using motives/reasons instead causes and goals instead effects in turn. This is known as semantic-logic model. The model is still logical, describing the human actions' causality and putting in a scheme in order to describe historical events, even the explanation is in the future not in the past.

The semantic model was enriched by Salmon [17].with a new one, called realist-semantic model. This point of view is focused not only on inference as a syllogism but also on its relevancy. The information captured by causal inference must be Statistical Relevant (S. R.) for us in order to be accepted. That means to use the meaning of information for cognitive agents, especially when we try to explain unobservable realities (in subatomic physic). So, the scheme of S. R. inferential explanation should be a list of relevant information, not only a syntactic syllogism like in previous model.

- If we take some events E, F, G and assume that between them there are some probabilistic physical connections;
- Between E and F is a priority causal temporal connection from past to future;

- The Relevant Probability is mathematical expressed: x (E:F).

The connection x (E:F) means the degree of E, in order to cause F, or the contribution of E to cause F. More than, we can talk only about the tendency of E to cause F, or the E type events are statistical relevant for us and can produce F type, or any change of F produce also a change in F events. Salmon [17]

All this contributions to the theory of explanation are belonging in the logic paradigm.

For some time now, the most interesting conception about the dynamic of science was claimed by Thomas Kuhn in whose point of view the theory and its related elements as mind's products are conceived evolving in a social historical environment, complex realm full by philosophical presuppositions (cognitive values). This point of view, inspired by history of sciences studies, has been sustained by some other historians and philosophers of sciences like Koyré [8] or Toulmin [18].

This conception was shared also by Bas van Fraassen [5], author interested in how we make scientific explanation, other than syntactic-nomologic explanation or realist-semantic explanation. In his opinion, scientific explanation is not only a syllogism or a list of relevant information used in an inference capable to explain unobservable realities, but it is more then. It seems to be that kind of information with which we understand the purpose of a cognitive agent and his interests in a historical moment or place. Science should answer to questions like: Why? What for? In whose interest can we produce explanations? To answer we have to understand and be aware of the existence of cognitive ideals, presuppositions which are playing a role as responsible factors in designing and developing theories and scientific explanation. That means we need, in order to be successful, new logics as Antonelli [1] showed, new tools like non-monotonic logic. "The term non-monotonic logic covers a family of formal frameworks devised to capture and represent *defeasible inference*, i.e., that kind of inference of everyday life in which reasoners draw conclusions tentatively, reserving the right to retract them in the light of further information. Such inferences are called non-monotonic because the set of conclusions warranted on the basis of a given knowledge base does not increase (in fact, it can shrink) with the size of the knowledge base itself. This is in contrast to classical (first-order) logic, whose inferences, being deductively valid, can never be undone by new information." Antonelli [1]

The structure of explanation in the pragmatic and contextual paradigm is quite different:
- The topic of P (presupposition) - the problematic field of study;
- The contrast class, $X = \{P_1, \ldots P_i \ldots P_n\}$; The contrast class to P;
- A relevant connection *x* between a question, Q and an answer, R.

Given any assumption A, it might be relevant for (Q question), if it helps couple P_i (presupposition) to X (class). The answer that "P is…", in contrast with all other possible answers from the class X, means that is the only one which can occur „because of A". „Because of A" hasn't any causal meaning, none statistical or teleological one, it simply offers the support to believe in this relevance, truth, importance of relation between Q and R, at the very beginning. The stress is now on the relation between question and answer, supported by presupposition. [5] This new model assuming beliefs, intentions, interests and ideas regarding knowledge open a new perspective for this type of special sciences and for all whom believe in alternative methods for them. This type of explanation generated by social environment and psychology of scientist has a pragmatic dimension including human beings' interests and has nothing to do with logical standards, correctness or fitness to the reality. The request is just make things to work properly.

3. The Paradigm and its tricks in Educational Sciences

Taking in consideration all discussions in epistemology, I can figure out that there are still blank fields in our part of research, education, and sometimes it is impossible to be explained them correctly. Researchers presumed that always we, human beings, teachers and students are mostly rational, conscious agents. Inhelder and Piaget [7]; Oancea [13]. They like to believe and study schools and educational activities as rational, that means at surface culture and less regarding their deep and covered culture. We are

wandering anytime when some unexpected results occur in our education. Sometimes we can be shocked by the behaviour of people schooled, but acting in a totally different way that are not totally rational for us. Why the implementation process of the same official curriculum could have sometimes so different results?

The rational, logic ideal of explanation as only a logic one, even having semantic interpretation was the paradigm's product of modern science. The consequence of assuming the only rational logic paradigm is that pedagogy became a mimetic science. This kind of cognitive ideal (of explanation) continues to be disastrous for psychology and not only for this science. Putnam [16] Educational sciences are still considered weak sciences without any powerful explanation; students and teachers are lacking a good explanatory image (scientific) regarding their lives and activities. If educational sciences are considered natural sciences or social sciences, they failed to be considered real sciences. They cannot totally accept the schema of nomologic-explanation or semantic explanation, as well. What can we do? Can we search again a new alternative or not? Why after making a lot of efforts we couldn't explain what kind of sciences are educational sciences? Are they social sciences? Are they natural science? In what sense can we adopt such points of view? It seems we are cached in the tricks of paradigm and its standards.

The paradigm always trick us, and put us in a circular way giving the model and the tools and ask us to make a chair or a box and after that push events to set on or enter in it. Can educational sciences follow this path? If we will assume that, we should explain everything by accepting standards for conforming events and meanwhile simplify the world. But we know nowadays, that this kind of knowledge ideal is not proper for complexity. In the educational field of research, scientists agree that natural and social aspects are both involved in theoretical explanation of the educational activities. Authors like J. A. Fodor [4], focused on cognitive psychology called all sciences that are rebel "special science", which need new schema for explanation and he Romanian educationist, C. Bîrzea [2], emphasized that educational sciences are "complex sciences".

We should change the point of making science to accept the local, not de universal ideal as causal explanation, accept the difference and multi-perspective. At this moment starting from these kind of questions we try to propose some direction for future possible perspective of researches.

4. The re-definition of concepts and new explanation

We can also call educational sciences *integrative sciences,* using methods from anthropology or cognitive sciences perspective. From cognitivists point of view we need concepts which could change the meanings about educational realm: learning as a social process, the educational group as a cognitive system.

4.1. Learning as a social process

The goal of education is to develop the child physical states and also moral states required by the social and private lives. Here the concept of cultural transmission assume that the information, whatever it is, is embed in a cognitive scheme able to valorize itself, precisely trough the self-regulating content of the provided information. Knowledge, experiences, values are also acquired using interests. The concept used here is socialization but we think a more complex meaning is that of social group learning, if we accept the logic of this issue. Learning in the school is always a social type of learning; it is an interaction between people in groups. All this systems are conscious models and we can also add unconscious models. Nowhere in this world, learning in schools and in real life is not an individual process (except mystical experiences), but it is a social one.

4.1. Social educational system as a cognitive system

The efforts of cognitive psychology were focused, at first, on individual process and their cognitive architecture. Some authors emphasised that computation is not realized just in an isolated person's mind, but also like an emergence of the functioning social groups. Curseu [3]; Miclea[11]. This idea was developed by in the book „Grupurile în organizații". The author Curseu [3] said that, this theoretical proposal issue is

more and more accepted, because there are some aggressive influences from the new paradigm of cognitive science. There are three important reasons for those influences. He figures out that the first reason in the group information processing that is more accurate for this kind of tasks; the second reason is that the more important decisions with long time duration are made by the groups with greater priority; the third is that the knowledge is engrammed in the network's connections not in the units of networks (neuroconexionism); and the forth is that the group, as a relevant psychological entity, can operate because all members share the same mental model of knowledge as scheme, stereotypes, attitude. To assume that social groups are cognitive systems that mean that it allows us to study educational groups like a system generating knowledge, a very different knowledge than individual acquisitions and processing. Nowadays knowledge is accepted to be in different forms, not just declarative. They are also implicit or practical, tacit procedural. Kuhn [10].

And that is the difference between semantic explanation and pragmatic explanation. The first are using declarative values and the second are using tacit value, assumptions covered by surface culture. Let's consider, for example, cognitive scheme and stereotypes. All this scheme are cognitive units with meanings as groups of words, abstract, helping us as a tool for making selection or interpretations of social reality. According to this new conception about cognitive units, even outcomes can be considered produced by the members; actually effective outcomes have been processed by the group's working mind.

As we could see and already knew, the cognitive orientation for educational fields are not just an analogical explanation using the computer metaphor for memory or individual learning, but also it is an orientation that can opens new ways for a better understand and new way for educational researches and also for practitioners. We can emphasized that sciences of education as a social science of learning is studying a very complex system and has to use all contribution from related sciences.

This new contextual paradigm and its pragmatic model might be very fruitful for any process of explanation. May be accepting knowledge more than explicit declarative information but also as a tacit, deeply embodied in a particular culture and expressed only in a right moment, linguistic or not, using a particular logic, and so on. It could be a better way to study or initiate some specific research in particular part of education, but not in education as a wholly system, of course. A new analyse in sciences of education for a segment like school culture ought be more advantageous, if we accept the meaning of a scientific explanation as a pragmatic construct, in which the inference can capture the tacit knowledge, values or presuppositions.

Cross-national comparisons may also point to possible directions that could be followed and about which the researcher may not previously have been aware, or they may help to sharpen the focus of analysis of the subject under study by suggesting new perspectives. Knipping[9]; Pepin [15] So far, that new enterprise needed to study cultural products (believes, customs, rites, natural languages) that embodied tacit knowledge and can make them manifest.

Conclusion

We can assume that cognitive perspective and contextual pragmatic paradigm can enrich our range of explanations for educational practice and also for theoretical field. Some new directions could be pointed out.

If the social educational groups are conceived as a cognitive system, then we can find out new knowledge. Groups and their members are generating knowledge (explicit/tacit, declarative/procedural). We can look, here, upon cognitive scheme as knowledge units which are specifically related or designed into educational domain. More than, emergent knowledge of the group leads us to infer and have achievements trough special inferences. If the pedagogy, educational sciences are sciences of complexity, at least, certain segments can be studied with the help of cognitive-behavioural theory, anthropology, non-monotonic logic.

A possible research can be start with the introduction of a new taxonomy of cognitive units identified in prescribed cultural scholar contexts. In the first stage, the priority might be the extraction and the conscious acknowledgement of the collective mental schema cultural stereotypes, cognitive representations (found in language, beliefs, customs and behaviours) that play a role in the mental structuring of the teachers and the

students as a cognitive subjects. Also, we can efficiently direct the process of teaching through training of the personal that would incorporate the results of the research, transforming them in future cultural mind sculptures. The new image as a theory is an outcome that could explain better the school culture and learning style. It could be realized by the theories of educational science regarding it's domain of research and would prove to be a very dynamic one. Furthermore, we can prove that the changes occurring in the general scientific conception involving explanation (the assimilation of a contextual, cognitive perspective) have implications on the way that pedagogy is producing its theoretical explanations governed by contextual factors.

This cultural-contextual perspective and pragmatic explanation must be assumed with its value and limitations. Also, we keep in mind the theoretical needs of conceptual extension, and as well as the local dimension, its applicability determined by the nature and area of the research object, small groups with their relatively reduced interactions. This is the reason why the analyses have to be done in a spirit of caution for an extrapolation of the results in within the macro groups.

References

[1] Antonelli GA. Non-monotonic Logic. In Edward N. Zalta, editor:*The Stanford Encyclopaedia of Philosophy*, (Winter Edition); 2008. http://plato.stanford.edu/archives/win2008/entries/logic-nonmonotonic

[2] Bîrzea C. Arta şi ştiinţa educaţiei. Bucureşti: Editura Didactică şi Pedagogică; 1995.

[3] Curşeu PL. Grupurile în organizaţii. Iaşi: Editura Polirom; 2007.

[4] Fodor JA. Special sciences : The disunity of science as a working Hypothesis. In O. Bueno; V.F. Hendricks; W. van der Hoek; G. Sher, editors: *Synthesis*, October 1974, Volume 28, Issue 2; p. 97-115.

[5] van Fraassen, Bas. The Scientific Image.U.K.: Oxford University Press; 1980.

[6] Hempel G. Aspects of Scientific Explanation. New York: Free Press; 1965.

[7] Inhelder B, Piaget J. The growth of logical thinking from childhood to adolescence: An essay on the construction of formal operational structures. New York: Basic Books; 1958.

[8] Koyré A. Etudes d'histoire de la pensee philosophique. Paris: Gallimard;1973.

[9] Knipping Ch. Learning from comparing - A review and reflection on qualitative oriented comparisons of teaching and learning mathematics in different countries. In *Analyses, ZDM.,* Vol. 35 (6). Hamburg; 2003, p. 282 - 301.

[10] Kuhn Th. Structura revoluţiilor ştiinţifice. Bucureşti: Editura Ştiinţifică şi Enciclopedică; 1976.

[11] Miclea M. Psihologie cognitivă. Cluj-Napoca: Ed. Gloria; 1994.

[12] Nagel E. The Structure of Science: Problems in the logic of Scientific Explanation. New York & Burlingame:Harcourt, Brace & World Inc.; 1961.

[13] Oancea A. Explicaţia în pedagogie. Bucharest, 2002. (http://www.unibuc.ro/eBooks).

[14] Oppenheim P, Putnam H. The Unity of Science as Working Hypothesis. In: Richard Boyd, F. Gaspar, D. Trout editors. *Philosophy of Science*, U.S.A. The M.I.T Press; 1991.

[15] Pepin B. Different cultures, different meanings, different teaching. In: Haggerty L., editor. *Teaching mathematics in secondary schools* Routledge London; 2002; p. 245 - 258.

[16] Putnam H. Reductionism and the Nature of Psychology. In: Haugeland J., editor. *Design Mind*. A Bradford Book, Cambridge, Mass., London, England: The MIT Press.; 1991/1995.

[17] Salmon W. Causality and Explanation. Univ. Pittsburg Press. S.U.A.; 1998.

[18] Toulmin St. Human Understanding, vol. I, Princeton University Press, Princeton. New Jersey; 1972.

[19] Von Wright GH. Explicaţie şi înţelegere, Ed. Humanitas, Bucureşti. 1971/tr.1995.