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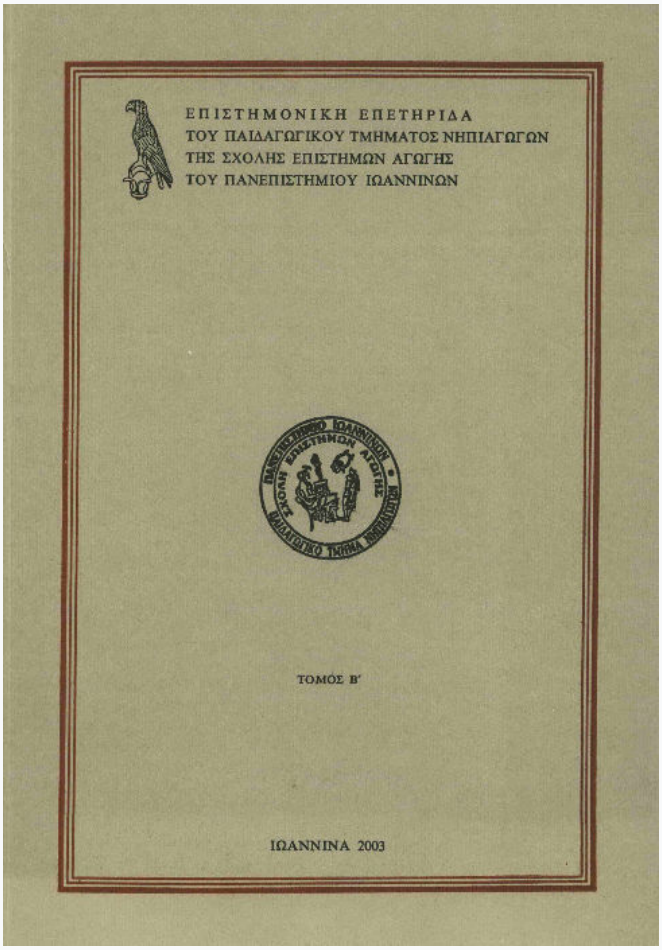

Reflective informal and non-linear aspects of argumentation in school practice

Κατερίνα Πλακιτσή, Βασίλης Κόκοτας

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KATERINA PLAKITSI - VASILIS KOKKOTAS

REFLECTIVE, INFORMAL AND NON - LINEAR ASPECTS OF ARGUMENTATION IN SCHOOL PRACTICE

SUMMARY

This study continues a previous one (Plakitsi, Kokkotas, 2003) on the ways of argument in primary science school classroom. According to our point of view, argumentation, is not a matter of application of pre-existing rules (scholastic approach), but the thematic and normative perhaps, but most of all, critical self-examination of thought (interpretative approach). We studied pupils' (10-12 years) arguments during their dialogues in classroom. We used D.Walton's (1996) argumentation schema and also we agree with his assertion that different standards for evaluating argument apply to different types of dialogue. Furthermore, we analysed pupils' argumentative operations according to the context provided by Pontecorvo & Girardet (1993) in relation with that provided by Resnick et. al (1993). We made discourse analysis and also we studied interaction features in accordance to Roth's (1995) categorization. Finally, we recorded pupils' socio-cognitive roles.

KEYWORDS: argument, informal logic, dialogues.

INTRODUCTION

Culture and value as factors of the birth and interpretation of science.

The main characteristics of the empiricist epistemology are its psychologism, the consequent ignorance and neglect of ontology, and the formalistic and monosemic concept of truth. Language is a closed set of descriptive propositions, which from the axioms of the given theory in a formal way. The subject is the passive receptor of sense - data and the valid statements are "verified" individually or separately in the group of the scientists that accept the principles of the given paradigm.

The weak point of this opinion is its philosophical one - sideness. This approach stubbornly ignores the wealth of the social sciences and the humanities, and identifies philosophy of science with the following of the tradition of the Circle of Vienna and its non fruitful interpretation of late Wittgenstein, pragmatism and post war epistemology. According to our point of view the crisis of logical positivism is a crisis of the utilitarian, individualist style of life, and the civilization that born it.

As pointed G.H. Mead, in an early article, man is not a passive imitator, but the imitative processes presuppose social instincts (Mead, 2001). The consequence of this thesis is that sociality and inter - sybjective interactionl estabish the root of all the activity of humanity. The social self is immediate and active. From his own side the contemporary German philosopher M. Frank shown that the subject is not the sensory data, the Humean "bundle of perceptions", but a bundle of polysemic interpretative versions which are enacted in the field of culture (Frank, 1988).

This poses another approach to language. It is not formed in denoting processes, but it is a living organism formed in the communicative activities of mankind. Thus polysemy emanates not from "analytical" definitions, but is a practice posited by culture and communication in actu. Much earlier than the adherents of the analytical philosophy of language, Dilthey wrote: "...we are forced by the nature of the linguistic process to use metaphors. Metaphors are also used in science. What has been narrated is then put forward as an instance, another instance is placed beside it, and through them a universal is exhibited" (Dilthey, 1996).

Viewed ontologically science is the study of beings in the world. This does not eliminate, but posits the polysemic approach from an ontic stance. Aristotle beginning his *Physics* writes that "being is uttered in many ways" (Aristotle, Physics A 185a 21). As Heidegger comments, from this passage follows as its consequence that the "in many ways spoken being", is spoken by the means of analogy (Heidegger, 1991). The ontological root of science, distinguishes, according to Jonas, nature as the birth place of values for man (Jonas, 1990), not reified according to our approach since values are not material objects, but consist in the wishful stances of mankind. Naturre is presupposed by science and culture and society, but on the other side, from the point of view of its historical beginnings, culture and society are the birth

place of natural sciences. According to K - O Apel, "what is complementary to the objectivity of science, it is not, or at least not only, the subjectivity of the irrational axiological desision. But, it is, equally, the inter - subjective validity of the moral norms of the community" (K - O Apel, 1994). Thus, although the descriptive function of science is objective and, in this sense axiologically "neutral", sciencs cannot contain its historical presuppositions, from the point of view of an priori cultural factor, but the social and cultural aspects are presupposed by the process of its interpretation.

ARGUMENT IN EPISTEMOLOGY:

Reflection, reasoning, and the limits of the normative approach.

We distinguish two approaches to argumentation. The first, whose most characteristic exponent is B. Russell, views it as a system of formal rules. But accordindg to our opinion, it is self - contradictory, if we view the problem of its substantiation as a normative one, since if reason consist in a closed system of rules, it must be proved either by itself or by another set of rules. In the first case we are led to a vicious circle. If on the other hand, this "proof" proceeds by another set of rules, these ryles are not exclusive.

Already by the end of 19th century and the beginning of the 20th Peirce radically changed the landscape in this article of 1906, "The Basis of Pragmaticism in the Normative Sciences" (Peirce, 1998), where he states that logic is a science "of conceiving and has nothing to do with the means where by the conceiving is performed", inaugurating, what we shall call the interpretative approach to reasoning and, speaking generally of reflection. An outcome of this is that logic is not a set of rules, but consists in the path of the critical self - examination of thought, where thought is approached as a totality of interpretative symbols. A major contribution of Peirce to the contemporary philosophy is the connection of Peirce (vide his lecture "Pragmatism"), of the interpretation of symbols, with the interpretation of minds as "theaters of consciousness" which interact the one with the other, and whose interactions is presupposed by any descriptive process. We state the last conclusion based on his position, expressed in the same lecture that "the Object of a Sign... is necessarily unexpressed by the sign, taken by itself" (Peirce op. cit..). Another conclusion we may reach, is that as states Ricoeur, the sign is "a supposition and not an assertion"

(Ricoeur, 1984). Thus the sign accomplishes an interplay between dissimulation and elicitation of a thought. In this sense the principle of thought cannot be "revelation", and interpretation is a presupposition of truth-functional semantics.

From his point of view von Glasersfeld argues that the communication is not the original deciphering of the, say, original meaning of the words. He rather states that the signals involved in it "carry instructions to select particular meanings from a list which together with the lists of the convened signals, constitute the communication code" (von Glasersfeld, 1995). In this sense, according to him, the communicational processes are normative, while from his own, psychological, point of view he agrees with Ricoeur that psychological interpretation is not pre-given. But we would be led to the scholastic deadlock, in case we thought that this code is universal and that it exists before the communicational process. Consequently we disagree with the point of view of Sperber and Wilson, according to which information is the presupposition of communication (Sperber, Wilson, 1989). For us communication is not a predictable process, but a process under construction. What objectifies it, is the fact that it is always actualized in the field of language and in this sense we agree with Plato that reason is the discursive combination of nouns and verbs (Plato, Seventh Epistle 342b). But most of all: reflexivity does not consist in normativity in abstracto, but as formulates Willke, with the self - thematization of systems involved in it (Willke, 1996).

Argument is a process evolving in time. We will perform a mild distinction between thought and language, always viewing the second as the implementation of discourse and inter-subjectivity. In this sense it consists in a serial combination of morphemes, while from the other point of view is not deterministically predictable. Depraz, Varela and Vermesch define non-linearity as bifurcation, limit-time oscillations and chaos (Depraz, Varela, Vermesch, 2003). And, even from the point of view of its agent, communication is always risky, since, during it comprehension, is not pre-given.

The learning subjects are always posited in the world as psychophysical entities, they are continuously elaborating information from it, and thus their cognitive status connot be immobilized in a permanent condition. We cannot ignore the functionalist thesis about the equilibration of the cognitive processes, but according to our opinion it is not fruitful, to view it as procedure of stabilization though time (Pia-

get, 1988). We meet this opinion and in Ashby's "Design for a Brain": in this book he connected equilibrium with recursineness and normality and as a characteristics of adaptation to the environment (Ashby, 1965). But adaptation presupposes a flexible latent mechanism, which buttresses the evolution of the given system, and its capacity to self-differentiate, and interact with any other system that surrounds it. It presupposes additionally the capacity of the cognitive system to observe and be self-observed, but also interact with the other relative natural, biological and social systems related to it. Thus it is necessary, according to our opinion, a shift of interest of the research from the field of functionalism and "strict" constructivism to those of the various "traditions"of social, philosophical and cultural hermeneutics. The learnign process involves active learning subjects, necessitates their interaction, and is "enacted" upon inter-subjectivity, language, and civilization (Varela, Thompson, Rosch, 1993); and proceeds through the, not only first and third person interaction, but in the second person too (Depraz *et. al.* op. cit., 2003).

ARGUMENT IN PEDAGOGY AND IN EDUCATIONAL RESEARCH AS WELL

Argument in pedagogy:

Argument usually is: "rhetorical"(Billing, 1996) or "didactical" (*teacher offers data in order to help pupils to consider a justification as logical* or "triadic discourse" (*Teacher question-Pupil answer-Teacher evaluation*) (Kuhn, 1997 - Lemke, 1990). There is luck of "dialectical" or "multi-thematic" or "polyporphous" arguments, that is to say multidimensional reasoning in order to construct a common answer. Some consequences of that luck are: 1) pupils hold wrong aspects about science; 2) they have difficulties to learn science and to participate in real discourses. According to our point of view, the most important problem of this situation is that pupils become familiar with linear reasoning even if the topic they have to study is multisemic. On the other side, rich dialogues, and also rich arguments support polysemy (or multiplicity) which is a substantial characteristic of real socio-scientific topics. Nowadays, scientific communities mostly search for non-linear analysis of the everyday life and environmental problems. But, we consider a challenge to define to what extent that non-linearity is necessary to be included in our educational system. For example a fundamental interdisciplinary concept is the concept of time. Time

is linear and cyclic; time is psychological, biological, and physical; time is internal and also external. So pupils have to reconcile their personal (subjective) conceptual system to the conventional (objective) system of the socio-culture context where they grow up.

Learning theories supporting our research are:

— Social constructivism: *learning is at first 'cross-individual' and then 'inter-individual'* (Vygotsky, 1978, Wertsch, 1985).
— Situated- learning theory (Brown et al., 1989, Lave, Wenger, 1990): *learning is defined by action, context and culture when in takes place.*
— "Authentic" learning environments, that make "meaning", "purpose" and "interrelation" (Roth, 1995).
— Social interaction in learning communities (Miller,1997).

Argument in educational Research:

— Up to now argument has been studied in relation to: 1) conceptualization -conceptual change, 2) pupils' epistemological ideas, pupils' learning difficulties and, 4) skills develoment. Recently research focuses into the process of argument construction itself. But, there are not so many data about the reasoning process and argument construction in small groups and also within different congitive contexts (Kelly, 1997, 1998).

Argumentation in our research.

— We believe that argumentation among pupils is an important strategy in the process of learning.
— Furthermore, we considered scientific knowledge as argumentation: *the ability of construction, justification and evaluation of scientific claims* (D. Kuhn, 1993).
— We choose a sequence of "authentic" discourses and "academic controversies" as "open environments".
— We examined pupils' scientific thought and also the processes of argument construction in small groups discoures.

Dialogic procedure occurs during dialectical argumentative exchanges, like that which occusr during collaborative small group science investigations, assessment conversations (Jimenez- Alexandre, et al, 1997). The discourse is typically focused on one or more advocated positions. Argumentation schemes that focus on presumptive reasoning focus on the evidence and premises a person uses to shift the burden

of proof from one advocate to another (Walton, 1996). Our analysis of small group discourse supports the use of presumptive reasoning as a framework to analyse students' argumentation. Further justification and elaboration of presumptive reasoning as an analytical tool is provided in the next section.

METHODOLOGY

Discourse of Argument analysis.

We studied some dialogues from 6 small groups of pupils, 10-12 years, while they were studying science in two schools of Athens, during the winter of 2003. Firstly, we took into consideration D. Walton's (1996) argumentation schema, trying to find an appropriate tool in order to analyse pupils' arguments while they argue about linear and cyclic time. In our previous work (Plakitsi, Kokkotas et al. 2003) we used Toulmin's Argument Pattern (TAP) in order to analyse analytical arguments emerging in multi-dimensional dialogues in classroom. Toulmin, in his book «The Uses of Argument» (Toulmin, 1958), radicalising, according to our opinion, the pragmatist approach, writes that premises linked to conculusions, are supported by general heuristics, offered in support of claims, he dubs «warrants».

In this study we tried to use D. Walton's *Argumentation schemes for presumptive reasoning* (1996). We supposed that a Walton's schema would be more appropriate tool in order to study dialectical arguments. In his New Dialectic (1998) Walton asserts that different standards for evaluating argument apply to different types of dialogue. An informal logic that is pragmatic and contextual, he maintains, works best for evaluating arguments that arise in everyday conversational exchanges. Walton's major innovation is to see a fallacy not as a general pattern of argument. What is a non-fallacious type of argument in one context of discussion may be fallacious in another. According to our point of view, and despite its undeniable usefulness, the new dialectic must at times founder in the face of the unruliness and recalcitrance of ordinary language.

The teaching and learning strategies were: a) discourses in small groups (initial phase of the research) and an academic controversy (last phase) about linear and cyclic time. According to our opinion, philosophical background of those strategies is Gadamer's (1978) game metaphor. He has suggested that every dialogue can be seen as a form of a game. Like a game, a conversation has a momentum of its own,

which carries it forward. Gadamer's point is caught in Quincey's metaphor of the "vast tennis-court of conversation, where the ball is flying backwards and forwards" ("Conversation", 422). People who argue must agree upon far more than they disagree about. Mainly, they must agree about the rules of play. In practical, we choose the type of academic controversy proposed by Johnson & Johnson, 1995. This type has the following five steps:

- Organizing Information and deriving conclusions: Pupils research a position, learn the relevant information, and prepare a persuasive «best case possible» for the position.
- Presenting and advocating positions: Pupils present in a persuasive and convincing way the «best case possible» for their position.
- Uncertainty created by being challenged by opposing views: Pupils engage in an open discussion, in which they argue forcefully for their position, refute the opposing position, and rebut attaks on their position.
- Epistemic curiosity and perspective talking: Pupils reverse perspectives and present the opposing position as accurately, completely, persuasively, and forcefully as they can.
- Reconceptualizing, synthesizing, and intergrating: Pupils drop all advocacies, create a synthesis or intergration of the opposing positions, and reach a consensus on the best reasoned judgment that may be made about the issue.

Data were a) groups' worksheets, 2) taped discourses and, 3) videotapes of the final academic controversy. For discourse analysis, at first, we de-record the tapes and the videos. Afterwards, we analyzed pupils' arguments using Walton's *Argumentation Schemes for Presumptive Reasoning*. Other researchers supported that their initial attempts to use Toulmin's Argument Pattern for the analysis of discourse did not prove useful (Duschl, Ellenbogen & Erduran, 1999). In spite of this we found TAP useful and functional for studying argumentation schemes in elementary schooml classrooms. For all that, designed to test another, contemporary, tool. Besides, the use of Walton's presumptive reasoning schemes more adequately fit the dialectical structure of the group discourse and the kind of evidence and premises students generate. Eight of the 25 argumentation schemes proposed by Walton were selected for the analysis of the reasoning units. The selected schemes

are presented in Table 1, in 4 collapsed categories. Given the emphasis on dialog, the unit of analysis was the reasoning sequence. The reasoning sequences is the conversation that takes place between group members when debating or arguing for, or against, a specific course of action or when evaluating a patricular claim.

Argumentative operations.

Beyond the argument structure there are argumentative operations. These are a means that speakers use for expressing and supporting their reasoning. From the context provided by Pontecorvo & Girardet (1993) in relation with that provided by Resnick et. al (1993), we coded argumentative operations into the following categories:

- claim: every proposition that exposes a thesis/situation, without any definitely answer to the matter.
- justification: every proposition that supports a claim (either towards a consensus or to a contradiction).
- consession: every proposition that accepts a previous idea (i.e. confirms a claim or a justification).
- opposition: every proposition that denies a previous idea (i.e. rejects a claim or a justification).
- challenge: every proposition that works as a demand for justification / demand for investigation / indirect controversy.

RESULTS / CONCLUSIONS

Children's thought is influenced by cognitive, but also intuitive factors. In this sense, although their development passes through evolutionary phases, it is not, concerning its initial phases, homogenously predictable. The non thematic factors form the background of the argument. In this sense, the argument does not appear isolated, but is multithematic and polymorphous. Thus children synthesize their views, and reach the conclusion that «time is linear and cyclic at the same time».

The articulation of children thought and their argumentation is not organized in a linear and unanimous way. Thought, at least when it is controllable by formal criteria, is always articulated, but its articulation is self-productive and self-reproductive.

Thought, as we stated before, is not monologic, but discursive and dialectical. This opinion has, especially for education a significant

sociological aspect, according to the assertion that "the first logical categories are social cartegories"(Durkheim, Mauss, 2001). Discussion is needed for another reason: it is the only way by which the pupils can learn the scientific way of thought and be committed to it.

As far as is concerned to argumentative operations:

— During the discourse and in each turn when the speakers were exchanging messages (message units) we recorded: (claim + justification) → (opposition) → (opposition) → (opposition) → challenge → (claim + justification) → .... → (opposition) → (opposition) ..... → consession.

— Pupils held all the categories of the argumentative operations (claim, justification, consession, opposition, challenge).

— Too much opposition (rebuttals) was recorded. This is essential part of an academic controversy, which demands direct or indirect attacks and defends.

About justification structure we recorded the following categories:

1)indirect: (claim + justification) → claim, 2) "response" to a challenge, 3) "response" to an opposition, 4) supporting an opposition and 5) need for a consensus.

The analysis employing the Walton scheme shows that pupils bring a great deal more to argumentation than are identified by strict analytical logical schemes. Presumptive reasoning analysis seem to be a natural entry point for the assessment and development of student's argumentation strategies. Creating contexts and facilitating discourse that promote effective argumentation is a poorly understood element of science education. Augmentation of student's discourse to promote critical thinking and reasoning would benefit by a shift from an emphasis on deductive and inductive argumentation schemes to an initial emphasis on the more natural dialog logic found in dialectical contexts.

Future research needs to be carried out on the content of argumentation in natural settings like that in whole class, small group, and / or asynchronous computer contexts. Identification of the patterns of reasoning and argumentation schemes will facilitate and enrich our understanding of how to execute formative assessments of students reasoning from evidence to explanation.

We support that:

— Pupils can be able to make arguments through appropriate practice in discussing controversial topics.

— Cooperative and controversial didactical strategies could support polysemic scientific reasoning and rich socio-scientific discourse.

— At first we believe that, despite the many obstacles and barriers posed by the demands to implement different and innovative practice, it is possible for primary teachers to adapt, change and develop their practice to one where there is a fundamental change in the nature of classroom discourse. Furthermore, pupils' reasoning about the topic of cyclic and linear time was better after the academic controversy. Pupils who believed only in linear time and those who believed only in cyclic time recognized the necessity of a synthesis among the conflict opinions. It seems that so Toulmin's as Watlon's tool could work to pupils of 10-12 years under conditions. One of this is to familiarize puplis in argumentation for a long period (at least a school year). Table 2 present the collapsed categories of pupils' arguments according to Walton's schema figured on table 1. We recorded more inferences which are analysed on special categories on table 3.

— In general we believe that pulpils after having a long practice in a) working in authentic environments, b) discussing controversial topics and, c) following cooperative strategies; then they will manage to make rich arguments. They will manage to set rules and play roles in an argument game enriching their conversations and social interactions.

— Finally, an important factor in the whole procedure is teacher's profile. Because a teacher who is not afraid of open environments could enhance his or her pupils to improve their ability in social - scientific argumentation.

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APPENDIX 1

Collapsed Categorles from Walton's Schemes

Request for Information = Sign, Commitment, Position to Know

Expert Opinion = Expert Opinion.

Inference = Evidence to Hypothesis, Correlation to Cause, Cause to Effect, Consequence.

Analogy = Analogy.

Table 1:

Argument from	**Definitions**	**References**
Request for Information = Sign, Commitment, Position to Know	Reference to spoken/written claims are used to infer the existence of a property or event. Suggests action should be taken. There is insufficient information to make a judgment. Involves request for more information.	Sign: References to the topic. "look at this" "it shows" Commitment: Look for a request for action "should.." "could..." Position to know: Look for opposition statement
Expert Opinion	Reference to an expert source (person, text, group consensus, etc.) in order to support a claim	"the book says"

Inference=Evidence to Hypothesis, Correlation to Cause, Cause to Effect, Consequences	Reference to premises followed by conclusion. Includes a hypothesis or a conjecture or generalizable prediction capable of being tested. (The hypothesis can come as part of the "if" or the "then" part of the argument.) Infer a causal connection between two events. Characterized by an inferential leap, based on a natural law, but devoid of any reference to observational evidence. Reference to premises that are causally linked to a non-controversial effect. Effect is an observable outcome, with no need for testing. Practical reasoning in which a policy or action is supported/rejected on the grounds that the consequences will be good/bad. A statement about the value of the conclusion without any expressed concerns for neither the properties nor the events that comprise the full argument.	"I think..." "it looks like..." "it probably would..." "if it had..." "then it would" (Often based on plausibility rather than probability.) " it will..." "then it would be better" "itis basically good"
Analogy	Used to argue from one case that is said to be similar to another.	"like" or use of a metaphor

APPENDIX 2

Table 2: Collapsed Categories

Table 3: Inference Categories

APPENDIX 2

Table 2: Collapsed Categories

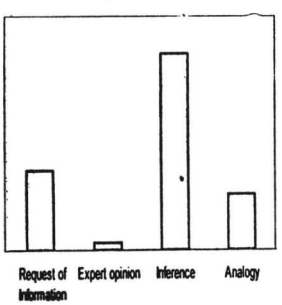

Table 3: Inference Categories