DOCUMENT RESUME

ED 361 184 SE 053 588

| | |
|---|---|
| AUTHOR | Morais, Ana M.; Fontinhas, Fernanda |
| TITLE | Students' Coding Orientation and School Socializing Context in Their Relation with Students' Scientific Achievement. |
| PUB DATE | Apr 93 |
| NOTE | 30p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, (Atlanta, GA, April 15-19, 1993). |
| PUB TYPE | Reports - Research/Technical (143) -- Speeches/Conference Papers (150) |
| EDRS PRICE | MF01/PC02 Plus Postage. |
| DESCRIPTORS | *Academic Achievement; Blacks; Concept Formation; Educational Research; Elementary School Science; Foreign Countries; Intermediate Grades; *Race; Racial Factors; *Science Education; *Sex Differences; *Social Class |
| IDENTIFIERS | *Orientation Inventory; Portugal (Lisbon) |

ABSTRACT

The study described in this article is part of a broader research undertaking developed by the Project ESSA--Sociological Studies of the Classroom--whose main aim is to find pedagogic practices appropriate for all children. This study is mainly based on Bernstein's theory concerning the relation between social class and code and uses his concept of code as instrument of analysis. The study analyzed the relation between general coding orientation and school achievement of socially differentiated children (social class, race, gender). It also studied the influence of different modalities of school pedagogic practice on children's coding orientation (n=80, students ages 10-12 in Lisbon). The results show the higher the degree of coding orientation the higher the achievement. For all social classes, except the lower social class, achievement increases with the increase of coding orientation. For black students, coding orientation does not seem to have any influence on achievement. Coding orientation seems to have more influence on boys' achievement than on girls' achievement. (Contains 26 references and 8 figures.) (PR)

PROJECTO E.S.S.A.
Departamento de Educação
F.C.L.



# STUDENTS' CODING ORIENTATION AND SCHOOL SOCIALIZING CONTEXT IN THEIR RELATION WITH STUDENTS' SCIENTIFIC ACHIEVEMENT

**Ana M. Morais**
**Fernanda Fontinhas**
Department of Education
Faculty of Sciences University of Lisbon
Campo Grande, C1 - 3
1700 Lisbon - Portugal

*Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Atlanta, U.S.A., 15-19 April 1993.*

## 1. INTRODUCTION

The study described in this article is part of a broader research developed by the Project ESSA - Sociological Studies of the Classroom - whose main aim is to find out pedagogic practices more appropriate to all children. The study is mainly based on Bernstein's theory (1977, 1990; Domingos *et al*, 1986) and uses his concept of code as instrument of analysis. It intends at analysing the relation between general coding orientation and school achievement of socially differentiated children (social class[1], race, gender). It also intends to study the influence of differential modalities of school pedagogic practice on children's coding orientation.

Starting from previous studies which have validated Bernstein's theory in what concerns the relation between social class and code (Bernstein, 1973; Adlam, 1977; Holland, 1981), this study seeks at giving some contribution to the understanding of that relation. In doing this it complements other results obtained in more recent studies carried out by the Project ESSA which point out to the influence of multiple characteristics of the family and school instructional and regulative contexts on the differential acquisition of the code (Neves and Morais, 1993; Morais *et al*, 1992 a, 1993 b; Morais and Antunes, 1993 a) and its interference in children's achievement.

Beyond the analysis which constitutes the main focus of the study - relation between general coding orientation, pedagogic practice and school achievement of socially differentiated students - we describe in this article an analysis of the relation between the students' general coding orientation and their specific coding orientation in specific contexts of the science classroom. With this analysis, it is intended to interpret differences arising out from the operationalisation of the concept of code when viewed in differential evaluative contexts. In doing this, the study seeks at giving methodological suggestions with respect to forms of appreciating the coding orientation. Details of this research can be seen in Fontinhas (1991) and Morais *et al* (1993 b).

## 2. THEORETICAL FRAMEWORK OF THE STUDY

According to Bernstein, the code is a regulator of the relation between contexts. The code should generate principles which permit to make the distinction between contexts and principles which lead to the creation and production of specialized relationships within a context. These principles are the *recognition rules*, which create the means to distinguish between contexts and consequently to recognise the specificity of a given context and the *realisation rules* which regulate the selection and production of the meanings appropriate to the context that is to the production of the legitimate text. In other words, the code is a regulative principle, tacitly acquired which selects and integrates relevant meanings, forms of realization and evoking contexts. It follows from this definition that the unit of analysis of the code is not an abstract expression or a context but the relationship between contexts and through that relationship the regulation of the relations within a given context. Within the analysis of the realisation rules Bernstein has recently distinguished between the *passive realisation* (selection of meanings) and the *active realisation* (production of the legitimate text).

According to the theoretical framework where the concept of code is included, we constructed a reference scheme (figure 1) which would orientate the definition of the tasks to be done by students and the analysis of the texts produced by them in specific contexts and as such would lead to determining the children's degree of coding orientation.

(insert figure 1 about here)

Starting from Bernstein's idea that children's coding orientation, primarily acquired in the primary socializing context, is crucial for their answer to the school, the main hypothesis of the research was set - socially disadvantaged children, which tend to acquire in the family an orientation to particularistic meanings dependent of the context will tend to show higher school failure whereas socially advantaged children, which acquire in the family context an orientation to universalistic meanings, relatively context independent, will tend to achieve better at school. We also started from the hypothesis that the way in which the elaborated code of the school is institutionalized (translated for example by differential modalities of pedagogic practice) may influence the children coding orientation brought from the family/community. This hypothesis was grounded in former studies (Domingos, 1989 a; Morais, 1992 a, b; Peneda e Morais, 1992) which suggest the educational advantage of school practices which legitimise particular social relations teacher-student and student-student.

The analyses developed in this article address the following question: *In what extent does the child's coding orientation constitute a sociological variable which, arising out from the socializing processes of both the family and the school, explains his/her differential achievement?*

## 3. SAMPLE

The sample was made up of 80 children distributed by four classes of a preparatory school of the suburban area of Lisbon. Each class, with the same number of students, had an heterogeneous constitution in terms of social class, race, gender and age ($10^- - 12^+$) and was submitted in the subject of Natural Sciences to one of three distinct modalities of pedagogic practice. All classes were taught by the same teacher (female). On the basis of the information given in the registration file of each child, the sample was organized in a way that all social groups were equally represented in each one of the classes. Further information obtained through questionnaires and interviews to the families led to some change in the sample distribution although the heterogeneity referred was kept. The study took place during two years (5th and 6th years of schooling).

Black students were part of the lower social class and their parents were non-qualified manual workers with low or no schooling. White children were distributed by the four social classes considered in the study.

A sub-sample constituted by thirty students, ten from each pedagogic practice, was also selected (see § 4.1), the heterogeneity of the global sample being kept, i.e. there were children of different social class, race and gender in each group of ten students. Within each social group, and on the basis of the results of the first two science tests, students which were placed in the extremes in terms of their relative achievement were selected.

There was also a pilot sample constituted by eighteen students, nine white upper middle class and nine white and black lower working class. These students were in the same level of schooling of the experimental sample.

## 4. METHODOLOGY

As was said above it was intended to analyse the relation between children's general coding orientation and specific characteristics associated with the family (social class, race, gender) and the school (pedagogic practice and science achievement). With this objective, appropriate methodological procedures were developed so that data on coding orientation and other variables could be obtained. Given the focus of the analyses carried out in this study, particular attention is given to the description of the methodology which refers to the coding orientation (§ 4.2).

### 4.1 GENERAL PROCEDURES

Three pedagogic practices were implemented. These practices differed in terms of power relations (classification) and control relations (framing), from a practice more acquirer centered ($P_1$) to a practice more transmitter centered ($P_3$). A third practice ($P_2$) had some characteristics which approximated it from $P_1$ and other characteristics which approximated it from $P_3$. From the four school classes of the study, one (class X) was submitted to practice $P_1$, other (class Z) to practice $P_3$ and the other two (classes Y and W) to practice $P_2$. The implementation of the practices was preceded by the definition of detailed theoretical profiles (Neves, 1991; Morais and Neves, 1993 c) in terms of the relation between discourses, spaces and subjects and respective indicators for the classroom.

Briefly, the differentiation between the practices translated a crescent degree of control on the part of the teacher over the transmission-acquisition process. The pedagogic practice $P_3$ was the practice with stronger framings with respect to the discursive rules (greater control of the teacher on the selection, sequence, pacing and evaluation criteria) and to the hierarchical rules (imperative and positional control), whereas $P_1$ was the practice with weaker framings with respect to those rules, i.e. there was less control of the teacher on what the discursive rules were concerned and there were mainly interpersonal modalities of control. In pedagogic practice $P_2$ some control was given to the students on their learning (relatively weak framings in the discursive rules) and the modalities of control were mostly positional and personal.

By direct observation of the classes, the practices were characterized in both the instructional context (Fontinhas and Morais, 1993) and the regulative context (Antunes and Morais, 1993 a). With this procedure it was intended to have a correct measure of the differentiation between the practices. The practices, as they really occurred, showed not to be so separated as theoretically defined. In particular the framing over the pacing and in the relation school-community was weaker than planned for practice $P_3$ and stronger for practice $P_1$. The evaluation criteria were less explicit in pedagogic practices $P_3$ and $P_2$ and less implicit in $P_1$ when compared with the theoretical definition. However, in relative terms, the pedagogic practices were kept different. The implementation of the three practices by the same teacher had the intention of controling the conceptual demand which other studies (Domingos, 1989 b; Morais, 1992 b) had revealed to interfer in the achievement of students socially differentiated.

The school achievement which is taken in the various analyses refers to the results obtained in complex cognitive competencies in sciences in two assessment moments (third term of 5th and 6th years). In each term the students answered to two tests, each of which had 60% of the questions directed to simple cognitive competencies (SC) and 40% to complex cognitive competencies (CC)[2]. The marks obtained in the two tests in this last type of competencies were translated in a 0-100 scale and constituted the achievement to be considered in the analyses of this study.

The social class was initially determined by father's and mother's academic qualification and occupation on the basis of data obtained through questionnaires applied in an interview situation[3]. Since there was a high correlation between the four indices and between them and school achievement it was decided to use father's academic qualification which showed the highest correlation. A scale of four categories was used.

It was also introduced as a variable of the study the specific coding orientation in the particular context of the problem solving in sciences. The data related with this variable were obtained (first term of 6th year) through a specific methodology described in detail in the respective study (Morais *et al*, 1992 a, 1993 b) and give information about the recognition and realisation rules in that particular context.

The relations studied were statistically appreciated through variance analysis (One Way and Two Way Anova).

## 4.2 DETERMINATION OF GENERAL CODING ORIENTATION

### 4.2.1 Description of the instrument

In order to obtain the degree of the students' general coding orientation, a questionnaire based on the study by Henderson (1971) was constructed. This questionnaire was constituted by a set of terms for each of which four alternative definitions were given and which the children should select. The terms were related to two areas, scientific and social, seven referred to relations between objects (salty, rough, health, mix, noise, night, heat) and three to relations between people (inequality, unemployment, justice). The questionnaire also included two introductory items with the intention of familiarising the children with the instrument. The four options presented for each term translated hierarchies in two dimensions, concrete-abstract and implicit-explicit. The ordering of the options varied in the different items of the questionnaire. The following is an example of one of the items of the scientific area:

What do you mean by noise:

It is the opposite of silence

In the fairs there is noise

When I shout I make noise

It is when there is a very loud sound

In this example, the first and fourth options represent abstract definitions respectively implicit and explicit. The second and the third options represent concrete definitions which translate an implicit and an explicit example of the term. Thus for each term there was always presented a general definition of the term (abstract explicit), an antonym (abstract implicit), a specific example which explicates the meaning of the term in a concrete situation (concrete explicit) and a less specific example which leaves implicit the meaning of the term (concrete implicit).

With this differentiation it was intended to have indicators which allowed for discrimination between an orientation to universalistic meanings, relatively context independent, and an orientation to particularistic meanings, dependent of the context. On the basis of the hierarchy established for the options, a scale of four points was constructed, in which the maximum score was given to the option which referred to the general definition and the minimum to the option which referred to the concrete implicit example. The antonym was scored with three and the concrete explicit example with two. The whole score obtained in the questionnaire gave a measure of the degree of the child's general coding orientation on a restricted-elaborated dimension. In some analyses we used the base data whereas in others four categories were created on the basis of the minimum and maximum possible score in the whole questionnaire. This procedure was followed for the terms of the scientific and of the social areas in order to obtain a separate measure of the degree of coding orientation to objects and to persons.

### 4.2.2 Application of the instrument

The questionnaire was first piloted with a higher number of items in order to select the most significant in terms of their discriminating power according to social group and also to the whole set of students. As a result, the redaction of some options was simplified and clarified and there was a general reformulation of the questions so that the students' task was made more explicit. Some terms were eliminated as a consequence of the difficulty of constructing a simple alternative within the conceptual scheme of reference or of the difficulties encountered by the students in the understanding of the term itself.

Although the pilot study had led to the selection of only three terms of the social area, they were kept in the final version of the questionnaire because it was considered important to compare the orientation to scientific meanings with the orientation to social meanings. The final version of the questionnaire was applied to the four classes of the whole sample by the end of the 5th and 6th years of schooling in a situation identical to the school tests (individual answering in an identical spacial set). A previous explanation was given, using a written example on the blackboard (one term and its four alternative definitions). The first two terms of this final version, which had been included in the questionnaire to let students be acquainted with the task, were not considered in the analysis of students' answers.

On the basis of the answers to the questionnaire, codified according to the criterion previously described, a score was given to each student, both in terms of the totality of points obtained and in terms of the four degree scale. Since there was a relatively small number of students in the categories 1 and 2 of the scale (see § 5.1), it was decided, for some analyses, to group these students in the same category. The original scale was then condensed in three categories (1 = 1 + 2;2 = 3; 3 = 4).

## 5. ANALYSIS AND INTERPRETATION OF THE RESULTS

### 5.1 GENERAL CODING ORIENTATION

As it was referred above, the same questionnaire was applied to the 80 students of the sample at two moments separated by one year, with the main intention of verifying the 'school effect' (or of its practices) in changing students' coding orientation. Figure 2 shows the distribution of the students according to their answers to the questionnaire at the first moment, using the four categories scale.

(insert figure 2 about here)

From the analysis of the results, it can be seen that the number of students with the higher scores in the orientation referring to scientific meanings is greater than the number of students with the higher scores in the social meanings. Thus the results show that the students selected more frequently universalistic meanings when these refer to relations between objects (scientific area). On the other hand, in any of the two areas (scientific and social) it is more frequent the selection of definitions which translate an orientation to universalistic meanings, relatively context independent (categories 3 and 4) than the selection of definitions translating an orientation to particularistic meanings context dependent (categories 1 and 2). Although these data can, in a first analysis, lead us to think that the majority of the students revealed an elaborated orientation, it is important to notice that the higher representativity of students is placed in category 3. Considering that the way it was determined, this category may correspond to frontier cases or dispersion of the answers, we thought that it would be necessary to go deeper in this study using the data we obtained with the sub-sample, whose information on students' coding orientation was more detailed and complete. This analysis will be described in the paragraph 5.3.

The results obtained after one year of learning within the same pedagogic practice, revealed that most of the students (61%) was kept in their initial category, whereas 30% of the students went up to a higher category and 9 % went down. The application of the t-test revealed that the change in scores between the two moments was highly significant ($p \leq .001$).

If the change of scores is considered separately for the scientific and the social terms, the t--test showed that the change in a positive direction (higher scores) had a higher level of significance for the former ($p \leq .003$) than for the latter ($p \leq .07$). This result seems to suggest that independently of the social group of students and of the pedagogic practice to which they were submitted, the school had a more favourable effect on the coding orientation at the level of the scientific area.

The general coding orientation was also analysed in relation to each one of the variables of the study. Given the results above, such relation was only studied in reference to the scores in the scientific area. On the basis of this decision was also the fact that the achievement in sciences was the one to be considered. The base data were used in the one-to-one relations and the three categories scale for coding orientation was used in the relations involving three variables.

Figure 3 presents the levels of significance obtained for the relations between scientific coding orientation (SCO) and each one of the other variables.

(insert figura 3 about here)

The correlations we obtained between the variables together with the data expressed in the figure allow us to say that, in the first moment, are the white students relatively to the black students and the boys relatively to girls which show a higher degree of coding orientation. In the second moment the gap between these social groups disappears. Further the correlations show that the relations expressed in figure 3 between coding orientation and achievement give an improvement to students' achievement when the degree of coding orientation increases, either for simple or for complex cognitive competencies.

## 5.2 GENERAL CODING ORIENTATION AND SCHOOL ACHIEVEMENT

One of the objectives of the study was to analyse the relation between coding orientation and students' school achievement, when it is mediated by other variables associated with the family and with the school. We started with the hypothesis that coding orientation can explain the school differential achievement of children of different social groups and of the same social group. Further, since it had be shown in another study with the same sample (Morais *et al*, 1992 d) that differential modalities of school pedagogic practice have a distinct influence on students' achievement, we thought that this influence could be the result of the action of the school practice on child's coding orientation. The analysis carried out and described in this paragraph refer to the above relations. All the relations refer to two moments of the research and for each one of them the respective data on coding orientation and school achievement are used.

If we first look at the one-to-one relation between coding orientation and achievement (§ 5.1) in the first moment of the research, we could see that there was a statistically significant relation between coding orientation in the scientific area and science cognitive achievement in both the complex competencies ($p \leq .03$) and the simple competencies ($p \leq .01$). In the second moment, after one year of learning, that relation is still significant (SC: $p \leq .05$; CC: $p \leq .03$). These results give support to the hypothesis that the child's coding orientation (as measured in this study) is a factor which influences school achievement.

When the relation between coding orientation and school achievement was mediated by social class (given by father's academic qualification - FAQ), race (R) and gender (G), we obtained some interesting results. Given its relevance and the space limitations we are limiting the analysis to the students' achievement in the complex cognitive competencies. This decision was reinforced by the fact that in the broader research where this study is included[4] it was noticed that these are the competencies with higher meaning in the family-school relations.

Let us start by analysing the relation between coding orientation and school achievement mediated by social class (figure 4).

(insert figure 4 about here)

The results show that, for the same degree of coding orientation, achievement is in general higher in higher social classes, this relation being clearer for category 3 of coding orientation and in the first moment. On the other hand, it can be seen that, within the same social class and in both moments, the coding orientation appears, in general, as a favourable factor to school achievement. This analysis suggests that in any social class, achievement increases with the increase of coding orientation. However, it seems that there is an exception in the lower social class (FAQ1) suggesting the existence of other factors than coding orientation interfering in students' achievement.

If we now analyse the relation between coding orientation and school achievement mediated by race (figure 5) it can be seen that for white children (R2) the coding orientation influences school achievement where better results are achieved by children who showed to have a higher degree of coding orientation. This influence, which is more evident in the second moment, is in the first moment mainly a consequence of the difference showed by students which revealed levels 2 and 3 of coding orientation.

(insert figure 5 about here)

For black children the coding orientation does not seem to have any influence in their achievement, although there is, in the second moment, a slight increase in achievement when the degree of coding orientation increases. Comparing the children of the two races we can see that for the same degree of coding orientation are black children who have in general a lower achievement.

The results on the influence of gender as a mediating variable in the relation between coding orientation and school achievement, are expressed in figure 6.

(insert figure 6 about here)

The data of the figure show that coding orientation is, in general, a favourable factor to the achievement of boys (G2) and girls (G1). Whereas in the second moment, gender is revealed as a variable which intervenes in the relation between coding orientation and achievement, particularly for children with an average degree of coding orientation (SCO2), in the first moment its influence is less notorious being only evident for those children who have the lowest degree of coding orientation (SCO1). If we look at both moments of the research it is clear that the general coding orientation seems to have more influence in boys' achievement than in girls', since boys relatively to girls not only are more disfavoured in terms of their achievement when they have a lower degree of coding orientation but are more favoured when having higher degrees of coding orientation.

Since we have data which show that, along one year, girls increased their degree of coding orientation, we would suggest that it is for girls that factors other than coding orientation, interfer more markedly in their achievement.

Although the above relations between general coding orientation and children's achievement in the complex cognitive competencies, mediated by social class, race and gender, had not shown to be in general statistically significant, they show important trends which should be taken into consideration. In fact, general coding orientation seems to be determinant in the cognitive achievement of specific categories of students of the social groups considered, particularly in the case of gender where the relations showed to be statistically significant.

The importance attributed in the research to the school pedagogic practice in students' achievement, led us to analyse its influence on coding orientation. Since it had been found out that, during the time of the research, there had been changes in students' general coding orientation (§ 5.1) it was important to know which pedagogic practice(s) had contributed more to those changes.

Figure 7 illustrates the distribution of the students of each one of the three modalities of pedagogic practice which in the first and second moments of the research showed different degrees of coding orientation. It is important to notice that, in the case of pedagogic practice $P_2$ we have only represented in the figure the students of one of its two classes, in order that the comparison between the practices could be easier. However, the other class with this practice had shown a similar pattern.

(insert figure 7 about here)

The results show that whereas in the first moment students of the three practices are mainly distributed in degrees 1 and 2 of coding orientation in the second moment only students of $P_2$ are majority placed in the higher degree of coding orientation. In the second moment and for pedagogic practices $P_1$ and $P_3$ students are equally distributed in degrees 1 and 2 on one hand and 3 on the other. Although in all practices there has been a positive change in coding orientation, it was pedagogic practice $P_2$ which, after one year of action, contributed in a significant way to that change. The change in that practice was so important that in the second moment of the research almost all students (83%) attained the higher degree of coding orientation (SCO3), there being only three students in the lower degrees. Although the relation between pedagogic practice and coding orientation had not shown to be statistically significant (§ 5.1), this more subtle analysis of the data show the decisive influence of differential practices on students' coding orientation and through it on achievement.

It is important to notice that similar results were found when the relations were analysed with the sub-sample of 30 students. This shows how representative was this sub-sample which constitutes an important finding in terms of the validaty of the analysis which follows (§ 5.3) and of other analyses made within the broader research where this study is included and where the sub-sample was used.

### 5.3 GENERAL AND SPECIFIC CODING ORIENTATION

In order to have a more complete information on students' coding orientation, it was decided to complement the data of the questionnaire on terms' definition with the data obtained from a study on the students' specific coding orientation in the evaluative context of the science classroom. That study which was focussed on the 30 students which constituted the sub-sample is described in detailed in another article (Morais *et al*, 1992 a, 1993 b). To obtain a measure of the specific coding orientation, questionnaires were given in an interview situation to evaluate the degree of recognition and realisation of students when faced with tasks related to the evaluative science contexts - A context (concerned with competencies of acquisition of knowledge, i.e. simple cognitive competencies) and U context (concerned with competencies of using acquired knowledge to solving or explicating everyday problematic situations, i.e. complex cognitive competencies). The tasks presented to the students asked for explications corresponding to the different dimensions of code realisation; the interviwees had to produce various texts indicators of recognition between A and U contexts and also of realization in the U context. Thus, faced with various U questions related with matters studied in the science classroom, the children were asked for instance to select, between alternative answers, those which were less adjusted to the questions, those which represented the best answer and also to explain the reasons of the selections they were making. The instrument which was used, constructed on the basis of the operationalising of the concept of code, gave for the 30 students of the sub-sample, a measure of the specific coding orientation in particular contexts of sciences. This measure was translated in a four degree scale.

Once we had for the 30 students two types of scores on coding orientation - a score from the questionnaire on the definition of scientific terms[5] (SCO) and a score from the interview on the recognition and realisation in the A and U contexts (OAU) - it was possible to reflect on the level of competence demanded in the solution of the tasks included in the two instruments. We were interested to analyse the extent to which the scores obtained through the application of the two instruments could be considered expressions of the same area of interactive competence in sciences. Would it be possible to associate a general coding orientation to meanings of a scientific nature with the orientation to specific contexts in the science subject, namely the evaluative A and

U contexts? Although it is not the intention of this analysis to find out exaustive answers to questions of this type, we thought that would be interesting to compare the scores obtained by the students in order to evaluate possible articulations, on the light of the concept of code.

Figure 8 presents for each one of the children the result of the application of the two instruments. In the table students are identified by their code number and by a letter indicating the class they attended.

(insert figure 8 about here)

A first analysis of the figure reveals that a large number of students (19 in 30) show discrepancy between the scores obtained with the two instruments. In terms of statistical validity we obtained, through the application to the two distributions of the Spearman correlation non-parametric test, a value of rs = .29. Since to N = 30 and at the level of significance p = .05 the critical value is .306, it can be considered without statistical meaning the relation between the scores related to the specific coding orientation in the A and U contexts of the science classes and the scores related to the general coding orientation at the level of the scientific area.

The discrepancy between the two sets of scores led us to rethink the idea that the texts produced by students in the two situations could be expressions of the same interactive competence. The obtainment, in most cases, of lower values in the interview on the specific coding orientation as compared with the questionnaire on the general coding orientation (as happened to students Y8, Y10, Y17, Y18, Y19, Z29, Z34, Z36, Z40, Z43, X70, X72, X79, X81, X82, X88, X90) could have to do with the fact that in the interview the elaborated coding orientation was more directly implicated, through the recognitions and realisations required and also the need to explicate the respective rules (e.g. when the student had to explain the reasons for selecting the most correct answers to use questions). Since in the questionnaire on the general coding orientation the task required did not demand the justifications of the selections made nor the production of a definition by one's own words, we were led to think that it had only given information on the recognition rules and at the most on the first part of the realisation rules (selection of legitimate meanings). It might even have happened that the selections made meant, in some cases, little more than the recognition of the evaluative context considered. The production of the legitimate meanings to the context (second part of the realisation rules) would be absent in the questionnaire on the definition of the scientific terms. This reflexion led us to reformulate the former hypothesis according to the following: the tasks demanded by the two instruments, although moving in the same area of interactive competence, do not however demand, within it, the same levels of performance.

In this way if, in the score for the specific coding orientation in the A and U contexts, were only considered the two indices for recognition ('Identifies A and U questions' and 'Selects the answer which adjusts less to the U question') and the first index of realisation ('Selects the most correct answer to the U question') we will obtain a composite index which will not go beyond the level of competence demanded on the questionnaire on the general coding orientation. And if the same level of competence is required it would be probable that the scores obtained by the students with both instruments would not significantly differ. In effect, when we applied the same Sperman correlation non-parametric test to the two distributions we obtained a highly significant value (rs = .48). This value gives confirmation to the hypothesis that the level of interactive competence demanded on the interview is only equivalent to the level obtained in the questionnaire if we exclude the production of explanatory texts (second part of the realisation rules).

In the face of this analysis it can be assumed that the instrument used in determining the general coding orientation is not giving us the global measure of student's coding orientation but only the measure of the recognition of the context and the selection of the meanings adequate to the context (passive dimension of the realisation rules).

As it was applied, the questionnaire on general coding orientation, only allows us to conclude that a student with a high score, recognises the school context (the school demands universalistic meanings) and is able of recognising the legitimate meanings but does not provide data to state that that student is or is not able to produce the legitimate text.

Therefore the results suggest that in order to obtain an equivalent information with the two instruments (although referring to different contexts) we should have to broaden the application of the questionnaire on the general coding orientation by the use of other tasks which demanded the explanation of the term by one's own words and the explicating of the selection made.

## 6. CONCLUSION

One of the objectives of the study was to analyse the relation between the general coding orientation and school achievement. The results obtained suggest the influence of that orientation in the students' answer to the school, the students with better achievement being those which show a higher degree of general coding orientation (as measured in this study). The general coding orientation comes out as an important sociological characteristic for children's cognitive achievement in both simple and complex cognitive competencies: the higher the degree of coding orientation the higher the achievement. This conclusion is reinforced if we consider that the relations between general coding orientation and achievement was found in both moments of the research. These results contribute to validate the idea contained in Bernstein's theory according to which the coding orientation is crucial to the students' answer to the school.

When we appreciated the relation between coding orientation as mediated by social class, race and gender, we obtained data which suggest that not all social groups and within each group not all categories are equally sensitive to that relation - there are groups to which the degree of coding orientation is more important for their success in school. It is possible that for some groups there are other factors which simultaneously with coding orientation, interfer in school achievement, namely for black children and for girls. One of the studies carried out within the broad research where this study is included (Antunes and Morais, 1993 b) points to the positioning of the child in the school as one possible factor.

The conviction of the existence of other factors is reinforced by the fact that we have evidences that in the second moment of the research not only general coding orientation but also achievement became to be characteristics which approximate students of different race and gender. On the other hand, the fact that after one year of learning a change on coding orientation occurred, highlighted by the approximation of students of different social groups, shows the influence the school can have in that change, particularly in the case of socially disadvantaged children.

This influence of the school on general coding orientation seems to be dependent on specific modalities of pedagogic practice. In this study, pedagogic practice $P_2$, relatively to practices $P_1$ and $P_3$, revealed itself as having a higher potential to increase the students' degree of coding orientation and consequently their achievement. It seems therefore that a pedagogic practice favourable to the increase of the coding orientation should contain, among other characteristics, the explicating of the evaluation criteria and a weak pacing, together with weak framed relations between students of different social groups and also weak framing in the hierarchical relations which regulate the interaction teacher-student.

The results obtained about the positive influence of pedagogic practice $P_2$ on students' coding orientation give some contribution to explain students' higher achievement in this practice which came out in an analysis carried out with the same sample (Morais *et al*, 1993 d).

Beyond the conclusions of this study on the influence of family and school sociological factors on general coding orientation and students' achievement, it was possible to evaluate the instrument which was used in terms of its capacity of measuring different dimensions of coding orientation—recognition and passive and active realisation. From that evaluation it seems that it can be concluded that the instrument on general coding orientation did not give a measure of the active realisation, limiting itself to measure the degree of recognition and, to a certain extent, the degree of passive realization. This appreciation of the instrument if leads to suggestions of its improvement in order to measure children's active realisation it leads also to the contextualizing and interpretation of this study.

Within its limitations, the study gives a contribution both in methodological and conceptual terms. It was evident the influence that the school pedagogic practice can have in changing coding orientation, showing how sociological characteristics primarily acquired in the family and unfavourable to students' achievement may be modified by the school.

## NOTES

1. Social class is here used as a nominal concept.

2. *Simple cognitive competencies* include all knowledge whose learning requires a very low level of abstraction on the part of the learner. In practical terms, as far as science education is concerned, this first group of competencies includes factual knowledge and the understanding of primary concepts at the lowest level defined, for instance, by the ability to define a concept in one's own words. With respect to the scientific process, this group of competencies includes observation, recording and interpretation of data at the lowest levels. In terms of Bloom's Taxonomy of Educational Objectives, these competencies are included in the first category of the cognitive domain, i.e. "Knowledge". They are also included in the lowest sub-category (translation) of its second category "Comprehension". The competencies we defined as *SC* can be considered as a pre-requisite to further learning.
   The competencies called *complex cognitive competencies* (*CC* ) include all knowledge whose learning requires a high level of abstraction. In practical terms, this second group includes the understanding of concepts at a higher level defined, for instance, by the ability to make predictions on the basis of a concept. It also includes the application of concepts to new situations, and, with respect to the scientific process, it includes nearly all the abilities this process requires, from the more complex level of interpreting data to the ability to state problems and hypotheses. In terms of Bloom's Taxonomy of Educational Objectives, the competencies of this second group are included in the two highest sub-categories (interpretation, extrapolation) of its second category "Comprehension" and also in the categories "Application", "Analysis", "Synthesis", "Evaluation".

3. A detailed description of the scales for academic qualification and occupation, and of their construction, can be seen in Morais *et al* (1993 e). A short version is the following:
   *Scale for academic qualification*
   Number of years of schooling was the main criterion for the scale of academic qualifications: 1 - cannot

read or write; 2 - completed primary school or attended a part of preparatory school; 3 - completed preparatory school (5th and 6th grades) or attended some years of secondary school (7th-8th grades); 4 - took the 9th grade exams or completed a medium-level course after 6th grade; 5 - took the 11th grade exams (completed secondary school) or completed a medium-level course after 9th grade; 6 - completed a medium-level course after 11th grade or did some years at a university or obtained a university degree. This scale was reduced, in this study, to a 1-4 points scale: 1=1; 2=2; 3=3+4; 4=5+6.

*Scale for occupations*

The socio-economic status was the main criterion for the construction of this scale: 1 - unskilled workers with non supervisory functions; 2 - unskilled workers with supervisory functions, skilled workers with or without supervisory functions, self-employed unskilled workers; 3 - self-employed skilled workers, small proprietors; 4 - non-manual employees in administration, commerce and other services without supervisory functions; 5 - non-manual employees in administration, commerce and other services with supervisory functions; 6 - self-employed or salaried professionals, administrators, managers. This scale was reduced to a 1-4 scale: 1=1; 2=2+3; 3=4; 4=5+6.

4. See, for example, the study carried out by Morais *et al*, 1993 d.

5. The data on the general coding orientation, used in the study of this relation refer to the first moment of the application of the questionnaire (third term of 5th year) since they were the nearest to the data on the specific coding orientation, obtained through the interview (first term of 6th year).

*Aknowledgements*

The authors are grateful to Professor Basil Bernstein, consultant of the Project ESSA, for the discussions and suggestions made. They also aknowledge to the JNICT - Junta Nacional de Investigação Científica e Tecnológica and to the Gulbenkian Foundation which financed the research.

## BIBLIOGRAPHY

Adlam, D., Turner, G. J. and Lineker, L. (1977). *Code in context*. London: Routledge & Kegan Paul.

Antunes, H. and Morais, A. M. (formerly Domingos) (1993 a). Caracterização da prática pedagógica no contexto regulador. *In* A. M. Morais *et al. Socialização primária e prática pedagógica, Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Antunes, H. and Morais, A. M. (formerly Domingos). (1993 b). Influência da socialização primária e secundária na relação entre o posicionamento e o aproveitamento na escola. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Bernstein, B. (1973). *Class, codes and control: Vol. II, Applied studies towards a sociology of language*. London: Routledge & Kegan Paul.

Bernstein, B. (1977). *Class, codes and control - Vol. III - Towards a theory of educational transmissions*. London: Routledge & Kegan Paul.

Bernstein, B. (1990). *Class, codes and control - Vol. IV - The structuring of pedagogic discourse*. London: Routledge.

Domingos, A. M. (now Morais) (1989 a). Conceptual demand of science courses and social class. *In* P. Adey *et al* (Eds.). *Adolescent development and school science*. London: The Falmer Press.

Domingos, A. M. (now Morais) (1989 b). Influence of the social context of the school on the teacher's pedagogic practice. *British Journal of Sociology of Education, 10* (3), 351-366.

Domingos, A. M. (now Morais), Barradas, H., Rainha, H. and Neves, I. (1986). *A teoria de Bernstein em sociologia da educação*. Lisbon: Gulbenkian Foundation.

Fontinhas, F. (1991). *O contexto instrucional em diferentes modalidades de prática pedagógica: Aquisição diferencial do reconhecimento e da realização do código pedagógico por alunos de diferentes grupos sociais*. Master's dissertation, Faculty of Sciences, University of Lisbon.

Fontinhas, F. and Morais, A. M. (formerly Domingos) (1993). Caracterização da prática pedagógica no contexto instrucional. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Henderson, D. (1971). Contextual specificity, discretion and cognitive socialization: With special reference to language. *In* B. Bernstein (Ed.). *Class, codes and control - Vol. II: Applied studies towards a sociology of language*. London: Routledge & Kegan Paul.

Holland, J. (1981). Social class and changes in orientations to meanings. *Sociology, 15* (1), 1-18.

Morais, A. M. (formerly Domingos) (1992 a). Influência da classe social no nível de desenvolvimento científico dos alunos. *In*. A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 1*. Lisbon: Gulbenkian Foundation.

Morais, A. M. (formerly Domingos) (1992 b). Influência do nível de exigência conceptual dos professores no sucesso dos alunos em ciências. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 1*. Lisbon: Gulbenkian Foundation.

Morais, A. M. (formerly Domingos) (1992 c). Socialização primária e prática pedagógica como factores importantes no aproveitamento diferencial de rapazes e raparigas em ciências. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 1*. Lisbon: Gulbenkian Foundation.

Morais, A. M. (formerly Domingos), Fontinhas, F. and Neves, I. P. (1992 a). Recognition and realisation rules in acquiring school science: The contribution of pedagogy and social background of students. *British Journal of Sociology of Education, 13* (2), 247-270.

Morais, A. M. (formerly Domingos), Peneda, D., Neves, I. P. and Cardoso, L. (1992 b). *Socialização primária e prática pedagógica: Vol. 1*. Lisbon: Gulbenkian Foundation.

Morais, A. M. (formerly Domingos) and Antunes, H. (1993 a). Regras de reconhecimento e de realização na aquisição do texto regulador da sala de aula. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Morais, A. M. (formerly Domingos), Fontinhas, F. and Neves, I. (1993 b). Regras de reconhecimento e de realização na resolução de problemas em ciências. *In* A. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Morais, A. M. (formerly Domingos) and Neves, I. (1993 c). Poder e controlo na sala de aula - Definição teórica de três modalidades de prática pedagógica. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Morais, A. M. (formerly Domingos), Peneda, D. and Medeiros, A. (1993 d). Os discursos instrucional e regulador no ensino das ciências - Influência de práticas pedagógicas diferenciais no aproveitamento dos alunos. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Morais, A. M. (formerly Domingos), Neves, I. P. *et al* (1993 e). *Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola*. Lisbon: Gulbenkian Foundation (in print).

Neves, I. P. (1991). *Práticas pedagógicas diferenciais na família e suas implicações no (in)sucesso em ciências: Fontes de continuidade e de descontinuidade entre os códigos da família e da escola*. Doctoral Thesis, Faculty of Sciences, University of Lisbon.

Neves, I. P. and Morais, A. M. (formerly Domingos) (1993). A orientação de codificação no contexto de socialização primária e o aproveitamento dos alunos. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 2, Análise de aprendizagens na família e na escola.* Lisbon: Gulbenkian Foundation (in print).

Peneda, D. and Morais, A. M. (anteriormente Domingos) (1992). Insucesso em ciências: As práticas pedagógicas na sua relação com o aproveitamento escolar, a classe social e a raça. *In* A. M. Morais *et al. Socialização primária e prática pedagógica: Vol. 1.* Lisbon: Gulbenkian Foundation.

| | | |
|---|---|---|
| The student well marks the boundaries between contexts<br><br>The student selects the context | **Has recognition rules** | RECOGNISES |
| The student selects the correct meanings to the selected context<br><br>The student produces the correct text to the context | **Has realisation rules** | REALISES |

Figure 1 - *Required competencies at each level of coding realisation.*

| GENERAL CODING ORIENTATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | SCIENTIFIC TERMS | | | | SOCIAL TERMS | | | |
| **Categories** | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Frequencies** | 4 | 4 | 41 | 31 | 4 | 11 | 45 | 20 |
| **Percentages** | 5% | 5% | 51% | 39% | 5% | 13% | 56% | 25% |
| **Totals** | 10% | | 90% | | 18% | | 81% | |

Figure 2 - *Data from the questionnaire on general coding orientation (first moment).*

| | FAQ | RACE | GENDER | PEDAGOGIC PRACTICE | SC | CC |
|---|---|---|---|---|---|---|
| **First moment** | $p \leq .83$ | $p \leq .01$* | $p \leq .02$* | $p \leq .58$ | $p \leq .01$* | $p \leq .03$* |
| **Second moment** | $p \leq .68$ | $p \leq .53$ | $p \leq .93$ | $p \leq .16$ | $p \leq .05$* | $p \leq .03$* |

* Statistically significant.

Figure 3 - *Levels of significance in the relations between coding orientation and each one of the variables.*

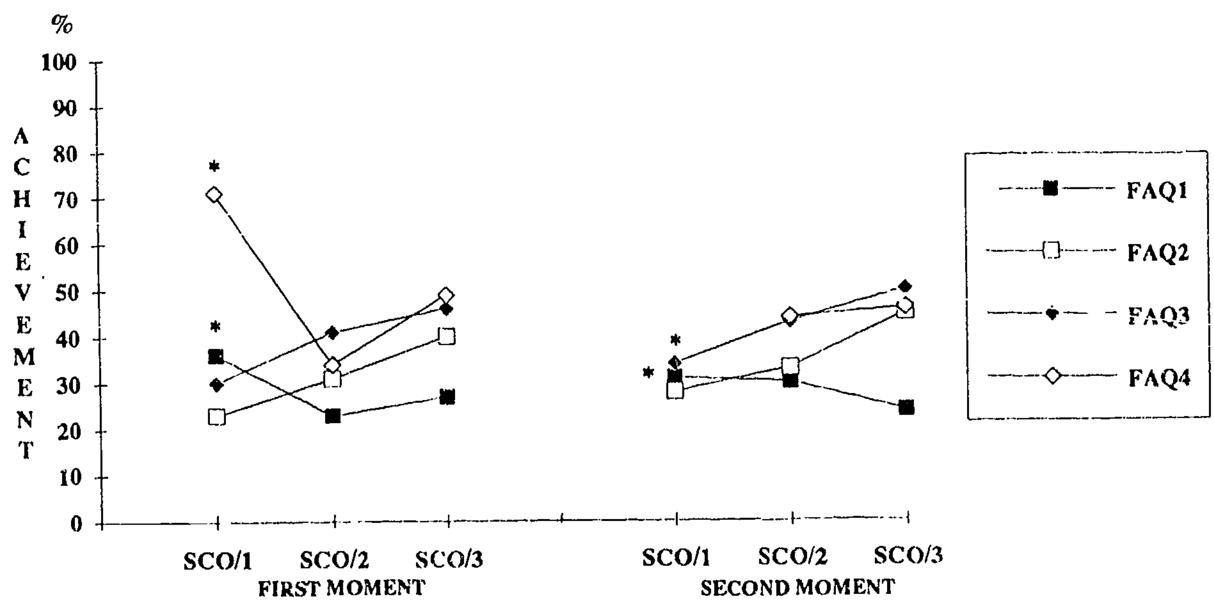



Figure 4 - *Relation between general coding orientation and achievement in complex cognitive competencies, mediated by father's academic qualification (first and second moments).*

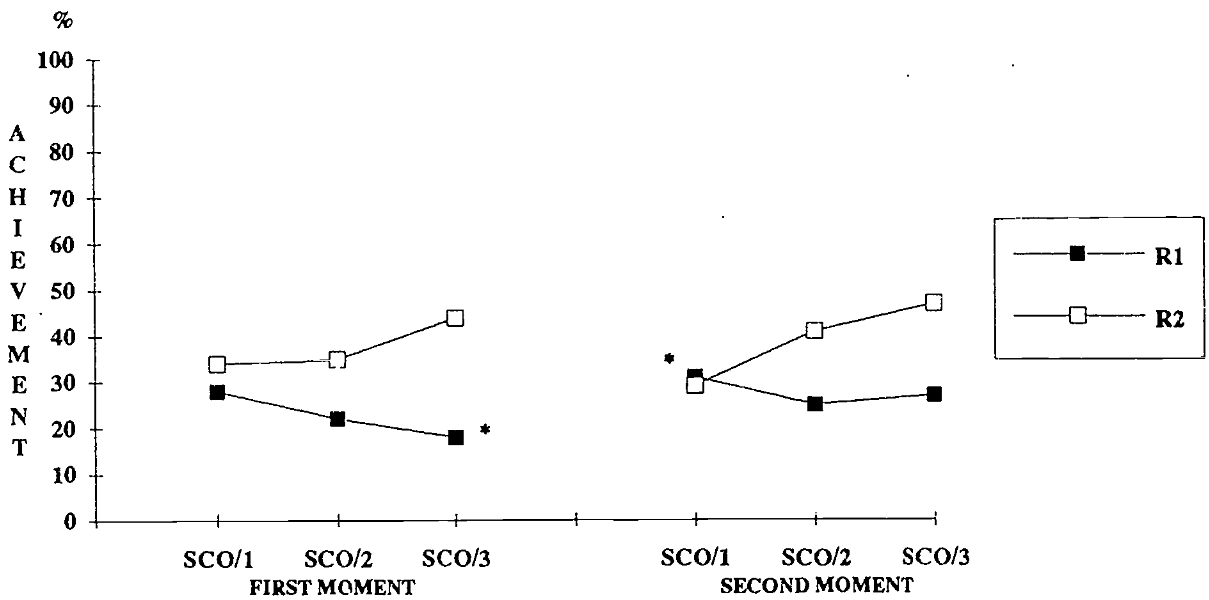



Figure 5 - *Relation between general coding orientation and achievement in complex cognitive competencies, mediated by race (first and second moments).*

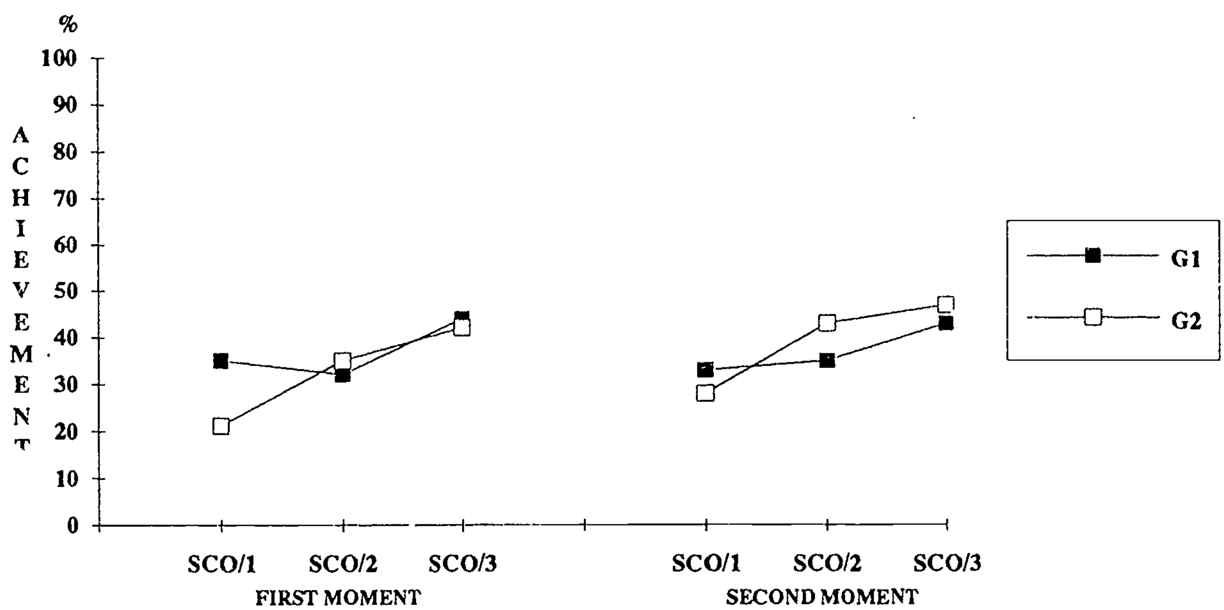
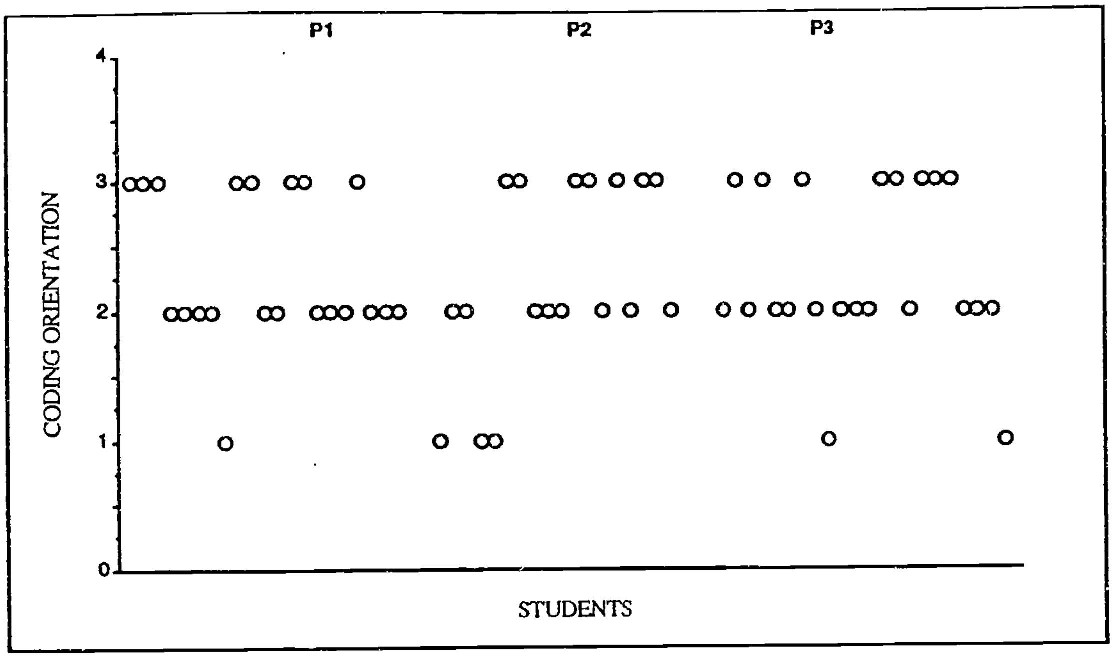



Figure 6 - *Relation between general coding orientation and achievement in complex cognitive competencies, mediated by gender (first and second moments).*

First moment




Second moment

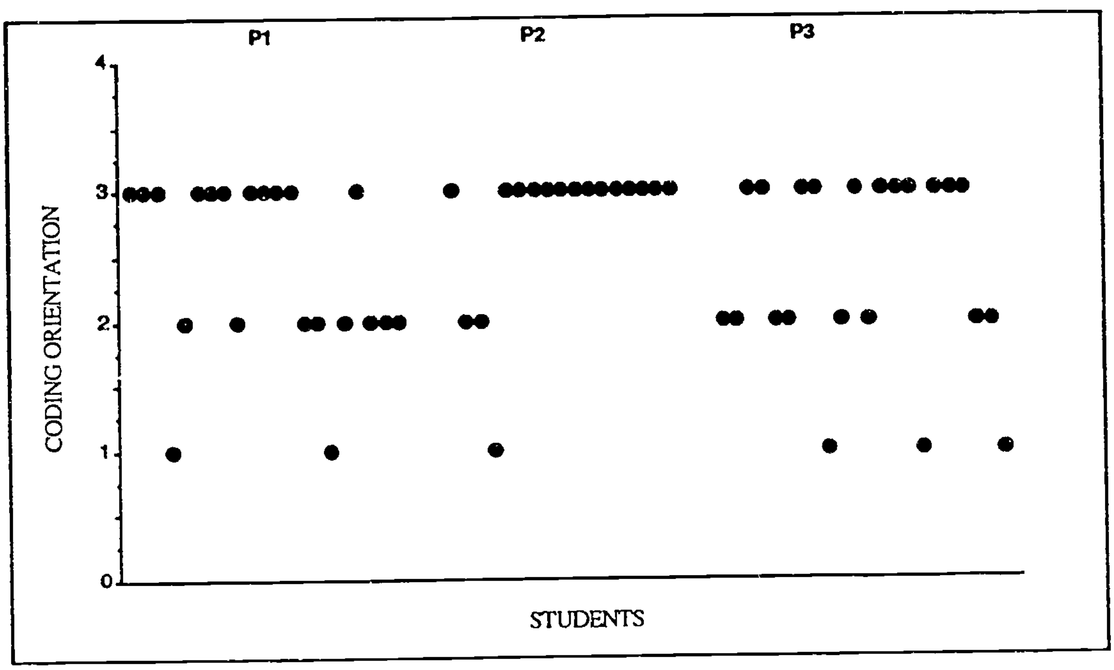



Figure 7 - *Relation between pedagogic practice and students' general coding orientation (first and second moments).*

| GENERAL CODING ORIENTATION DETERMINED BY THE QUESTIONNAIRE | | | | | | SPECIFIC CODING ORIENTATION DETERMINED BY THE INTERVIEW (A and U contexts) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Students (P1) | SCO | Students (P2) | SCO | Students (P3) | SCO | Students (P1) | OAU | Students (P2) | OAU | Students (P3) | OAU |
| X70 | 4 | Y1 | 2 | Z23 | 3 | X70 | 2 | Y1 | 2 | Z23 | 3 |
| X72 | 4 | Y4 | 1 | Z27 | 3 | X72 | 3 | Y4 | 3 | Z27 | 3 |
| X73 | 3 | Y6 | 4 | Z29 | 4 | X73 | 3 | Y6 | 4 | Z29 | 3 |
| X75 | 3 | Y8 | 3 | Z32 | 3 | X75 | 3 | Y8 | 2 | Z32 | 3 |
| X79 | 4 | Y10 | 3 | Z34 | 3 | X79 | 2 | Y10 | 2 | Z34 | 2 |
| X81 | 3 | Y13 | 3 | Z36 | 4 | X81 | 2 | Y13 | 3 | Z36 | 3 |
| X82 | 4 | Y15 | 3 | Z38 | 3 | X82 | 2 | Y15 | 3 | Z38 | 3 |
| X84 | 3 | Y17 | 4 | Z40 | 4 | X84 | 3 | Y17 | 2 | Z40 | 3 |
| X88 | 4 | Y18 | 4 | Z43 | 3 | X88 | 3 | Y18 | 3 | Z43 | 2 |
| X90 | 3 | Y19 | 3 | Z45 | 1 | X90 | 2 | Y19 | 2 | Z45 | 2 |

Figure 8 - *Scores obtained by the students in the general and the specific coding orientation.*