



THE INQUIRIES OF INSPECTOR CLOUSEAU  
THE CASE OF THE MURDERED MILLIONAIRE  
from the analysis of reasoning to the propositional variables

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1. The topics of this contribution are parts of a teaching activity on Logic started in 1986 with 11/14 year-old pupils. It has been run for two hours every week by myself, a Science teacher, in collaboration with the teacher of Arts in the same course (the teachers have been constantly holding the lesson together).

The general aims of this activity concern the *improvement of linguistic and argumentative skills* in the students, which represents one of the main conditions for *understanding*, quite apart from the disciplinary context (language, mathematics, science, history, etc.): it concerns then *every* discipline, even the more technical ones, which apparently require almost exclusively instrumental skills.

One of the most complex aspects of linguistic competence lies in the ability of organizing one's opinion in an exhaustive and conveyable way; in other words, in the ability of *explaining* the stream of a reasoning which starting from one or more premises comes to a conclusion. *we have developed*

We have faced these topics developing a teaching activity within Logic, seen particularly as:

- \* a *transversal area* with reference to the linguistic and scientific-mathematical areas
- \* a *reflection on language* trying to stimulate the pupils to express their arguments and to pay attention to their schoolmates' opinions.

For this reason we have tried to induce: *consider important to induce:*

- 1) order in the organization and communication of one's ideas according to priority, sequentiality, coherence among the concepts to be expressed, property of language, etc.
- 2) the comprehension of the "richness" linked to the ambiguity of a natural language on one hand, and of the "power" of a formalised language on the other, pursued through:
  - pointing out the differences between the *semantic* aspects and the *logic-syntactical* ones in a message; f
  - the acquisition of the concept of *symbol*;
  - the awareness of the relationship between the symbols and the rules through which they are to be connected with one-another; j
  - the ability of spotting out the values of truth of complex sentences, through the analysis of the clauses composing them, or viceversa.

2. The specific aim of the research we are presenting is to lead 12-year-old pupils to the aware acquisition of the concept of *propositional variable*, and of the more general concept of *variable* which is faced in many occasions during the lessons of Maths, and which the

pupils have often met since the first years of primary school even if *masked, made up* in many ways and not made explicit as such.

In spite of this *distribution* of the topic over years, the mathematics teachers know very well the difficulties of making understandable the meaning of the concept of *variable*, i.e. of the letter which indicates any number or, in the case of logics, any particular clause.

So, bearing in mind that facing a topic from different points of view *can help* the pupils, we have chosen a particular environment - i.e. the conception and solution of *detective stories* - to tackle in an original - and in our experience powerful - way such a delicate problem.

3. During the presentation we shall illustrate briefly the details of such activity, analysing through which reasonings and strategies our Inspector Clouseau - together with his young assistants - starting from the mysterious "*case of the murdered millionaire*" has come to the solution of the equally complicated case of the "*theft of the valuables of Lady Baroness Juvelier*".

#### 1st phase

- from a detective story are desumed the clues which are explicitated as *atomic clauses* or as sentences composed by two clauses;
- for each clue the following are desumed:
  - A) *the values of truth*,
  - B) *the connectives*,
  - C) *the atomic clauses*.
- the clues which are compatible with the relative values of truth are isolated and...
- through a reasoning plan the coherent ones are connected with one-another;
- eventually the solution of the crime mystery is obtained.

#### 2nd phase

- later a new list of clues is offered, which contains *semantically different but logically equivalent clauses*, i.e. having the same connectives and the same value of truth;
- such clues are then substituted to the previous ones on the reasoning plan, and...
- it appears that it *works* in this case too and leads to a different solution.

#### 3rd phase

- the clauses of the two previous phases are substituted with the letters "p", "q", "r", etc. and the clues are transcribed symbolically; this way we come to an aware usage of propositional variables.
- as a conclusion to this activity the pupils build up, on the base of other reasoning plans, new detective stories substituting to the variables clauses containing characters and situations which are completely different from the previous ones. Eventually we have grouped out *classes of stories* completely different from one-another in the narration but equivalent in their logical structure.

#### REFERENCES

- Arzarello F., 1989, The role of conceptual models in the activity of problem solving, in Vergnaud G., Rogalsky J., Artigue M. (eds.), Proc. *PME XIII*, Paris, vol.1°, 93-99
- Austin J.L., Howson A.G., 1979, Language and Mathematical Education, *Educational Studies in Mathematics*, 10, 161-197

- Boero P., 1991, Learning of mathematical modelling and reality: the intermediating role of language and culture, Proc. *TME*, in press
- Laborde C., 1990, Language and Mathematics, in Howson A.G., Kahane J.P. (eds.), *Mathematics and Cognition*, Cambridge University Press, 53-69
- Malara N.A., 1988, Implicazione e Modus Ponens: Sintesi di una esperienza didattica realizzata in una seconda media, in Barra M. e Zanardo A. (eds), proc. Conv. Naz. *La Logica Matematica nella Didattica - Roma* (1988), printed in Padova, 1989, 245-253.
- Navarra G., 1992, Il signor Kappa allo zoo: analisi di un'attività didattica sui connettivi logici "e" e "o", *Scuola e Didattica*, XXVII, 13, 83-88.
- Navarra G., 1993, Un mazzo di fiori alquanto pericoloso: un itinerario didattico sulle leggi di de Morgan, *Scuola e Didattica*, 9, 46-40
- Navarra G. 1993, Itineraries through Logics for potentiating linguistic and argumentative skills, paper for WG7 "Language and classroom communication" *ICME 7*, Quebec Canada (1992), in press on *L'Insegnamento della Matematica e delle Scienze Integrate*
- Schoenfeld A.H., 1985, Metacognitive and Epistemological Issues in Mathematical Understanding, in Silver E.A. (ed.), *Teaching and Learning Mathematical Problem Solving*, LEA, 361-379

PROCEEDINGS OF THE  
3<sup>rd</sup> BRATISLAVA INTERNATIONAL SYMPOSIUM  
ON MATHEMATICAL EDUCATION

**BISME - 3**

COMENIUS UNIVERSITY  
FACULTY OF MATHEMATICS AND PHYSICS  
BRATISLAVA  
UNION OF SLOVAK MATHEMATICIANS AND PHYSICISTS

August 25 – 27, 1993  
Bratislava  
SLOVAKIA

Edited by Peter BERO

