Educational texts and contexts that work
Discussing the optimization of a model of pedagogic practice

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Introduction

We have devoted more than twenty years of our research lives to find out answers to the major problem of improving the learning of students, especially the disadvantaged, without decreasing the level of conceptual demand. The research has been focused on the contexts of learning in families and schools, teacher education, and the construction of syllabuses and textbooks (e.g. Morais & Neves, 2001; Morais & Neves, 2006; Morais, Neves & Pires, 2004; Morais, Neves & Afonso, 2005; Neves & Morais, 2001; Neves, Morais & Afonso, 2004; Neves & Morais, 2005). Students’ learning has been studied across the whole educational system, from kindergarten to higher education, and mostly in the subject of science education. We have constructed various models to direct the research and also models to analyse our results. As a result of this research, we have come to a model that conceptualises a school pedagogic practice that seems to have the potential to lead children to success at school, narrowing the gap between children from differentiated social backgrounds.

Although we have incorporated research perspectives from the fields of epistemology and psychology, Bernstein’s theory of pedagogic discourse (1990, 2000) has provided the main theoretical framework for our studies. Its powers of description, explanation, diagnosis, prediction and transferability have supported more rigorous research on the production of new knowledge in education. The power of Bernstein’s theory, then, has facilitated advancements in our own work.

This paper intends to: (a) present the model introduced above and describe its characteristics; (b) present the model at work; (c) explain how this model can be extended to the contexts of teacher education and the construction of curricula and syllabuses; and (d) discuss the optimization of the model.

Model of school pedagogic practice

Figure 1 outlines diagrammatically the main characteristics of this model of pedagogic practice.

The main sociological characteristics of the modality of pedagogic practice that research has shown to be fundamental for students’ scientific learning are the following:
- Clear distinction between subjects with distinct statuses – Strong classification of the teacher-student relation.

- Teacher control of selection and sequencing of knowledge, competences and classroom activities – Strong framing, namely at the macro level, of selection and sequencing.

- Student control over the time of acquisition – Weak framing at the level of pacing.

- Clear explication of the legitimate text to be acquired in the context of the classroom – Strong framing at the level of the evaluation criteria.

- Personal relationships of communication between the teacher and the students and between the students themselves – Weak framing at the level of the hierarchical rules.

- Inter-relation between the various kinds of knowledge of a discipline to be learned by students – Weak classification at the level of intradisciplinarity.

- Blurring of the boundaries between the teacher-student and student-student spaces – Weak classification between spaces.

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The studies we have carried out also suggest the importance for students’ learning of the relation between students’ knowledge and experiences and the knowledge to be acquired, with higher status for the latter; that is, a school-community relation characterized by strong classification and weak framing.
According to our research, these characteristics may lead students to successfully develop complex scientific knowledge and competences. However, this can only occur if teachers possess a high level of scientific knowledge and competences which means that no optimum methodologies can compensate for poor scientific proficiency.

Our initial study was designed to compare three pedagogic practices: two that corresponded broadly to the two extremes - the traditional teaching-learning process of generally strong classification and framing and the progressive teaching-learning process of generally weak classification and framing - and a third which was in the middle in terms of teacher and student power and control relations (e.g. Morais, Fontinhas & Neves, 1992; Morais, Neves, et al., 1993). Throughout this study we perceived that a pedagogic practice where both teacher and students have control according to specific characteristics of the practice but where power would stay with the teacher would successfully promote student learning. For example, it was already clear at the time that evaluation criteria should be explicit (strong framing) and that hierarchical rules should be regulated by weak framing; that is, characteristics of traditional and progressive schooling should be present together in the same practice. We started then to develop studies that worked with mixed pedagogic practices by experimenting with several combinations of the various characteristics of the organizational and interactional contexts of classrooms (e.g. Morais & Rocha, 2000; Morais & Neves, 2001; Morais, Neves & Pires, 2004). These were studies which were focused on various samples of students at various levels of schooling and which used a variety of methodologies that, on the whole, constituted a mixed methodological approach (Morais & Neves, 2006). During this research process we came to develop a mixed pedagogic practice with the characteristics indicated in the model presented above.

The model at work

In this section of the chapter, we show how the model has worked in the studies we have carried out. We selected one study that was developed at the primary school level where two distinct pedagogic practices were implemented by two different teachers teaching science to a total sample of 26 children in two different schools (Silva, 2010). A book of activities with a teacher’s guide was produced and provided to the teachers so as to help them to develop children’s knowledge (regarding ‘the growth of living things’) and investigative competences (Deus et al., 2003). Underlying these activities was the model of pedagogic practice derived from previous studies.

We constructed an instrument that was used to characterize teachers’ pedagogic practices (Silva, Morais & Neves, 2003). The instrument includes indicators for the various characteristics of pedagogic practice, in the instructional and regulative contexts, through which teachers’ practice can be characterized in reference to four degree scales of classification or framing. As an example, we show in the appendix the part of the instrument that refers to evaluation criteria and intradisciplinarity. By using
the instrument we could analyse transcripts of audio and video recordings of the teaching-learning process that took place in the two school classes. The characterization of the two pedagogic practices is detailed in Table I.

| Table I – Characterization of two pedagogic practices in primary school. |
|-----------------------------|-----------------------------|
|                             | Sunflower School | Daffodil School |
|                             | macro level | micro level | macro level | micro level |
| Discursive Rules            |              |              |              |              |
| selection                   | F++         | F+/F−       | F++         | F++/F+      |
| sequence                    | F++         | F+/F−       | F++         | F++/F+      |
| pacing                      | F−/F+      | F−/F−       | F+          | F+          |
| evaluation criteria         | F++         | F++         | F−          | F−          |
| Relation between discourses |              |              |              |              |
| intradisciplinary relations | C−−         | C+          |
| interdisciplinary relations  | C−/C−−      | C+/C++      |
| School – community relation | C++         | F−/F−       | C++         | F+/F−       |
| Hierarchical rules          |              |              |              |              |
| teacher-students relation   | F−/F−−      | F+/F++      |
| student-student relation    | F−          | F+/F−       |
| Relations between spaces    |              |              |              |              |
| teacher space-student space | C−          | C−/C+       | C−          | C−          |
| student – student spaces    | C+/C−       | C+          | C−          | C+          |

The data presented in the table make evident differences between the practices of the two teachers. If we concentrate on two selected characteristics, evaluation criteria and intradisciplinarity, it is clear that the teacher of Sunflower School develops a practice that is in accordance with our model by making evaluation criteria very explicit at both the macro and micro levels (very strong framing: F++) and by establishing strong intradisciplinary relations between the various kinds of knowledge (very weak classification: C−−). On the contrary, the teacher of Daffodil School develops a practice that departs from our model by leaving evaluation criteria implicit at both levels (weak framing: F−) and by establishing weak relations between the various types of knowledge (strong classification: C+). Taking into account the table in its entirety demonstrates that this pattern of difference between the two teachers stands in general for all characteristics of pedagogic practice.

The following excerpts illustrate some values of classification and framing attributed to the pedagogic practices of the two teachers with regard to evaluation criteria and
intradisciplinarity, when the indicator *constructing syntheses* is considered (see appendix).

**Excerpts**

 […] Would chickens have grown if they had no food? [discussion with the children] Do they [the living things] grow under any one condition? [discussion with the children] No. They don’t grow. They need special conditions to grow; that is, plants need water, animals need food, so, they don’t grow under any one condition […]. Sunflower school’s teacher

The teacher reads aloud the sentences of the book of activities: […] throughout the year, we have observed changes in seeds, in the chicken, in the silk worms and also in your own body. We saw that they changed, right? […] they grew, they grew. So write down in the first space. Go on! Have you already written? We learned that when things grow they are… alive, go on write this down, on your worksheet, they are alive… finished? Daffodil school’s teacher

The first excerpt evidences the existence of (a) very strong *intra-disciplinary relations* (C−), because distinct concepts of the theme under study (the growth of living things) are integrated, and (b) explicit evaluation criteria (F++), because syntheses are clear and constructed with the children. The second excerpt evidences (a) weak *intra-disciplinary relations* (C’), because distinct facts of the theme are inter-related and (b) implicit evaluation criteria (F –), because the teacher tells the children what they should write without explaining its meaning.

In order to evaluate the results of the two practices in terms of children’s learning, we used Bernstein’s concept of code to appreciate children’s specific coding orientation (SCO) in the specific context of concept understanding; that is, their possession of recognition and realization rules in that context. We conducted semi structured interviews with the children before and after the learning process. Figure 2 shows the results of the interviews, when we consider three levels of children’s performance and the social composition of the schools. The graphs highlight major differences between the two groups of children. As a consequence of the exposure of the working class children of these two schools to differential pedagogic practices, the development of scientific understanding among Sunflower School’s children was greater than the development of scientific understanding among Daffodil School’s children. This is particularly relevant as other studies (e.g. Domingos,1989) have shown that working class children are at a double disadvantage when they learn in working class schools, as is the case at Sunflower school.

From the results it is clear that the teacher who developed a pedagogic practice closer to our model led their children to a higher degree of scientific literacy when compared to the teacher whose pedagogic practice departed from the model. And, most importantly, the results show that pedagogic practice can overcome the effect of social class.

The small size of the sample of this study might lead us to think that these conclusions are not valid. However, the fact that these results confirm results of previous studies
conducted with distinct samples at different school levels increases the degree of validity of the studies as a whole. It should be noted that this kind of study requires depth and rigour at all levels of the research, something that cannot be attained with large samples.

Although the model of pedagogic practice has succeeded in raising the students’ level of scientific knowledge and competences and in narrowing the gap between students of different social backgrounds, our research has also provided us with information that can allow us to go much further. We will deal with this in the last section of the chapter.

![Figure 2 – Evolution of children’s specific coding orientation in the two schools](image)

**Extension of the model to other educational contexts**

In this section of the chapter we will concentrate on two studies, one similar to the study described above but conducted at the level of higher education and the other focused on the context of curricula and syllabuses. With the first we intend to show how the model can be applied to a different level of schooling and with the second to contexts other than those directly relating to teaching-learning situations.

**The model in a context of higher education**

The study developed in the higher education context focused on lessons on Science Teaching Methods for those pursuing a degree in Science Education (Santos, 2010). We wished to examine whether or not the model of pedagogic practice we had developed through research in lower levels of schooling could be applied successfully to higher education in terms of enhancing university students’ learning. We studied two distinct pedagogic practices implemented by two different teachers in two different classes and we analysed students’ learning with regard to their specific coding orientation to selected knowledge of the discipline. We also constructed an instrument to characterize
pedagogic practice similar to the instrument employed in the study described earlier (see appendix) but adapted to the new context (Santos & Morais, 2007).

The following are excerpts from the transcripts of the lessons which refer to the indicator constructing syntheses for the discursive rule evaluation criteria.

Excerpts

F** […] to make a synthesis of all we have done in the past three lessons […] what is it that we have learned? [the teacher discusses with the students all relevant points and ends up with a structured conclusion written down on a slide]: “Science is an organized body of knowledge in permanent evolution that is the result of a dynamic process of problem solving and that involves a non-linear set of inter-linked stages (problems, hypotheses, planning and experimenting, observation, interpretation of results) where laboratory work plays a crucial role”. […] this is the broadest idea […] there are other more restricted ideas that we have constructed along the process […]

(clear syntheses constructed with the students and recorded)

F* […] as a synthesis of the past three lessons we can say that […] (the teacher presents the conclusion written down on a slide): “The level of conceptual demand of the teaching-learning process is a consequence of the degree of complexity of the scientific and metascientific knowledge and of the cognitive competences and also of the degree of intradisciplinarity between distinct kinds of scientific knowledge”. […] when we plan the teaching-learning process, on the basis of given knowledge and competences, we should be aware that this process can have a range of various degrees of complexity and that education should not be restricted to the lowest degrees.

(clear syntheses constructed by the teacher and recorded)

F – […] What is it that we want to teach to our students? […] (the students start collecting their own materials, without taking any notes of what the teacher was saying) It’s the language of competences that I want you to learn here. It’s those competences you have mentioned that we have to develop with our students. They have to do with reasoning, they have to do with attitudes, they have to do with mobilization of scientific knowledge, they have to do with the processes of science; it’s all that.

(syntheses not clearly constructed by the teacher and not recorded)

These excerpts also evidence distinct degrees of intradisciplinarity. The first and second excerpts can be classified as C– because they are syntheses that indicate a relation between various concepts of a given theme under study. The third excerpt can be classified as C++ because it is a synthesis that presents factual knowledge of a given theme.

Given limitations of space, the results that refer to the characterization of the practice, and to students’ specific coding orientation are not presented in this paper.

The model in a context of curricula and syllabuses

The next study was developed in the context of current Portuguese education reform (Ferreira, 2007) and is part of a broader research that intends to analyse the recontextualizing processes that occur within the official recontextualizing field and between this field and the pedagogic recontextualizing field. We will focus on the former by analysing the curricula and syllabuses produced in that field, particularly two main documents: the Essential Competences (EC - the general principles) and the
Curriculum Guidelines (CG - the specific principles). The analyses were centred on the subject of Natural Sciences, on the theme of Earth Sustainability, and some specific aspects related to both the what and the how of educational processes were studied: science construction, conceptual demand, intradisciplinarity and evaluation criteria. For each one of these aspects we constructed instruments organized to account for the four main sections of the syllabuses (knowledge, aims, methodological guidelines and evaluation) in terms of four degree scales of classification or framing and the respective descriptors for each case (e.g. Alves et al, 2006; Ferreira et al, 2006). The analysis required that the text of the syllabuses be divided into units of analysis; that is, short sections of the text with a given semantic meaning.

Table II shows the Aims section as included in the instrument for intradisciplinary relations. The following are examples of units of analysis.

Table II – Intradisciplinary relations in the Natural Sciences syllabuses – A section of the instrument

<table>
<thead>
<tr>
<th>Sections</th>
<th>C++</th>
<th>C+</th>
<th>C-</th>
<th>C--</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aims</td>
<td>The aims are focused on the relation between knowledge of a simple order within the same theme. Or Scientific knowledge essential to the understanding of the relation between various content knowledge within the same theme is omitted.</td>
<td>The aims are focused on the relation between knowledge of a simple order of distinct themes. Or Scientific knowledge essential to the understanding of the relation between content knowledge of distinct themes is omitted.</td>
<td>The aims are focused on knowledge of a complex order or between this and knowledge of a simple order, within the same theme.</td>
<td>The aims are focused on knowledge of a complex order or between this and knowledge of a simple order of distinct themes.</td>
</tr>
</tbody>
</table>

Excerpts

Intradisciplinarity

C++ It is recommended that, within this thematic, the students understand the existence of various types of water and the relation of these types with their distinct uses (Curriculum Guidelines)

C– Understanding that ecosystem dynamics result from the interdependence between living things, materials and processes (Essential Competences)

C-- Another aspect to be highlighted is the articulation of the themes. The suggested sequence intends that, after having gained understanding of the concepts related to the structure and functioning of the Earth system, the students are able to apply them in situations that relate to human intervention on the Earth […] taking into account the sustainability of the Earth (Essential Competences)

Table III shows the Methodological Guidelines section as included in the instrument for evaluation criteria related to knowledge of the ‘external sociological dimension of the construction of science’. The following are examples of units of analysis.

Table III – Evaluation criteria for knowledge of the ‘external sociological dimension of science’ present in the Natural Sciences syllabuses – A section of the instrument
Methodological guidelines

Strategies / methodologies are provided for the transmission/acquisition of knowledge, related to the external sociological dimension of science, and of its relation to the development of competences associated with this dimension. The meaning of these strategies for the teaching/learning of metasciences is explained and the general importance of metasciences in science education, according to the curriculum perspectives, is referred to.

Excerpts

Evaluation criteria

F⁻⁻ It is suggested the discussion of real problems, such as accidents at nuclear power plants, the addiction of lead to petrol [...]. These problems can serve as opportunities to discuss social and ethical questions that lead students to reflect about the pros and cons of some scientific innovations for the individual, society and the environment. [no additional explanations are given] (Curriculum Guidelines)

F⁻⁻ The planning of field trips to industrial plants located in the school area and the corresponding analysis of costs, benefits and social and environmental risks associated with industrial activity is recommended. [no additional explanations are given] (Curriculum Guidelines)

No values of F⁺⁺ and F⁺ were present in the syllabuses which means that the evaluation criteria were never made explicit.

The analysis of both curriculum documents - Essential Competences (EC) and Curriculum Guidelines (CG) – is presented graphically in figures 3 and 4. Figure 3 (Intradisciplinarity) and figure 4 (Evaluation criteria) refer to all the four sections of the documents and to the sections taken together.

Briefly, we can say that the relative value attributed to the intradisciplinary relations within scientific knowledge decreased generally when passing from the Essential Competences text to the Curriculum Guidelines text which evidences a recontextualization, that took place within the official recontextualizing field, of the message contained in the official pedagogic discourse. As a consequence, science teachers will receive two contradictory messages and, if they follow the specific guidelines, they may be led to devalue intradisciplinarity in their pedagogic practices.

With regard to the evaluation criteria, we can say briefly that, even when the construction of science is present in the syllabuses, as it is in the case of the external sociological dimension of science, the message regarding the process of science construction is implicit and, in many cases, totally implicit (F⁻⁻⁻) in both the Essential
Competences (EC) and Curriculum Guidelines (CG) texts. As a consequence, teachers may disregard or be unable to introduce it in their pedagogic practices.

![Intradisciplinary relations in the Natural Sciences syllabuses.](image)

**Figure 3** – *Intradisciplinary relations in the Natural Sciences syllabuses.*

![Evaluation criteria for knowledge of the 'external sociological dimension of science' in the Natural Sciences syllabuses.](image)

**Figure 4**— *Evaluation criteria for knowledge of the ‘external sociological dimension of science’ in the Natural Sciences syllabuses.*

The research cases described above show how it is possible to study differentiated texts and contexts by using the same theoretical relations and concepts. This makes possible to make comparisons along the educational system and may therefore increase the conceptual level of the conclusions.

**Optimization of the model**
As stated earlier, our model is the result of the many studies we have carried out and, for this reason, we have some confidence on the conclusions we have reached. However, we believe that we need to go much further in increasing the rigour of future research if our model is to reach a higher degree of precision in terms of its transferability to curriculum development and classroom practice.

Thus, on the basis of the present model, we intend to construct a new theoretical model to be tested in future research. This model will contain hypotheses that, based either on theory or our previous results, will be focused on the main weaknesses of the previous model.

First, there are two characteristics of pedagogic practice, school-community relations and interdisciplinary relations, that need to be studied in more depth. In the first case, we have always started from the assumption that classification between discourses, that is between school knowledge and everyday knowledge, should be very strong because, in the school, the former should have the highest status of the two. However, we believe that students’ learning may be enhanced by allowing their knowledge and experiences to enter into the school, signalling communication between school and community. Thus we propose to conceptualise a school-community relation characterized by both classification and framing, although framing has here an ambiguous meaning because does not refer to the relation between subjects. This clearly needs further development.

In the case of interdisciplinarity, we have always worked on the widespread assumption that the blurring of boundaries between disciplines is favourable to students’ learning but, in practice, we have nearly always conducted our research either in contexts where a given discipline of science is institutionally isolated from other school subjects or in contexts where that isolation was created by us, as it is the case of kindergarten or primary school. The latter was the consequence of trying to encourage teachers in our samples to concentrate on the subject of science in contexts where little status is traditionally accorded to it. However, in some studies some relation was established with other disciplines, such as mathematics and Portuguese, which means that, when we characterized pedagogic practice on a four degree scale of classification between distinct school subjects, the value of C− could be attributed to interdisciplinarity. Thus far, there is no evidence in our studies that this blurring of boundaries is favourable to students’ learning or, rather, we have not yet been able to single out this characteristic as favourable. Theoretically, the opposite could be defended as students are socialized throughout their school lives with strong classifications between distinct school subjects and may end up not learning anything if they are pushed to learn all subjects in a context of inter-relation. Interdisciplinarity increases the level of abstraction and is easier to implement successfully when there is already some proficiency in separate areas of knowledge. Moreover, disadvantaged students may find particular difficulties in learning in interdisciplinary contexts. Thus, this aspect of the practice needs further attention.
The other area where the model requires further optimization involves the indicators selected for each characteristic of pedagogic practice. Indicators have varied according to the study that is being carried out. For example, the indicators for the discursive rule selection differ from the context of the kindergarten to the context of higher education. However, some indicators have been common to all contexts, as is the case of constructing syntheses, because we have considered them important in the characterization of any pedagogic practice. We have tried to select a sample of indicators that are relevant and representative of the multitude of indicators that can be defined as characterizing pedagogic practice, but this selection needs to be more rigorous. On the other hand, we want to reduce the number of indicators by determining which are sufficiently powerful to represent the whole of a given characteristic of pedagogic practice and to make the descriptors of these most relevant indicators more precise and concise. This will be useful for future research and, most importantly, will increase the power of the transferability of research results to education in practice, by making easier their use by teachers and curriculum developers. It is also important to determine if both macro and micro levels should be kept in the analysis or if indicators of one of them can be representative of both levels. Another aspect that needs further development is the determination of which indicators can be common across all characteristics of pedagogic practice such as, for example, evaluation criteria and hierarchical rules. This is something we have already attempted but that, so far, we have had difficulty achieving.

Another important aspect to be considered in future studies is the study of one characteristic of the pedagogic practice at a time, controlling the values of all other characteristics. This is particularly relevant for characteristics which have been less studied. For instance, if we want to find out how important interdisciplinarity is for learning, we should analyse the influence of different values of this characteristic while keeping the values of other characteristics equal in all school classes of the sample. However, this procedure should not interfere with the wider procedure we have referred to before, where we construct a model and see how it works.

It is important to note that throughout our research it became clear that some characteristics of pedagogic practice are closely interlinked in such a way that the values of classification and/or framing of one characteristic may determine the values of some others. For example, explicit evaluation criteria (very strong framing) requires (a) student control over pacing (very weak framing), so that there is time to explicate the criteria, and (b) student control at the level of the hierarchical rules (very weak framing), so that students can freely raise questions and have their doubts discussed.

An important point of a different order that we wish to address in future research is related to teachers’ scientific proficiency in terms of knowledge and competences. Our studies have shown that many teachers, particularly at the kindergarten and primary school levels, fail to have scientific knowledge and competences. In order to achieve a
higher degree of rigour when studying the effect of given pedagogic practices, we need to include in our research controls for teachers’ scientific proficiency.

Finally, we wish to emphasise that we are not looking for a model that works in all circumstances; that is, a model that works in all contexts, whatever the conditions, and with no need for any adaptations. For example, we can start with a very strong framing of selection and, later on in the year, when students have already acquired the recognition and realization rules for the specific context of that classroom, we can let them have some control over the selection of activities, materials, etc. However, if learning is to occur, selection should never be regulated by weak framing. We conclude by emphasising that all of our research indicates that there are characteristics of pedagogic practice that are indispensable for successful learning and that we should work to optimize them.

References


## APPENDIX

### Relations between discourses: Intradisciplinary relations

<table>
<thead>
<tr>
<th>Indicators</th>
<th>C**</th>
<th>C*</th>
<th>C'</th>
<th>C***</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exploring themes under study</strong></td>
<td>Knowledge previously learned is never referred to when exploring a new theme. Relations between distinct kinds of knowledge are ignored.</td>
<td>Knowledge previously learned is only referred to if it constitutes a condition to the understanding of the new theme.</td>
<td>Knowledge previously learned is necessarily referred to when exploring a new theme.</td>
<td>Knowledge previously learned is the starting point for exploring the new theme. Relations between distinct kinds of knowledge are made and explained.</td>
</tr>
<tr>
<td><strong>Doing tasks</strong></td>
<td>The tasks do not require the relation between distinct kinds of knowledge.</td>
<td>The tasks make only a brief reference to the knowledge already learned.</td>
<td>The tasks contain relations between various kinds of knowledge of a same theme.</td>
<td>The tasks integrate the knowledge of various themes studied.</td>
</tr>
<tr>
<td><strong>Applying learning to new situations</strong></td>
<td>The situation of application requires only factual aspects of the theme under study.</td>
<td>The situation of application requires the relation between distinct facts of the theme under study.</td>
<td>The situation of application requires the relation between distinct concepts of the theme under study.</td>
<td>The situation of application integrates concepts of the distinct themes studied.</td>
</tr>
<tr>
<td><strong>Constructing syntheses</strong></td>
<td>The syntheses contain only factual aspects of the theme under study.</td>
<td>The syntheses contain the relation between distinct facts of the theme under study.</td>
<td>The syntheses contain only conceptual aspects of the theme under study.</td>
<td>The syntheses integrate distinct concepts of the theme under study.</td>
</tr>
<tr>
<td><strong>Students’ questions</strong></td>
<td>Questions related to other themes are ignored. The answers to students do not inter-relate distinct kinds of knowledge.</td>
<td>Questions related to other themes are not ignored but distinct themes are not inter-related in the answers to students.</td>
<td>Questions that relate to various themes are accepted and used to make a brief relation between the distinct kinds of knowledge studied.</td>
<td>Questions that relate to various themes are not only accepted but are used to emphasize the relations between the distinct kinds of knowledge studied.</td>
</tr>
</tbody>
</table>
## APPENDIX

Relation between subjects – Discursive Rules (Evaluation criteria): Teacher-student relation

<table>
<thead>
<tr>
<th>Indicators</th>
<th>F **</th>
<th>F *</th>
<th>F ′</th>
<th>F ′′</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exploring themes/problems under study</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explorations are very detailed, illustrated and exemplified and the various aspects are recorded on children’s worksheets.</td>
<td>Explorations are detailed and illustrated but only the main aspects are recorded on children’s worksheets.</td>
<td>Explorations are slightly detailed and illustrated and only some key sentences or words are recorded on children’s worksheets.</td>
<td>Explorations are not detailed nor illustrated and recordings are not made.</td>
<td></td>
</tr>
<tr>
<td><strong>Doing tasks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children are informed of the task they are going to do and the respective procedures are explained.</td>
<td>Children are informed of the task they are going to do but the respective procedures are only explained in generic terms.</td>
<td>Children are informed of the task they are going to do but the respective procedures are not explained.</td>
<td>Children are not informed of the task they are going to do and respective procedures are not explained.</td>
<td></td>
</tr>
<tr>
<td><strong>Constructing syntheses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syntheses are quite clear and constructed in interaction with the children. They are written down on the blackboard and on children’s worksheets.</td>
<td>Syntheses are orally made by the teacher with no interaction with the children. The teacher checks that they have been written down by children on their worksheets.</td>
<td>The teacher tells the children what they should write on the blank spaces of the worksheet, without discussing/clarifying its meaning afterwards.</td>
<td>No syntheses are made.</td>
<td></td>
</tr>
<tr>
<td><strong>Discussing the questions of the tasks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children are told, in interaction with the teacher, what is incorrect and what is missing and the meaning of the correct answer is explained.</td>
<td>Children are told, with no interaction, what is incorrect and what is missing and the meaning of the correct answer is explained.</td>
<td>Children are generically told the answers to the questions, and their meaning is not explained.</td>
<td>Some points are made about the questions but incorrections are not pointed out and answers are not given.</td>
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<tr>
<td><strong>Recording information on worksheets</strong></td>
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<tr>
<td>All recordings are written down on the blackboard in order that children write them down on their worksheets with the help of the teacher who checks that they are correctly transcribed.</td>
<td>All recordings are written down on the blackboard in order that children write them down on their worksheets, but the teacher does not check if they are correctly transcribed.</td>
<td>Only some of the most important recordings are written down on the blackboard in order that children write them down on their worksheets, but the teacher does not check if they are correctly transcribed.</td>
<td>Children make the recordings they wish on their worksheets as the teacher does not require that any recordings are made.</td>
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<tr>
<td><strong>Incorrect students’ statements</strong></td>
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<tr>
<td>Children’s statements are reformulated/corrected/completed in detail, in interaction with the children.</td>
<td>Children’s statements are reformulated/corrected/completed with no interaction with the children.</td>
<td>Children are told that their statements are incorrect but no reformulation is made.</td>
<td>Children’s statements are not corrected nor reformulated.</td>
<td></td>
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</tbody>
</table>