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Field Dependence - Independence (FDI) Cognitive Style: The Influence in Memory tasks

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Abstract

Reflecting the concerns arising from the professional teaching practice, in this study it is our intention to try to understand the differences of the students in their learning and school achievement. Whereas the predictive value of Cognitive Style FDI (Field Dependence-Independence) in the success or failure of schools, it was our goal to check if the subject with different cognitive styles feature differences in the performance in tests involving encoding processes, storage and retrieval of information. Our study sample consists of two groups of students with different age levels. The first group consists of (N = 98), 98 children aged 8 and 9 years of age, students of the 3rd and 4th years of schooling respectively; the second group comprises (N = 95), 95 teenagers aged between 13 and 14 years, students of 7 and 8 grades. Once evaluated the Cognitive Style FDI of the two groups, through the tests: "EFT" and "CEFT" respectively, teenagers and children, we proceed to the evaluation of Memory tasks. The instruments used were: (i) a copy of the Rey Complex Figure Test (memory test) and (ii) Spanish Verbal Learning Test-Complutense Children (SVLT-CC). We concluded that the differences between students in FD, intermediate and FI, at any age, don't relate to the amount of information retained or stored but with the differences in frequency of use of strategies of learning organization that do point out the differences in their learning processes.

Keywords: cognitive Style FDI, cognitive processes, memory, learning, school performance

Introduction

Reflecting the concerns arising from the professional teaching practice, in this study it is our aim to try and understand the differences of the students in their learning and school achievement. Considering the probability of these differences being associated with cognitive variables, we intend to add to the cognitive variables usually considered (e.g. intelligence quotient), other more descriptive variables of cognitive processing. Being studies about the cognitive styles scarce in Portugal, and more specifically on the FDI (Dependence-Independence), we want to diversify the cognitive information used in the diagnosis of learning problems and inventory of practical ways of promotion of cognitive skills and learning of students with greater difficulties.

Thus, the present work relates to cognitive style FDI, assumed to be an attractive concept to describe the cognitive functioning of the subject and its intellectual assessment. It is in this framework of cognitive orientation, or theory of information processing, we have endeavored to theoretical models that can support us in a better analysis of the human cognitive functioning, specifically in learning tasks and troubleshooting.

This analysis, along with more circumscribed objectives of research, urges some practical implications, in particular in the world of education. Hence, in fact, a growing concern of the schools with the individualization of teaching, assuming this individualization as one of the guiding principles of the educational act, particularly in the context of a "comprehensive school". The need for a differentiated methodology or individualization of teaching is, without doubt, one of the goals of the educational reforms in our days.

Cognitive style FDI-Field Dependence-Independence

The concept of cognitive style has its origins in the movement "New Look" emerging research proposed by Klein and Schlesinger, in an article titled “Where is the perceiver in perceptual theory?” an inappropriate assumption for psychologists of the time claiming the intelligibility and its evidence. Herman Witkin was one of the precursors in the investigation of cognitive styles pondering them as quirky shapes of people to realize and process information.

Witkin subsequently reinterpreted the dimension of Field Dependence-Independence as an articulated style versus global, a solid bipolar variable that integrates a measure of the ability of analysis, i.e. the disruption and the structuring of figurative contexts. The concept of increasing articulation applied to the experience of immediate configurative stimuli (perception) can also be applied to the experience that supports symbolic material (thought). Thus, we can conclude that Field Independent individuals are also called "articulated thinking", in relation to intellectual functioning, while the Field Dependent, in this aspect, present global type characteristics. The first (articulated type) excel in the ability and ease in solving problems that require analysis power, isolate critical elements of a given context, linking scattered and isolated elements, recreating new structures. The second or global type individuals, as opposed to first, have less ability to restructure and save the stimulating setting as they have been granted.

Progressively, the Field Dependence-Independence was expanding to a number of areas considered relevant enough for its theoretical developments, areas

traditionally framed in the context of personality and cognitive functioning (Witkin et Al., 1954). Currently, the possibility that the Field Dependence-Independence cognitive style is related to the individual differences in learning and memory was getting consolidated, presumably by the greater emphasis that cognitive psychology places on the active role of the individual, in the processes of acquisition, storage and retrieval of information. This approach strengthens the study of individual differences in learning and memory.

There is no doubt that the mnemonic activity is considered a fundamental structure in the information processing. The encoding, storage and information retrieval are processes of this activity, closely linked, which regulate the retention of information and its availability for its application when necessary. It is assumed that these processes work in chain, and it is not possible to analyze these disintegrated operations.

FDI and the Encoding Process

When we mention encoding set of processes, we refer to the set of processes which are essential for storing information in memory which are responsible for the transformations of the sensory stimuli in codes or expressive traits and comparable memory systems (De Vega, 1998). According to several studies, we have knowledge of relevant data that suggest the existence of significant differences in the encoding form between field dependent and independent students.

FDI and the Process of Information Retrieval and Storage

The analysis of the processes of memory would remain incomplete if you don't explain the circumstances and operations that determine the storage and retrieval of information. With reference to these processes also differences have also been found between field dependent and independent individuals.

Objectives of the Research

Restless by the generating questions on the predictive value of FDI in the success or failure at school, we add to our executive concerns in the most practical form of promoting skills for school success and other social and personal achievements of the individuals. Thus, the objective of this study is to verify whether individuals with different cognitive styles feature differences in performance when coding processes are involved, storage and retrieval of information (visual and verbal). We will investigate the cause of these discrepancies, as a dominant motif of this study, we seek to ensure, if the differences observed in individuals of this age range are the same or different in groups of different ages.

Method

Our study sample consists of two groups of students with different age levels. The first group consists of (N = 98), 98 children aged 8 and 9 years of age, students of the 3rd and 4th years of schooling respectively; the second group comprises (N = 95), 95 teenagers aged between 13 and 14 years of age, students of 7 and 8 years of age respectively. In table 1 we describe our sample.

Table 1.

Sample Distribution According to Age and Gender

	Male	Female
Age 8	28	23
9	25	22
13	20	25
14	26	24
	99	94
Total	**193**	

All these students attend a private school of the city of Braga. The preference given to these students ' ages, was based on the fact that, firstly, it is from this age, 8/9 years old, that children begin to understand, organize and store more systematically their learning material, as well as, in general, they manifest from this age a greater interest in school learning. We consider this interest in learning as generalizable to the implementation of the assessment tests required to our study. In addition, in view of the objectives of our study, it became necessary to evaluate children and adolescents.

Instruments

(i) Field Dependence-Independence Assessment

To evaluate the FDI cognitive style we used the hidden figures test (HFT) with the sample of adolescents. The test consists of a series of 24 blades with complex images, in which the individual must identify a simple figure, previously presented, which is cloaked in a complex image. This test reflects the perceptive competence, as the subject's task is to find a simple geometric figure, observed previously, within a complex and bigger figure, with some colored elements in different tonalities, which "hides" a simple figure that must be found. The score on the HFT is given by the total time used on the correct identification of the figures, or the total allowed (3 minutes) in the incorrect resolutions being considered field independent the individual that employed less time in their performances.

To assess children, the CEFT (Children Embedded Figures Test) was used, an adaptation of the EFT performed by Karp and Konstadt (1971), designed to assess children under 12 years. This test, of individual administration, is composed of 25 blades with complex images and two models cut into simple figures. In each complex figure there is a cloaked simple form that the child must find. The correction was made according to the standards of scores proposed by the authors. The index of performance in CEFT corresponds to the sum of the elements that

the individual correctly identifies. In this investigation the time of completion of the test was considered, with the maximum time of three minutes for each item. A high score in this test is synonymous of greater independence.

Intelligence Assessment

To evaluate the intelligence we used the BPR, "Bateria de Provas de Raciocício": BPR-5. It is a calibrated and validated test for Portuguese students of the 7th to the 12th year of schooling, and in this research the version A of BPR-5 was the one used (for students from 7th to 9th grade). This battery is intended to evaluate the reasoning skills in inductive and deductive terms (Almeida, 1992). On the basis of the battery "Tests of Raisonment Différentiel" (Meuris, 1969), the current version reflects a development of "Bateria de Provas de Raciocínio Diferencial" (Almeida, 1986), having been published simultaneously in Portugal and in Brazil (Almeida & Primi, 1996). The battery consists of five tests, all of them evaluating the reasoning, using different content items in each test: figurative-abstract (proof), verbal (VR Test), mechanical (MR Test), spatial (proof ER) and numeric (NR). In the case of our investigation, we used only the abstract reasoning, test, consisting of 25 items in the form of analogies (A:B-C:D) containing geometric figures (similar to the g factor tests). In terms of factor analysis, the five evidence of BPR-5 saturate a single factor, being the evidence AR the one that saturates this factor, considered general. The score on the exam is given by the sum of the adjustments, having the student five alternative answers for item and five minutes to complete the test.

In relation to the Group of students of the 3rd and 4th years of schooling (8-9 years of age), we used the Coloured Progressive Matrices Test of Raven (CPM-Coloured Progressive Matrices – Raven, 1947) for the intelligence assessment. This is one of the versions of this evidence internationally used and referenced as one of the best measures of the g psychological factor (General Intelligence). Even assuming the g factor assessment, some authors (Sweetland & Keyser, 1991) describe their initial items are mainly of Gestalt perception (perceptual organization of the elements of the matrice as a whole), while the latest items are already structured in a deduction and induction logic of relationships among its constituent elements (reasoning by analogy). The test consists of 36 items organized by three series (A, Ab, B) of cognitive difficulty, being the 12 items in each series also organized hierarchically by index of difficulty. Compared to standard and advanced version of the Raven test, the CPM uses colorful items, seeking in this way to capture the children's attention and interest. Furthermore, the test is calibrated and validated for the Portuguese population (Simões, 1994), being the subject of several studies with specific groups of students bearing in mind their socio-cultural characteristics and levels of learning (Sen, 1995). In our study, the test was administered on an individual basis, with no limit of time, being true that almost all the students performed the test in a range between 10 and 15 minutes. The score is given by the total number of correct exercises on the set of the series.

Cognitive Functioning Assessment

The evaluation of the cognitive function (memory) of the individuals in our study was done through a battery of tests, selected on the basis of the age and the sensitivity for the detection of different aspects related to the function which we meant to assess in accordance with the objectives of our study.

Material used in the Exploration of Cognitive Function: MEMORY

• Copy of the Rey Complex Figure test (memory test)

• Adaptation of the Spanish Verbal Learning Test-Complutense Children (SVLT-CC)

Then we described each of these tests in order to better explain the cognitive functions assessed, also justifying the reason of our choice.

(i) Copy test of Rey Complex Figure (memory) (Rey, 1987)

In this task the individual should remember, after about five minutes, tops, the complex figure previously copied. Like in the copy test, the examiner must provide different pencil colors to the individual, so that the examiner can later identify the order followed in the evocation process.

As mentioned, in the parameter of visual-perceptive abilities and visual-constructive for the correction of this test, the procedure indicated in the manual of Rey was not applied, but we followed the model of Bernstein and Waber (1996). This model, in addition to providing us with information about the individual's ability to reproduce the exact figure, also and perhaps more importantly, allows us to make qualitative and stylistic approaches to the figure reproduced by the individual.

On memory condition we evaluate the same performance parameters as in the copy rehearsal, but, for the first two, a number of differences is introduced: in the organization we evaluate 16 criteria instead of 24 as in the rehearsal copy; in style, the approach to the figure is characterized as oriented in parts, intermediate or configurational, without subdivisions in the intermediate value. Finally, in precision we quantify the same structural and incidental elements than those in the rehearsal copy. This score is particularly useful in this condition because it indicates the amount of information retained by the individual.

The memory essay explores, fundamentally, matters related to the encoding, storage and recall of new and complex information.

(ii) Spanish Verbal Learning Test-Complutense Children (SVLT-CC) (Benedet & Alexandre, 1998) is the memorization, by the individual, of several lists of words read by the examiner and which subsequently the individual will have to evoke or recognize: a learning list (A), a list of interference (B) and a list of recognition. The memory phase is held in various conditions: immediately after listening to the words, having listened and learned a second list, with the help of semantic keys offered by the examiner, after an interval of 20 minutes, and finally, using a list of recognition. In each memory test, a correct answer will be considered if i tis in the list of corresponding learning and if it first appears in this memory test.

The evocation or a list of words recently learned is, by itself, an exercise in episodic memory. Without a doubt, the processes necessary to learn to discriminate this set of words that make up the list of learning from the rest of the words stored in the semantic system, requires that this system is well organized.

This test helps us to carry out a detailed and rigorous assessment of memory and

learning capacity of the individual. Revealing, among other things, information on the learning curve, the primacy and recency effect, the use of learning strategies and serial semantics, susceptibility to interference, the retention of information in the short or long term, and the comparison of the free evocation with the evocation helped by semantic keys.

This evidence was previously adapted to the Portuguese population, as in the lists there were words unknown to our students. Pretesting was made to three groups of students from different schools in the city of Braga, in order to select common words, respecting the themes inherent to the Spanish test.

Procedures

The application of the instruments was preceded by an application asking for the authorization to the directors and the Association of parents of the school, a private institution in the city of Braga. Once obtained the consent of the school, the second step consisted of a formal request to the families of the students.

Presentation and Discussion of the Results

1. The Dependence-Independence Cognitive Style and the Gender

To assess whether there are differences between male and female individuals, according to their direct scores in CEFT (children's version) and EFT (teen version), we did an analysis of differences in averages using the Student's t-test for independent groups.

In table 2 we present the averages and standard deviations of the results in measures of FDI in the two gender.

Table 2.

Averages and standard deviations in FDI tests according to the gender

Tests	Gender	N	M	DP
CEFT	Female	45	18.5	3.52
	Male	53	18.7	3.65
EFT	Female	49	33.4	19.39
	Male	46	31.5	17.19

According to the proximity in the average obtained by the two gender, notably in CEFT, it is not identified a statistically significant difference in the averages of the two sexes, whether in CEFT (t =. 452; p =. 503) or in EFT (t =. 044; p =. 835). Facing the purpose of this analysis, we can accept that the gender variable has no impact on scores of evidence of cognitive style, which is why this variable will no longer be considered in subsequent analyses.

As, in the course of this work, we will consider the cognitive styles, not on the basis of direct scores, but of three groups of students (dependents, intermediate and field-independent), it was also considered appropriate to test a non-differentiation of the two genders in the three considered groups. The values obtained are presented in tables 3 and 4, respectively for children and teenagers.

Table 3.

Sample Distribution in the CEFT according to FDI and gender (kids)

	Field dependence-Independence			
	FD	Intermediate	FI	Total
Gender Female	13	18	14	45
Male	18	16	19	53
Total	31	34	33	98

According to the results obtained in the CEFT, i.e. the group of children (8-9 years of age), differences were not shown in the FDI according to gender ($\chi 2$ = 1,036; gl = 2; p =. 596). A relatively close proportion to students of both sexes is distributed by three groups of cognitive styles.

Table 4.

Sample Distribution in the EFT According to the FDI and Gender (teens)

	Field Dependence-Independence			
	FD	Intermediate	FI	Total
Gender Female	14	21	14	49
Male	18	11	17	49
Total	32	32	31	95

Also in the teenagers' group of (13-14 years of age), the individuals of the two sexes approach in the three groupings of cognitive styles according to the results in the EFT ($\chi 2$ = 3.24; gl = 2; p =. 148), while in the intermediate group we see a sharp discrepancy that favors the female students. So, moving from direct scores to cognitive style groups, there is a difference with statistical significance according to the variable gender, reinforcing the previous conclusion that we can leave it out in our future analysis.

2. The Dependence-Independence Cognitive Style and the Socio-Economic Status

Then, we proceed to the analysis of any differentiation in the cognitive style of students taking their social background, even if this variable has been relatively controlled by us in the beginning, when we decided to take a sample of students attending a private school in the city of Braga. For the students' evaluation according to the socio-economic status of family membership, the level of studies and the professional status of both parents, by a

crossing of the data obtained, have been taken into account. In face of the desired mixing in obtaining the sample and the choice of a private school, basically the families present in the sample belong to a medium and high social status. In addition, five students were eliminated of the sample, because the parents had no job or referred jobs without classification, in addition to very low school qualifications (small number of children in foster care by social situation, part of the religious congregation which oversees the private school). Thus, a conversion in the levels of studies was done and we decided to form 2 groups: Group 1- in the couple, only one element has higher studies; and Group 2- in the couple, both parents have higher education. In a professional level we also formed two groups: Group 1-average socio-economic status; and Group 2- high socio-economic status.

A non-parametric statistical analysis through the Chi-square test was performed to see if there were differences between dependent groups, intermediate and field-independent and academic qualifications and the type of the family job. In table 5 we present the values in the group of children of 8-9 years of age, and in table 6 the same values for the group of teenagers of 13-14 years of age.

Table 5.

Distribution of children according to the socio-economic status and FID

		Field dependence-Independence		
		FD	Intermediate	FI
Studies	Group 1	17	23	13
	Group 2	14	11	20
Job	Group 1	15	21	17
	Group 2	16	13	16

No statistically significant differences were observed in the distribution of three group styles, not according to the qualifications of the parents ($\chi 2 = 5{,}393$; gl = 2; p =. 067), or according to the jobs of parents ($\chi 2 = 1{,}301$; gl = 2; p =. 522) in the group of children of 8-9 years old. Even so, and especially in relation to the education of parents, there is some tendency for higher rate of FI children in families with higher qualifications.

Table 6.

Distribution of teenagers according to socio-economic status and FDI

		Field dependence-Independence		
		FD	Intermediate	FI
Studies	Group 1	15	13	18
	Group 2	17	19	13
Job	Group 1	11	10	10
	Group 2	21	22	21

Also, there are no statistically significant differences in the groups of FDI with teenagers, whether on the basis of qualifications ($\chi 2 = 1{,}964$; gl = 2; p =. 375) or in parents ' jobs ($\chi 2 =. 074$; gl = 2; p =. 964). The distribution of teenagers by three cognitive styles, especially in relation to the parents' jobs, is made in a fairly homogeneous mode.

Once considered the lack of difference in the students' groups in the three cognitive styles according to their socio-economic status, from this moment on we will no longer consider the qualifications and jobs of the parents in the analyses of the subsequent results.

3. The Field Dependence-Independence Cognitive Style and the Intelligence

Because the research on cognitive styles suggests some differentiation in the results in intelligence tests students according their cognitive style, this leads us to consider necessary to assess the possible relationship between these two cognitive variables in this sample. Table 7 describes the results of intelligence tests (factor g), separated on the basis of the evidence used for the two age groups of students: Raven's progressive matrices and Reasoning test (Abstract Reasoning), sample and Battery of Reasoning tests (Abstract Reasoning). This presentation considers students divided by three groupings in FDI.

Table 7.

Averages and standard deviations in Raven and BRT For the three student's groups in FDI

Test	FD		Intermediate		FI	
	M	DP	M	DP	M	DP
Raven (n=98)	27.2	4.98	27.2	5.19	30.7	4.45
BRT (n=95)	14.4	2.71	17.2	2.66	18.1	2.48

As we can see, in the group of children there is a non-differentiation in the averages between the field dependent group and the intermediate, which no longer occurs from these two groups to the field independent learners (with the highest average in the Raven test). Looking at the results in the group of teenagers, the averages appear more differentiated in the three groups of students, increasing the average test results of abstract reasoning as we passed the field dependent students to students of the intermediate group, and for field independent students (3.7 average oscillation in the average of the two extreme groups).

For a statistical analysis of differences in test scores on Raven and the test of abstract reasoning of BRT, respectively for the individuals of 8-9 years old and 13-14 years old, according to the students ' cognitive styles, we carried out an analysis of variance (F-Oneway). Differences in intelligence tests, in both age groups, according to the students' cognitive style, are highly significant, either in the Raven's progressive matrices test [F (2.97) = 5,604; p <. 01], or in the test of Abstract Reasoning [F (2.92) = 16,552; p <. 001]. Independent students boast a higher average field intelligence test, differing of the other two groups of students, particularly those students field dependent and the ages of 13-14 years old, in more than one standard deviation unit. The subsequent contrasts confirm precisely this difference (scheffe procedure). So, with the younger children, the FI group overpasses both the FD group and the intermediate group (these two don't differentiate between them), and this difference is of about 3.5 points and statistically significant (p <. 05). In the teens' group, there is a superiority with statistical significance of the FI group when compared to the FD group (average difference of 3.6 points; p <. 001), also a statistically significant difference between the intermediate group and the FD group (difference of 2.8 points in the averages; p <. 001). In all cases, a lower performance on intelligence tests by the field-dependent students was noticed.

Cognitive Functioning (MEMORY) in Children and Field Dependent and Independent Teenagers

In this section, we present the results of the differences among the three groups of students according to cognitive style (FD, intermediate and FI) in the cognitive task evaluated in this work, i.e., memory. To control the effect of intelligence in these tests performance, in all the analyses, we will assume the intellect evaluated through the g factor tests as a covariate.

For the verification of possible differences in the cognitive memory tests, we analyzed the covariance, assuming this cognitive function as dependent variables, taking the field dependence/independence (cognitive styles) as an independent variable and the g factor tests score (intelligence) as a covariate.

Cognitive Styles and Memory

As mentioned, to evaluate some relevant aspects of the processes of memory, we used two tests, more specifically the Rey Complex Figure Test and an adaptation of the Spanish Verbal Learning Test-Complutense Children (SVLT-CC).

In table 8, we present the results in the cognitive indicators taking the Rey Complex Figure Test on memory condition. This presentation considers students by age and cognitive style.

Table 8.

Averages and standard deviations in the copy test of the Rey Complex Figure (memory)

Test	Age	FD		Intermediate		FI	
		M	DP	M	DP	M	DP
RCF (memory)							
Organisation	8-9	1.8	1.99	2.8	3.43	5.2	4.60
	13-14	9.8	3.91	11.5	3.47	10.5	3.77
Precision Structural Elements	8-9	10.7	6.72	13.8	6.98	17.8	7.04
	13-14	23.5	3.66	23.6	2.76	24.6	1.17
Precision Incidental Elements	8-9	12.3	8.73	17.2	8.93	23.0	9.38
	13-14	33.0	6.64	35.4	4.23	35.9	3.67

The values of the averages for the three cognitive indicators of reproduction by memory of Rey's Figure oscillate enough depending on the age of the students and the three groups of cognitive styles. For example, taking students of FD and FI, there are major discrepancies in the averages when we compare children and teenagers in three cognitive indicators (organization, structural elements and precision accuracy of incidental elements) with the FD students. These differences are also higher among students of intermediate cognitive style when compared with FI students.

In the group of children with 8-9 years old, the statistical analysis revealed a lack of statistical significance for co variable intelligence in the differences in the three groups of cognitive style on information organization [F (1.97) = 3,416; p =. 068], as well as in scoring for the structural elements of the figure correctly reproduced [F (1.97) = 1.82; p = 671] and the actual number of incidental elements [F (1.97) = 2.33; p =. 630]. In relation to the study of the differences of averages according the cognitive style, we considered statistically significant the difference for the organization of complex visual information [F (2.97) = 9,307; p <. 001], (see Figure 5), to the structural elements [F (= 2.97) 8,352; p <. 001] (see Figure 6) and to the incidental elements [F (2.97) = 11,044; p <. 001]

In relation to the results obtained with the teenage students, in the organization of visual information, there were no statistically significant differences neither in function of FDI [F (2.94) = 1,054; p =. 353], nor on the basis of the intelligence co variable [F (1.94) = 1,129; p = 291]. The same is true in relation to structural elements, both for the cognitive style [F (2.94) =. 735; p =. 353] (see Figure 6), and for the intelligence co variable [F (1.94) = 2,471; p =. 119]. Similarly, also the incidental elements did not show significant effects in function of the FDI [F (2.94) = 1,427; p = 245] nor in relation to the co variable intelligence [F (1.94) =. 592; p =. 444].

Passing the test of contrasts between the three cognitive styles in the 8-9 year old students, there are differences with statistical significance on the results obtained at the level of the index in favor of FI students' organization. FI students present a superior performance to the FD

children (average difference = 3.79; p <. 001) to intermediate (average difference = 2.83; p <. 01). Also in the score of structural elements, FI students feature superior performance to other colleagues, however, this difference is only statistically significant in relation to the FD students (average difference = 7.39; p <. 001). Finally, on the score of incidental elements FI students feature superior performance with statistical significance relative to FD students (average difference = 11.09; p <. 001) and in relation to intermediate style students (difference in style average = 6.12; p <. 05).

So, in summary, we can confirm that the results with the teenage students don't differ in organization and precision parameters (incidental elements and structural elements) in the Rey Complex Figure Test (memory condition), both according to the FDI as in the covariate intelligence. However, with the students of 8-9 years old, statistically significant differences were observed in these same parameters in the function of the FDI, not having verified a statistically significant effect of the covariable intelligence.

In table 9 are presented the data corresponding to the variable that measures the style of approach to figure on the part of the individuals. As a result of the analysis focus on the frequency of students per each style of approach, such results were subjected to an analysis of differences in frequency through a non-parametric test (Kruskal-Wallis).

Table 9.

Frequency of students on the types of styles in copy testing of the Rey Complex Figure (memory)

Test RCF (memory)	Age	FD	Intermediate	FI
Style Parts Priented	8-9	26	24	15
	13-14	3	4	5
Intermediate	8-9	1	6	7
	13-14	8	4	3
Configurational	8-9	4	4	11
	13-14	21	24	22

These results suggest that, in the memory of the Rey Complex Figure, cognitive style produces differences in approach to complex materials presented in visual form (style). So, with the students of 8-9 years old, the frequency of styles according to the FDI shows statistically significant ($\chi 2$ = 10,538; gl = 2; p <. 01), with a clear advantage of FI students in the configurational style and of students and of the intermediate and FD in the oriented by parts. On the other hand, with the 13-14 year old students there were not observed a statistically significant difference by combining the reproduction style and the FDI ($\chi 2$ =. 552; gl = 2; p = 759), a clear majority of these older students (n = 67) configurational style regardless of your cognitive style.

As mentioned, another of the evidence used to evaluate different aspects of the memory, was the Spanish Verbal Learning Test-Complutense Children (SVLT-CC). In table 10, we present the averages and standard deviations of the results in several cognitive indicators obtained with this test considering the

cognitive style of the younger children (8-9 year old students). It should be noted that, in most of the parameters considered, we report to the scores, however in "primacy region", "midrange" and "recency region" we worked with the ratio or proportion of words considered there.

Table 10.

Averages and standard deviations in Spanish Verbal Learning Test-Complutense Children (SVLT-CC) (children)

Test	FD		Intermediate		FD	
SVLT-CC	M	DP	M	DP	M	DP
IR 1st trial list A	5,5	2,23	4,9	1,48	5,3	1,83
IR 2nd trial list A	7,1	2,59	7,0	2,17	7,0	1,94
IR 3rd trial list A	8,1	2,70	8,3	1,87	8,6	2,68
IR 4th trial list A	8,6	2,43	9,6	2,72	10,1	2,10
IR 5th trial list A	9,6	3,02	10,4	2,63	10,7	2,88
IR List B	5,2	1,98	5,5	1,73	4,9	1,78
Primacy region	26,3	5,34	26,0	7,09	29,0	5,92
Middle region	47,0	8,20	50,8	10,77	46,0	7,80
Recency region	27,2	8,37	24,1	7,80	25,1	6,75
STFR	8,5	2,37	9,4	2,16	9,4	2,96
Short term RC	9,9	2,21	9,8	2,41	10,6	2,00
LTFR	9,4	2,90	10,2	2,10	11,0	2,30
Long term RC	9,9	2,76	10,4	2,85	11,1	2,69
Contrast serial IR list A	1,8	2,18	2,1	2,03	2,6	2,64
Contrast serial IR list B	0,3	0,70	0,5	0,71	0,2	0,40
Contrast serial FR short term	0,1	0,43	0,2	0,65	0,2	0,44
Contrast serial FR long term	0,2	0,52	0,1	0,41	0,1	0,33
Contrasts semantic IR list A	7,0	3,98	8,4	4,85	9,3	5,31
Contrast semantic IR list B	0,5	0,81	0,7	0,84	0,6	0,67
Contrast semantic STFR	2,6	1,93	3,0	2,08	2,8	1,95
Contrast semantic LTFR	3,1	2,27	3,7	2,18	3,4	2,05
Error Preservation	4,4	3,68	4,2	2,89	3,5	3,10
Intrusion errors FR	1,2	1,95	0,8	1,40	1,0	1,55
Intrusion errors RC	0,5	0,96	0,3	0,68	0,4	0,97
Recognition	14,1	2,10	14,5	2,35	14,9	1,81

Note. IR: Immediate recal/ FR: Free recall, STFR: Short term free recall/LTFR: Long term free recall; RC: Recall with cues

The results with children of 8-9 years of age suggest several oscillations in the obtained averages. Thus, in the immediate recall task, consisting of five essays (listing, from 1st to 5th), it was found in all groups (FD, intermediate and FI) a gradual increase in acquisition and recall of words from rehearsal to rehearsal. However, there was a significant effect of FDI in relation to results in the immediate recall in the 4th test of the A-list [F (2.97) = 3,484; p <. 05], as well as on free long-term memory [F (2.97) = 3,065; p <. 05]. Another variable measure, with significant effect of FDI was the primacy [F (2.97) = 3,786; p <. 05], being equally significant the effect of the covariable intelligence [F (1.97) = 3,959; p <. 05]. Similarly, it was observed an effect with statistical significance of the intelligence in the region of recency [F (1.97) = 3,908; p <. 05], as well as the immediate recall in the 3rd test [F (1.97) = 4,212; p <. 05].

All groups (FD, intermediate, FI) used the serial strategy both in the list of free memory, as well as in list B, of interference. In free, short term memory, the FI used more often semantic strategy compared to FD students, although less than the students in the intermediate group. The same happened in immediate recall, although here the FI students have used the semantic strategy more than FD and intermediate students. With respect to errors, the FI group repeated fewer words (preservation), as well it as added fewer words to the list evoked (intrusion) compared with FD

students, although more than the intermediate students. Finally, the list of recognition words, mostly students of the three groups identified all the words belonging to the first list, even if we observed a tendency towards a gradual increase in the passage of FD students to intermediate and these to FI students.

In the analysis of contrasts, there were statistically significant differences in cognitive style function in relation to the immediate memory index (fourth list test) between the IF students and the FD students (1.6 points difference in the averages in favor of the FI students; p <. 05) and, in the primacy, between the FI group of students and intermediate group students (3.0 points difference in the averages in favor of the FI students; p <. 05). The same happened with the index of free memory in the long term, noting a statistically significant difference (difference of 1.2 points in the averages; p <. 05) between the FD students and the FI students, in favor of the latest.

Passing the SVLT-CC results next to the teenage students, in table 11, we present the averages and standard deviations in the various cognitive indicators obtained with this test considering the students' cognitive style. We remind you that the parameters considered report to the students' scores, however in "priority region", "intermediate region" and in "recency region" we work with the ratio or the proportion of words considered there.

Table 11.
Averages and standard deviations in Spanish Verbal Learning Test-Complutense (SVLT-CC) I (teenagers)

Test	FD		Intermediate		FI	
SVLT-CC	M	DP	M	DP	M	DP
IR 1st trial list A	7,0	2,26	7,8	2,36	7,3	1,86
IR 2nd trial list A	9,3	1,73	10,1	2,44	9,3	2,32
IR 3rd trial list A	11,0	1,82	11,3	2,26	12,0	2,17
IR 4th trial list A	11,7	1,42	12,6	1,97	12,6	1,89
IR 5th trial list A	12,8	1,64	13,5	1,92	13,7	1,60
IR list B	6,7	1,77	7,0	1,48	7,55	2,20
Primacy region	27,0	3,93	27,7	5,72	26,2	4,91
Middle region	46,7	8,08	45,4	6,04	45,5	7,66
Recency region	28,2	5,82	26,9	5,16	28,4	5,77
STFR	12,3	2,03	12,4	2,90	12,8	2,14
Short term RC	13,0	1,88	13,2	2,35	13,4	2,09
LTFR	12,8	2,13	13,4	2,29	13,4	1,99
Long term RC	13,4	1,97	13,8	2,16	14,1	1,98
Contrast serial IR list A	3,8	3,77	4,5	4,31	4,1	3,67
Contrast serial IR list B	1,1	2,33	0,9	2,23	0,6	0,77
Contrast serial FR short term	1,3	2,41	0,5	0,84	0,7	1,53
Contrast. serial FR long term	0,9	2,73	0,2	0,54	0,4	0,96
Contrast semantic IR list A	14,8	7,03	15,0	8,39	15,2	9,24
Contrast semantic IR list B	1,2	1,26	1,3	1,28	2,2	2,59
Contrast semantic FR short term	5,6	3,02	5,2	9,32	5,7	2,82
Contrast semantic FR long term	6,8	3,21	7,0	3,18	6,3	2,91
Error preservation	3,2	2,89	3,3	2,69	3,5	2,77
Intrusion errors FR	0,6	1,11	0,2	0,45	0,4	0,81
Intrusion errors RC	0,1	0,35	0,0	0,00	0,1	0,40
Recognition	15,2	1,14	15,6	0,71	15,6	0,89

Note. IR: Immediate recal/ FR: Free recall, STFR: Short term free recall/LTFR: Long term free recall; RC: Recall with cues

As we can see in table 18, the results of teens (13-14 years old), similarly to the results obtained by the students of 8-9 years old, suggest an improvement on the memory of words from test to test, in terms of immediate recall (the A list, from 1st to 5th test). In relation to the ratio of words according to the areas of incidence (primacy, average and recency), an almost uniform distribution framework in relation to cognitive style can be observed.

FI students used more serial strategies on the A list of immediate recall than FD students, but less than the intermediate students. In free memory in the short term, the same did not occur, because the FD students appealed more to this kind of strategy than FI student (intermediate students even less that the FI). FI students appealed more to the semantic strategy of immediate recall (list A and list B) and free memory in the short term. With respect to errors, the three groups present very approximate results in the preservation index, while intrusion errors punctuate the FD students more. In the recognition list, in accordance with the results obtained with the younger students, the values approach, despite the minimal differences between the three cognitive groups' styles.

The covariance analysis of results between FDI and the cognitive aspects measured by this test (in the teenagers' group) showed no values with statistical significance. However, the effect of the intelligence covariable was significant in the short term RCL evaluation [F (1.94) = 7,820; p <. 01] and RC in the long term [F (1.94) = 3,832; p <. 05]. In the use of serial strategies of the immediate recall list, it was equally significant the effect of the intelligence covariable [F (1.94) = 5,987; p <. 05]. Even though the differences the differences were not statistically significant, the FD students tended to use a serial type strategy with greater frequency and FI students a semantic strategy.

Cognitive Styles and Memory

In our research, the evaluation of the acquisition, storage and retrieval of information processes was carried out through the memory task of the Rey Complex Figure and SVLT-CC.

Taking the three performance indicators in the Complex Figure memory test into account, there were statistically significant differences in the score of the organization, and the precision parameters (incidental and structural elements) in the group of children (8-9 years of age). In the teenagers' group (13-14 years of age), there were no statistically significant differences according to the three groupings of cognitive styles. Regarding the approach to the figure, in the children's group, it showed a statistically significant difference in function of a higher FI rate in the configurational approach, a situation that is not present in the teenagers' group.

Other authors (Guisande, 2004; Páramo et al., 1999; Tinajero, Corral et al., 1998) noticed that there were better scores in FI individuals both in the organization and precision parameters, and in the approach style to the task. The use of information organization strategies used by the individuals, according to Davis and Cochran (1989), may explain the differences in the memory processes. These organizational strategies promote internal cohesion and the meaning of the material to retain (Gallini's, 1989).

Another explanation is the figurative-spatial nature of the Rey Complex Figure. This material is suitable for the increased inherent skills of FI in operating with visual and spatial material type (graphics categorization task) that contribute to its better memorization (Amador, 1992; Forns, 1994 & amateur;

Guisande, 2004). According to these studies, we can anticipate that the observed differences can be attributed to a superior ability of the FI to learn and memorize visual and graphic material type.

From the above, we can infer that the FI individuals are more efficient than the FD, and those in the intermediate style, in different learning tasks, especially when the material to learn involves graphic-visual or spatial content. The difference between the FD and FI in the Rey Complex Figure reproduction seems to be explained by the requirement of a more active restructuring and organization, more inherent skills in a more independent cognitive style.

In our study, applying the SVLT-CC, in different immediate recall rehearsals of the words list presented, significant differences were not shown. However, if we analyse the order in which children and teenagers recalled the words, FI individuals reveal greater tendency to combine the words recalled, thus reflecting a greater propensity for spontaneous information analysis on time of the knowledge acquisition, as well as a predisposition for the use of their personal schemes during recovery. Our results are consistent with those obtained in studies with children and teens (Amador, 1992; Coward & Lange, 1979; Guisande, 2004) and with adult individuals (Annis, 1979; Balluerka & González-Tablas, 1996; Frank, 1983; Frank & Keene, 1993; Kiewra & Frank, 1986; Rickards et al., 1997).

It also seems that the FI individuals of the group of children (8-9 years of age) tend to apply, with more assiduity than the FD, a semantic type strategy. This discrepancy reaches expressivity in the immediate memory of the A list. In the group of teens (13-14 years of age), the FI use more semantic strategies in the immediate recall of the A list and in the list of interference. This brings us to the kind of approach to information by the individuals of different cognitive styles. The FD individuals establish a global approach, so it is not surprising that they prefer to deal with the material as a whole (serial strategies). On the contrary, the FI employ an analytic approach, what predisposes them to a material for categorization research (semantic strategies) and the imposition of a proper structure.

The extraction and analysis of information content communicated orally require necessarily the use of memory resources. In this circumstance, there is a superiority on the part of the FI (Bennink, 1982; Bennink & Spoelstra, 1979; Cochran & Davis, 1987; Guisande, 2004; Robinson & Bennink, 1979). This Field Independent superiority translates a more diligent use of useful strategies in the attention space management, as well as the realization of inferences about the information contents, re-encoding and relating it to the previous knowledge. We can relate this, mainly to greater structuring of the FI and the plasticity of their information-processing style.

Our results suggest that the three groups of cognitive styles, whether in children or in teenagers, improve their performance both in short term and long term memory tasks, when the experimenter provides them a categorization of terms presented. That is, regardless of the cognitive style, all benefite from foreign aid (Balluerka & González-Tablas, 1996; Frank & Keene, 1993; Kiewra & Frank, 1986; Rickards et al., 1997).

It is interesting to add that, with teenagers, the gain for foreign aid is clearly superior in FD students in long term memory task. According to Ennis (1991), the FD individuals present greater difficulty to abstract certain relationships acquired in the course of a given learning process, making its implementation harder. This

circumstance makes us believe in a predisposition for a greater use of strategies on the part of the Field Independent individuals.

Finally, comparing the number of hits on the recognition test with the words recalled in the free SVLT-CC memory rehearsal (memory in the short and long term), we note that the amount of information stored is higher than the amount of information the individuals mentioned. In any of the cognitive styles'groups it was noted an improvement in the word recognition task, given the evocation without help, a situation that occurs among teenagers and, in particular, among children. These results lead us to believe that the processes are less affected by cognitive style that recovery processes. Thus, the observed differences in the memory tasks will be more related to the enconding and retrieval processes than with the storage process.

To sum up, seeking the convergence of results that extract the characteristics inherent to the used evidence (Rey Complex Figure and SVLT-CC), specifically the level of structuring in the evidence they present, when the material to assimilate has some kind of organization or structure, such as SVLT-CC, we do not see differences in the learning processes between the individuals of different cognitive styles. However, when the material is disorganized or requires structuring, as in the case of the Rey Complex Figure, the FI individuals manage a superior performance.

Discussion

For this differential cognitive functioning analysis, we evaluated the process of memory. In relation to cognitive style dimension, although a large number of studies only use the extreme groups (field dependent versus field independent), in our study, we covered a group of individuals with intermediate scores in the FDI, like in other investigations (Guisande, 2004; Páramo et al., 1999; Tinajero et al., 1998). Finally, it is relevant to mention that we considered, in our study, two age groups of students: teenagers of 13-14 and children 8-9 years of age.

Controlling some personal variables of the students which could interfere in the relationship we wanted to study between cognitive style and the results in the cognitive tasks (memory), we previously checked if the styles differed in function of the gender, the socio-cultural level and intelligence.

In relation to the gender variable, both in terms of 8-9 years of age children, or 13-14 years of age teenagers, there were no statistically significant differences by taking averages in direct scores, respectively, in the CEFT and EFT, as well as the frequency of students of both sexes by groupings of considered styles (field dependent, intermediate and field independent), although in the intermediate group more than 2/3 of this group's students are female. In other studies, there were no differences in cognitive styles in both gender in the children's group (Amador & Kirchner, 1993; Bigelow, 1971; Forns & amateur, 1990; Goodenough & Eagle, 1963; Guisande, 2004; Karp & Konstadt, 1971; LIS & Powers, 1979; Saracho, 1984), as well as in the teenagers' group (Abouserie et al., 1992; Corman & Platt, 1988; Jackson et al., 1964; Johnson et al., 1979; Lusk & Wright, 1981; McRae & Young, 1990; Peplin & Larsen 1989; Young et al., 1989). Thus, there is no differentiation according to gender, it is legitimate not to take this variable into consideration in our analyses.

The same has occurred with regard to the socio-economic status, where we considered both the school qualifications and the parents' jobs, consisting of two

groups on the basis of academic qualifications and of a higher or lower occupation. We also did not find differences with statistical significance, related to the job or the education of parents, to the three cognitive styles groups considered, although there is a higher percentage of field independent students (group of children) whose parents have more education. It is important here to point out that, because we were careful when establishing the constitution of our sample, this social variable is controlled (only students of medium and high status). In the available literature we tend to find a higher frequency of field independent students in higher social and cultural status (Páramo & Tinajero, 1990).

Finally, as it was I supposed according to the volume of inquiries in the area, there is an association with statistical significance between intelligence levels (g-factor evidences) and the cognitive style of participants, in particular among teenagers. According to most studies, field independent learners tend to have higher levels of achievement on g factor tests of fluid intelligence tests (Amador & Kirchnner, 1999; Arthur & Day, 1991; Guisande, 2004; Hulfish, 1978; Ohlmann, 1982; Páramo et al., 1999; Roberger & Flexer, 1981). In this sense, it acceptable that we have used the terms intelligence as a covariate in our analyses.

According to these studies, we can anticipate that the observed differences can be attributed to a superior ability of the FI to learn and memorize visual and graphic material type.

In our study, applying the SVLT-CC, in the different immediate recall rehearsals of the words' list presented, there were no significant differences. However, if we analize the order by which children and teenagers recall the words, FI individuals reveal greater tendency to combine the words recalled, thus reflecting a greater propensity for spontaneous analysis of information at the time of the knowledge acquisition as well as a predisposition for the use of their personal schemes during recovery processes. Our results are consistent with those obtained in studies with children and teens (Amador, 1992; Coward & Lange, 1979; Guisande, 2004) and with adult individuals (Annis, 1979; Balluerka & González-Tablas, 1996; Frank, 1983; Frank & Keene, 1993; Kiewra & Frank, 1986; Rickards et al., 1997).

Also it appears that the FI individuals in the children's group (8-9 years of age) tend to apply, with more assiduity than the FD, a semantic type strategy. This discrepancy reaches expressivity in the immediate memory of the A list. In the teenagers' group (13-14 years of age), the FI use more semantic strategies in the immediate recall of the A list and in the interference list. This differenciation brings us to the kind of approach done to the information by individuals of different cognitive styles. The FD individuals did a global approach, so it is not surprising that they prefer to deal with the material as a whole (serial strategies). On the contrary, the FI applied na analytic approach, what predisposes them to a material research by categorization (semantic strategies) and to the imposition of a structure.

The analysis and extraction of the information content orally communicated necessarily require the use of memory resources. In this circumstance, there is a superiority on the part of the FI (Bennink, 1982; Bennink & Spoelstra, 1979; Cochran & Davis, 1987; Guisande, 2004; Robinson & Bennink, 1979). This superiority of the field independent individuals shows a more diligent use of useful strategies in the attention space management, as well as the realization of inferences about the contents of the handled information, reencoding and

relating it to the previous knowledge. We can relate this mainly to greater FI structuring capability and to the plasticity of their information-processing style.

Our results suggest that the three cognitive styles' groups, whether in children or in teenagers, improve their performance in short term and long term memory tasks, when the experimenter provides a categorization of presented terms. That is, regardless of the cognitive style, all of them benefit from external help (Balluerka & González-Tablas, 1996; Frank & Keene, 1993; Kiewra & Frank, 1986; Rickards et al., 1997).

We add that, with teenagers, the gain with external help is clearly superior in FD students in the long-term memory. According to Ennis (1991), the FD present greater difficulty to abstract certain relationships acquired in the course of a given learning, process, making its implementation harder. This circumstance makes us believe in a predisposition for a greater use of strategies on the part of the field-independent individuals.

Finally, comparing the number of hits in the recognition test with the recalled words in the SVLT-CC free memory rehearsals (memory in the short and long term), we note that the amount of information stored is higher than the amount of information the individuals have mentioned. In any of the cognitive styles' groups it was noted an improvement in the word recognition task, given the evocation without help, a situation that occurs among teenagers and, in particular, among children. These results lead us to believe that the processes are less affected by cognitive style that recovery processes. Thus, the observed differences in the memory tasks will be more related to the encoding and retrieval processes than with the storage process.

To sum up, seeking the convergence of results that extract from the inherent characteristics to the used tests (Rey Complex Figure and SVLT-CC), specifically, the level of structuring the tests present, when the material assimilated has some kind of organization or structure, such as SVLT-CC, we do not see differences in the learning between the individuals of different cognitive styles. However, when the material is presented disorganized or requires structuring, as in the case of the Rey Complex Figure, the individuals get superior FI performance.

Conclusions

The information collected in this study allows us to recognize the existence of evident differences manifested in the cognitive functioning of field dependent and independent individuals. Thus, the results relating to cognitive processes examined allow us to conclude that the subjects' cognitive style interferes, since very early ages, in their cognitive processes.

On the use of strategies on SVLT-CC, the FI, in addition to being more for its application, use more analytical strategies, specifically, in Rey Complex Figure by providing them the decomposition of the information and its restructuring according to their needs. In contrast, the FD individuals used a more global strategic approach. So, the FI used semantic strategies more frequently, both in the 8-9 years of age group, as in teenagers (13-14 years of age), while the FD and the intermediate individuals used serial type strategies.

We conclude that the differences between FD students, intermediate and FI, at any age, are not related to the amount of information retained or stored, but with differences in frequency of use of organization strategies of learning which do point out the differences in their learning processes.

The vision which recognizes the differences in the individuals performance with different cognitive style (FD and FI) is not very robust. Classified by the inferiority/superiority dichotomy, related to the dependence/independence, respectively, we admit that the interpretation of the results of our research may contribute to the demystification of certain claims concerning the qualitative assignments of these two groups namely opposites, not in terms of intellectual capacity but in terms of cognitive functioning.

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