

**TEXTBOOK LANGUAGE, TEACHER MEDIATION, CLASSROOM  
INTERACTION AND LEARNING PROCESSES: THE CASE OF  
NATURAL AND SOCIAL SCIENCE TEXTBOOKS IN BARRANQUILLA,  
COLOMBIA\*/\*\***

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*ABSTRACT: This paper will present a brief summary of the results of a long-term research programme in Barranquilla, Colombia, using SFL analyses of textbook and classroom discourse in conjunction with ethnographic techniques in investigating the complex relations between the language of school textbooks, the ways in which teachers act (or do not act) as mediators of this language for their students, patterns of classroom interaction and learning processes. The work I will comment on has been in two phases: the first concentrating on the identification of sources of difficulty in textbook language, the way teachers handle (or do not handle) these difficulties and the associated levels of learning discernible in students' discourse as observed in classroom interaction and in interviews; the second concentrates on the ideology of the textbook discourse, the teachers' mediation of it and its implications for citizenship education. I will first provide some background information about the context, sites and materials involved in the study and then go on to look at language features which have been found to cause difficulties in learning from texts and the related levels of learning which have been observed in students. I will make brief reference to the final stage of this first phase, which consisted in an intervention strategy at one of the research sites. The final section of the paper will focus on language features which we consider to be indicative of certain ideological positions and present some tentative conclusions as to their implications for citizenship education.*

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\*\* ROUND TABLE: Problems related to language in the school in different contexts and different areas of study

## 1. Setting and Methodology

Colectivo Urdimbre works in Barranquilla, an industrial and commercial city at the mouth of the Magdalena River on the Caribbean Coast of Colombia. For some ten years now, we have been carrying out research into the language of school textbooks in Natural and Social Sciences and its influence on both learning processes and education for citizenship. We have concentrated on seventh and eighth grades, involving children of between 12 and 16 years of age, carrying out ethnographic studies in 8 different schools, 5 of them state-run and 3 private, and analysing sections of 8 textbooks, 4 in each of the two areas of study.

For each study, after an initial meeting with the teacher, we analysed the unit of text to be worked in class during the period of observation, applying the following types of analysis:

- Transitivity and ergativity
- Grammatical metaphor
- Theme/Rheme and method of development
- Lexical density
- Modality: polarity, modalization
- Textual units, topic types

Most of these analyses have been based on the work of the Sydney school of Systemic Functional Linguistics (e.g. Halliday, 1994; Halliday and Martin, 1993; Halliday and Matthiessen, 2004; Thompson, 2004) with additional insights on Theme and method of development from Fries (1981). Analyses of Textual Units and Topic Types are based on Davies (1985, 1986) with certain modifications based on the nature of the texts studied (Moss *et al.*, 2003).

The ethnographic aspect of the study then involved observing the interaction between text, teacher and students in the classroom using non-participant observation, interviews with both students and teachers and analysis of written texts produced by students. This was followed by an action research project involving workshops for a number of teachers and accompaniment as support for innovation with two teachers, one each in Natural and Social Sciences.

The site of our most recent projects is a state-run secondary school in a fishing village near Barranquilla. The children come from low socioeconomic strata with low literacy levels in the home. The topics dealt with in the units studied were, in Social Sciences, “Arab expansion” and “The Industrial Revolution” and, in Natural Sciences, “Ecosystems”, “Water and air” and “Fluids”. These topics are specified in the National Curriculum.

## **2. Phase 1: Results**

In our analyses of the 4 textbooks studied in this phase, we identified the following features of the text which our “linguists’ intuition” and reference to previous studies (Davies and Greene, 1984; Halliday and Martin, 1993) led us to believe would probably cause difficulties for students who are inexpert readers and new to the fields of knowledge concerned:

- Insufficient textual units
- Incomplete information
- Complex Theme development
- Grammatical metaphor
- Undefined technical and sub-technical terms
- Lexical density
- Absence of modalization
- Overuse of negation.

Most of these features have been amply documented in the literature. The term ‘Textual Units’, following Davies, refers to introductions, transitions, linkers and conclusions. ‘Incomplete information’ refers to the information constituents to be expected in particular Topic Types. As regards overuse of negation, work by Labov (1972) and Ducrot (1988), among others, suggests that negative clauses are more difficult to process than affirmative ones.

Classroom observations and interviews with students later confirmed all these features as sources of difficulty in understanding texts and therefore in learning from them (Moss *et al.*, 2003; Colectivo Urdimbre, 2000).

The actions of teachers observed during this phase may be characterized in the following way:

- Use of the textbook as curriculum
- Little awareness of difficulties
- Belief that lack of understanding is due to inattention in reading
- Positive evaluation of literal reproduction of text
- Constant evaluation (IRE)

Teachers who are experts in their fields but have little knowledge of language may assume that the texts they use are transparent and therefore attribute students' lack of understanding to inattention in reading, laziness or stupidity. Many of the teachers observed frame their questions as prompts for decoding the text rather than as an invitation to reflect on its content; they give positive evaluation to students who produce literal citations from the textbook in answer to these questions, a practice which seems to discourage students from engaging actively with text and thus risking negative evaluation. Most of the teachers observed worked with a rigid IRE (Initiation-response-evaluation, cf. Cazden, 1988) framework in which each and every participation of students is evaluated, again discouraging risk-taking.

In response to the difficulties inherent in the language of the texts and the frequent lack of mediation on the part of teachers, students tend to show evidence of limited levels of learning (Barletta and Moss, 1999). Through analysis of classroom observations and interviews with students, we have identified six levels of learning:

- 0 Irrelevant utterance
1. Mechanical recitation
2. Incorrect elaboration

3. Academic understanding
4. Interaction between academic and experiential learning
5. Transformation of experiential learning

#### *Irrelevant utterance*

This category refers to those occasions on which students say the first thing which comes into their heads, simply because they have been called on by the teacher, but without relevance to the content of the question.

#### *Mechanical recitation*

This category covers those cases in which students reproduce extracts from the textbook in word-for-word form, either by reading or by reciting from memory.

#### *Incorrect elaboration*

In these cases, the students' participation shows evidence of processing, but the result is unsuccessful. The attempt to engage with and process the text leads us to classify this as a higher level of learning than Mechanical Recitation, although it may frequently be negatively evaluated by the teacher. There follows an example of this category, presented first in the original Spanish and then in translation into English<sup>1</sup>:

- ☞ ¿Por qué te pareció interesante [el capítulo sobre el Imperio Napoleónico]?
- ☺ Porque Napoleón Bonaparte primero fue un soldado del Imperio.
- ☞ *Why did you find [the chapter about the Napoleonic Empire] interesting?*
- ☺ *Because Napoleon Bonaparte started out as a soldier in the imperial army.*

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<sup>1</sup> In all the examples which follow ☞ indicates participation by the teacher, ☺ participation by the student, ✎ participation by the researcher-interviewer and 📖 an extract from the textbook.

In this case, the student has successfully picked out a salient characteristic of the career of Napoleon – that he rose to prominence from relatively humble beginnings. However, the mistaken reference to “imperial army” with regard to the period of Napoleon’s early life led to the teacher to give a negative evaluation to this answer.

#### *Academic understanding*

In these cases, the student demonstrates that s/he has understood the literal meaning of text but does not go beyond the text to relating its content to his/her context or experience. For example,

📖 Napoleón ocupó a España.

😊 Seño, que Napoleón invadió a España.

📖 *Napoleon occupied Spain.*

😊 *Ms., Napoleon invaded Spain.*

In this example, from the Social Sciences class, the student uses a synonym, demonstrating a basic understanding of the statement.

📖 Cuando el aire entra a los pulmones, el tórax se amplía y las costillas se desplazan hacia afuera.

😊 El aire entra a los pulmones, cuando entra el aire, las costillas se ensanchan hacia afuera.

📖 *When the air enters the lungs, the thorax enlarges and the ribs move outwards.*

😊 *The air enters the lungs, when the air enters, the ribs widen outwards.*

In this case, from the Natural Sciences class, the student paraphrases a statement from the book, again demonstrating at least superficial understanding of the idea.

#### *Interaction between academic and experiential learning*

In this category, the student shows evidence of establishing relations between the academic content of what is being learnt in the school subject and his/her own experiential learning.

☞ Un insecto se posa sobre una hoja y se la come ¿qué tipo de relación hay ahí?

☺ Depredación

📖 En la depredación una especie ataca y mata a otra de la que se alimenta, como sucede con el halcón y el pato.

☞ *An insect lands on a leaf and eats it. What type of relation is that?*

☺ *Predation*

📖 *In predation, one species attacks and kills another on which it feeds, as in the case of the hawk and the duck.*

In this example, taken from a Natural Science class, the student shows that s/he is able to describe an occurrence which is very frequent in the local context using a term which, in the textbook, is exemplified with the case of hawks and ducks, neither of which abound in Barranquilla. While most biologists would probably not consider the case of the insect and the leaf to be predation, the student's experience, in a tropical climate, tells him/her that insect action frequently leads to the death of the plant. This is a clear example of making sense of academic learning in relation to everyday experience, and an important step on the way to a more exact appropriation the scientific concept of predation (Giordan and de Vecchi, 1988).

#### *Transformation of experiential learning*

This is the highest level of learning identified in our observations and refers to those cases in which the student demonstrates that s/he is able to use concepts learned in the classroom in order to realign his/her understanding of the world. It corresponds largely with Ausubel *et al.*'s (1978) notion of significant learning. For example,

☺ Seño ¿los animales no pelean entre ellos mismos?

☞ Tiene que haber un líder.

☺ Seño y ¿cómo hacen ellos para elegirlo? Porque ellos no tienen lengua...

☺ *Ms., do animals fight amongst themselves?*

☞ *They have to have a leader.*

☺ *Ms. and how do they choose one? Because they don't have a language...*

In this case, in Natural Sciences, one can almost hear the cogs of the students' mind turning as s/he attempts to imagine how animals without speech can elect a leader. This clearly involves a realignment of his/her previous conceptions about animals without speech as lacking social organization and hierarchy. Something similar can be seen in the following case from a Social Science class:

☺ *¿Canadá pertenece a Estados Unidos?*

☞ *No, a Inglaterra; pero es una pertinencia apenas de tipo legal, jurídico, pero en la práctica hay un Primer Ministro que es el que manda (...)*

☺ *¿Canadá no tiene presidente?*

☺ *Does Canada belong to the United States?*

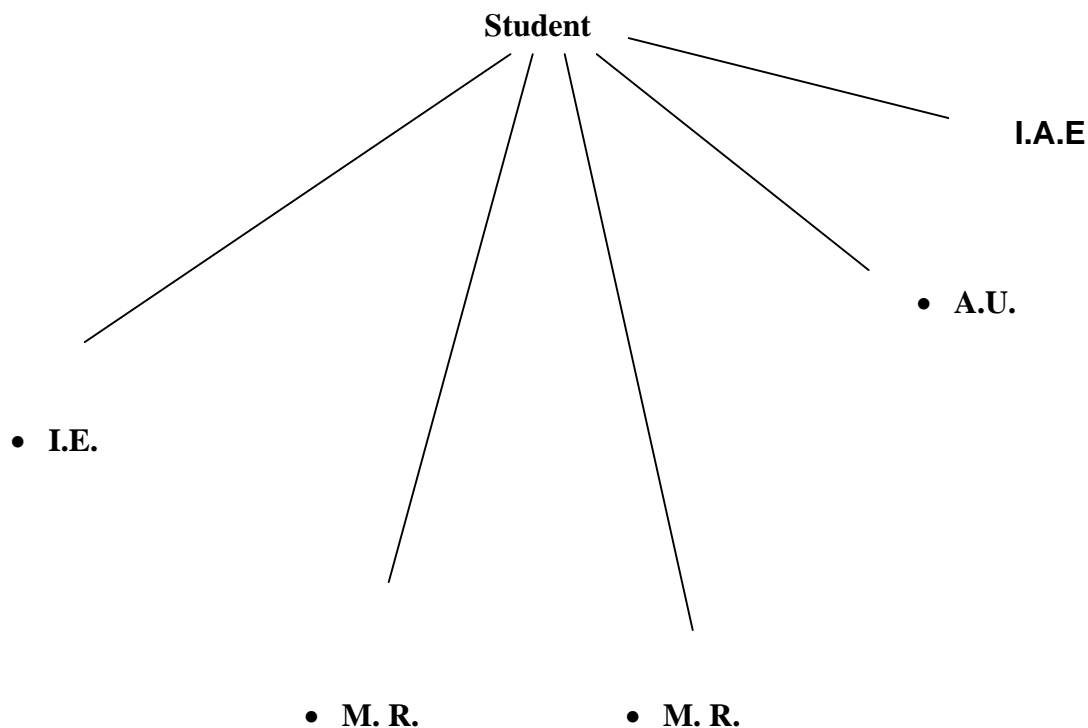
☞ *No, to Britain; but it's just a legal kind of belonging, in practice there's a Prime Minister who is in charge (...)*

☺ *Doesn't Canada have a president?*

It would seem evident that the student came to the class with the conception that all countries have presidents and has to readjust this conception in the light of the information that Canada is governed by a Prime Minister. It is interesting to note that both examples of this level of learning occurred in exchanges in which students, free from the pressure of evaluation, felt free to initiate interaction with the teacher by asking questions.

Observations suggest that the progression from one level of learning to another is neither linear nor continuous but that, in the context of the kind of interaction typical of these classrooms, there is a constant tendency to drop back to the level of 'Mechanical Recitation' when higher levels seem either too demanding or too risky. This rise and fall may usefully be represented in the form of a pendulum with a tendency to fall back to the bottom of its range unless pushed higher by some specific stimulus:





A. U. = Academic understanding

M. R. = Mechanical recitation

I. E. = Incorrect elaboration.

I.A.E. = Interaction between academic and experiential learning

### **3. Action research stage: Intervention/accompaniment strategies**

The final stage of Phase 1 consisted in an action research process in which the research group worked closely together with two teachers, one in Natural Science and the other in Social Science. Both teachers attended a two-week workshop designed to help teachers recognize potential sources of difficulty in the textbooks they use and design mediation strategies for making the text more accessible to their students. Individual work with each teacher then involved meetings in which teacher and researchers worked together on identification of difficulties in the text and recommendations for possible mediation

strategies. One or two researchers then observed classes and provided feedback for the teachers in regular meetings. This process continued for a period of about two months, at the end of which, the results were evaluated by analysis of observations, interviews with students and analysis of a written text produced by the students.

### *The Social Science teacher's strategies*

It is interesting to note that, although the intervention followed the same procedures with both teachers, each developed her own individual mediation strategies. In the case of the Social Science teacher, they may be summarized as follows:

- Unpacks grammatical metaphor.
- Works with difficult terminology.
- Completes information, particularly with regard to logical relations, e.g. Cause-effect.
- Provides relevant Textual Units.
- Gives the text voice.

The last point relates to the Vygotskian notion that learning naturally occurs in interaction and that, therefore, learning from text, without interaction, is an inherently difficult process (Sánchez, 1993). Giving the text voice (Beck *et al.*, 1995) involves anticipating reader doubts and questions and re-introducing human participants veiled by the academic register.

### *The Natural Science teacher's strategies*

The teacher of Natural Science developed the following strategies:

- Joint reading of a fragment of text
- Clarification of doubts about the text
- Clarification and explanation of concepts
- Co-construction of a concept map with the key terms from the text

- Opportunities for students to initiate interaction without fear of evaluation.

Thus, each one of the teachers involved in the intervention developed her own strategies in accordance with her own particular teaching style. In both cases, the results were encouraging, showing far less reliance by students on 'Mechanical Recitation' and higher proportions of both 'Academic Understanding' and 'Interaction between academic and experiential learning'. Occurrences of 'Transformation of experiential learning' are still rare in the extreme. It is to be hoped that these teachers will continue to apply these strategies and that, after longer periods of their application, achievement of higher learning levels will increase.

Our principal conclusions from this first phase of the work are, then, as follows:

- ➔ Teachers need help to become aware of the language difficulties present in school textbooks.
- ➔ It seems probable that teachers who consciously mediate textbook language can achieve higher levels of learning and greater success in concept formation.

#### **4. Phase 2: Results**

Phase 2 of the research programme has applied the same methodologies as Phase 1 but concentrating on a different aspect of textbook language and classroom interaction: ideology and its implications for citizenship. This phase is still in progress and, hence, the results presented here are partial and the conclusions tentative. We are currently completing the process of data analysis and hope to carry out an action research intervention in the near future. Our analyses to date suggest the presence in the texts under study of three 'grammatical conspiracies' (Martin, 1988): that of historical determinism in Social Sciences, that of superficiality with regard to ecological problems in Biology and that of total abstraction in Physics. These grammatical conspiracies combine to present a particular ideology of science and of social processes which, we believe, may have serious consequences in educating for citizenship.

*Grammatical conspiracy 1: Historical determinism*

This syndrome is grammatically constructed through the following features found to be characteristic of the Social Science textbooks:

- Absence of human agents:
  - Abstractions
  - Nominalizations
  - Inanimate Sayers and Behavers
  - Low occurrence of human participants as Actors and Goals
- Inevitability
  - Historical present
  - Non-ergative (agentless) processes
  - Lack of modalization

*Grammatical conspiracy 2: Ecological irresponsibility*

The lexicogrammatical features of this conspiracy, identified in the chapter “Air and water” of the Natural Science textbook, are:

- Subjectivity and superficiality
  - High levels of appraisal
  - Unsubstantiated categorical statements
  - Misuse of statistics
  - Vagueness
  - Imprecision in data
- Lack of human responsibility
  - Scarcity of human participants in transitivity patterns
  - Frequency of non-ergative processes

### *Grammatical conspiracy 3: Disembodied physics*

Finally, in the same textbook, in the unit entitled “Fluids”, physics is presented through the use of the following lexicogrammatical features:

- Blanket use of abstractions
- Absence of human agents
- Absence of reference to scientists or scientific processes and procedures → science as product.

This last characteristic – science as product not process – has been criticized as a feature of science textbooks since Kuhn (1962) but still persists today.

### *The ideology of science*

Through the use of the lexicogrammatical features described above, the text books in question present a view of science as a set of data of unknown origin, not open to scrutiny or question. Thus, science bears no relation to the lives of ordinary people and scientists are considered to be a breed of extraordinary and very strange creatures.

### *The ideology of social processes*

As regards the nature of social processes, the view manifest in the language of the textbooks is that social processes happen of their own free will, neither caused by human action nor having any effect on human lives.

### *Implications for citizenship*

Interviews with students have included questions relating to what they consider to be their options in life and to what they consider to be the usefulness or applicability of what they are learning in both Natural and Social Sciences. Students were also asked to produce a short written text in which they wrote about how they see themselves in 10 years’ time. Analysis of their answers has led us to the following conclusions as regards the implications for citizenship of the ideologies described above:

- None of the students of this school can envisage her/himself as a future scientist.
- These students do not conceive of themselves as possible actors on the political stage.
- They consider that their lives are predestined and that there is nothing they can do to change them.

Thus, the underlying message of these textbooks is one of exclusion of these students from the possibility of participation in scientific activity, processes of social change and responsible interaction with the natural world. This is not a happy picture for the future of Colombia.

### **5. Possible ways forward**

Finally, we would like to suggest a number of possible paths towards improving the situation.

- Including some linguistic elements in teacher education programmes in all disciplines, both pre-service and in-service.
- Including work on scientific registers in the education of language teachers and in language curricula.
- Team-teaching between language teachers and teachers of other disciplines.
- Setting up teams of researchers and teachers to design more appropriate materials.

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