Evaluation of image support in reading disability in the Spanish language

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Abstract

This research analyses possible advantages of using schematic drawings with dyslexic readers in a transparent orthography (i.e. Spanish language).

To assess the usefulness of such drawings, the procedure consisted of comparing latency times (LT) for familiar words and pseudo words in a naming task. The experimental group was formed by dyslexic readers who were aided by the image support of schematic drawings made with shorthand elements.

After comparing LT, it was observed that the dyslexic readers identified the stenographs (syllables) not as abstract signs, but rather as an integral part of the person-characters represented in the figures themselves. It is deduced that the difficulty which syllables present to dyslexic persons could be linked to their dissociation of syllables from the image corresponding to the whole word.

Key words: dyslexia; omissions; reversals; schematic drawings; stenographs**.**

Introduction

The cognitive deficit produced by dyslexia persists throughout life, although its consequences and expression vary noticeably. Retrospective studies (Scarborough, 1984) and prospective studies (Shaywitz, Holford & Holahan, 1995) indicate that dyslexia is a chronic disorder, and that it should not be considered a transitory maturational delay. For this reason, poor readers tend to be so throughout their lifetime. Nonetheless, the way this is expressed and its consequencies are quite different between school age and adult age (Cuetos, 2002). In dyslexic adults, there is usually some reading ability, although with less fluency and accuracy than that of non-dyslexic individuals, such that a greater effort is required during activities involving reading and writing (Fernández Baroja, Llopis & Pablo de Riesto, 1998).

Despite these considerations, all dyslexic children require therapeutic help that will allow them to develop and optimize their resources. Treatment should be intensive and long-term (Vygotsky, 1992). It is essential that this treatment be initiated early on, if possible before the end of first grade in primary education (Herrera Nieto, 1999).

Since reading requires appropriate processing of contrasts and image identification, this study tries to explain the difficulty which the dyslexic reader faces from the lack of an image, whether for syllables or for certain words in our language (Crystal 1980). Such an association was in fact made possible, thanks to the stenograph, which in our experiment was integrated into the image itself, fulfilling the function of link between the image and the short word or syllable.

It is useful to remember that not until 1975 did the World Federation of Neurology use the term developmental dyslexia for the first time. The definition proposed at that time was: "a disorder manifested by a difficulty in learning to read, despite conventional instruction, adequate intelligence and socio-cultural opportunity, which is dependent upon fundamental cognitive difficulties which are frequently of constitutional character." (Critchley, 1970).

We add that, despite numerous attempts to classify types of dyslexia, no consensus has been reached. On the contrary, recent publications emphasize the unitary nature of dyslexia, assigning phonological failure as the pathogenic basis for dyslexias (Shaywitz et al., 1992; Swank , 1999).

It must also be noted that, while on one hand the emphasis is on training in the grapheme-phoneme transformation process, another approach focuses on whole-word recognition.

Those who defend the first method consider that phonological skills are necessary for recognizing words. In a study comparing the two methods, the phonological method was shown to be clearly superior (Foorman, Francis, Beeler et al., 1997).

Reading tests used in this study differ radically from the method where the pupil must put together a pre-designed puzzle (Aymerich 1991). Moreover, the methodology used here seeks to respond to teachers who face special or differential educational settings. This study of the classroom teacher's incumbency, but is also relevant for students and practitioners of psychology and pedagogy, as well as of any branch of knowledge relating to learning to read.

In this regard, we must note that results of this experiment do not substitute the method of putting together a pre-designed puzzle, but rather we are dealing with a technique that offers an essential complement for the dyslexic person. Indeed, by supplying the link that dyslexic persons need to associate syllables and short words with their image, they have a tool for correcting the dynamic omissions and reversals characteristic of dyslexic readers (further explained later). In effect, we address cases of being blocked due to lack of image formation, or to image formation without adequate meaning.

In Basic Education and specifically in the subsystem of Special and Differential Education, quality problems in teaching and learning require that we readdress epistemological foundations of the psychology of reeducating dyslexic persons, as well as procedures for diagnosis and treatment within our academic reality.

Toward this end, using schematic drawings can be an effective help in stimulating verbal categorization, which develops the dyslexic pupil's ability to understand that objects perceived in the outside world are expressed by certain logical systems as a function of nearness, similarities or contrasts. On the other hand, in order to facilitate entry into the abstract world of symbols, we give several examples in this paper with appreciable results, as well as in the Appendix.

The main objective of this study was to observe if this type of drawing would allow the dyslexic person to immediately recognize the sign that it expressed, interpreting it without any confusion, since otherwise it would represent nothing more than a relatively vague indication. To this effect, and by way of example, bold, simple, schematic stick drawings were developed (Figures 1-20), in accordance with the dyslexic person's thought in images, and were used to accompany each of the tests carried out in this study.

So it was necessary to apply a knowledge of stenography in the creation of these stick figures; their purpose was to be incorporated into discriminatory methods for meeting the demands of the reading tests given to the group of dyslexic pupils.

In this way, taking into account the dynamic omissions and reversals of the dyslexic, we proceeded to adapt the reading tests in order to sensitize the dyslexic students with stenographic strokes (lines) equivalent to syllables. In effect, children, when reading, fix their sight on the word, all the more as they seek to find equivalent meanings in their own personal vocabulary. In such a situation, the message will be comprehensible as long as the vocabulary used is familiar to them; oral language, on the other hand, is developed from a global auditory perception.

In order to perform the necessary reading tests, figures were created using stenographic strokes commonly used in stenography (also called shorthand), each of which was equivalent to a syllable. In order to facilitate the dyslexic child's sensitivity to words and pseudo-words, these signs (strokes, lines) were combined with standard characters, such as: from /a/ to /z/, from /0/ to /9/, as well as the curved and straight lines (strokes) corresponding to the stenography alphabet (Figure 1).

The stenography alphabet used in this methodology is of a syllabic phonetic type (Figure 1), that is, it represents the basic articulations and sounds of the language. All the elements which make up this alphabet are found in Geometry. Thus, the straight line and the curved line give us strokes which represent simple syllables (see the Stenography Alphabet, below, in its totality). Furthermore, changes in the value of these two line types are obtained by difference in geometric direction: horizontal, vertical, slanted; and by different stroke widths: thin or thick. Vowels, on the other hand, are determined by the stroke's position with respect to the line of writing (see explanation below).

In summary, the regular nature of the Spanish language, where a constant grapheme/phoneme correlation exists, allowed us to adapt the values of the stenographic symbols. Thus, shorthand symbols in Spanish represent syllables, where vowels are determined by the position of the stenograph.

Method

Participants

The two groups under study were composed up of dyslexic children in 5 rural schools, as selected by the teachers. We studied only those children with a reading disability according to the "Test de Análisis de Lectoescritura" [Reading & Writing Analysis Test] (TALE, Toro & Cervera, 1980). Children were classified into two mixed groups of 22 children, dividing boys and girls evenly into both groups. Each group was formed by 22 third-grade children (8-year-olds) whose individual scores in reading were lower than the level required for third-grade pupils on each test per the rules of the TALE (i.e., reading letters, syllables and words). Children learned to read using a phonics method, based on the grapheme/phoneme correspondence from first grade onward. This teaching method is the so-called syllabic reading method, nothing other than the traditional method of reading.

Remember that this method is based on learning the letters of the alphabet, the combination of simple sounds, syllables and words, in order to later extend to reading phrases and longer texts (Bravo, 1999). This is a method known for its tendency to develop both visual and auditory faculties: reading aloud. Children who presented sensory problems were excluded from this experiment; we limited ourselves to a criterion which included children who presented exclusively reading disability.

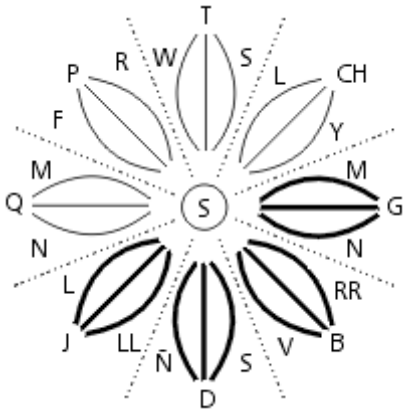
It is interesting to note that in the United States, implementation of phonological programs has already shown very favorable results after only two years. Children involved in phonological training programs show better abilities as compared to a control group in: letter identification, phonological analysis and reading isolated words (Torgesen et al., 1997). In our experiment, however, dyslexic children who underwent reading tests were sensitized previously through the support of a schematic drawing (Tables 5 and 6).

Materials. Type of visual aid used.

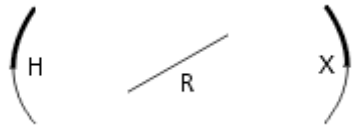
See the stenography alphabet below (Larralde, 1967), which served as the base for selecting strokes to form the schematic drawings we used with the reading tests (Fig 1).

Figure 1: Stenography Alphabet

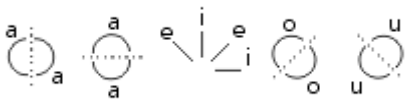
Consonants



Complementary Strokes



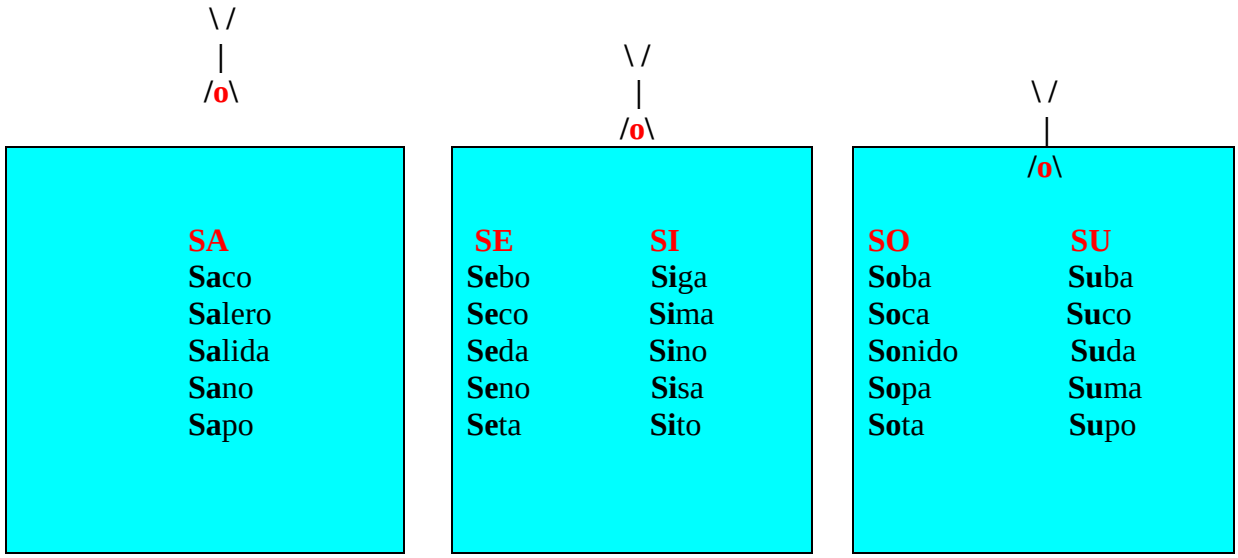
Vowels



According to rules of stenography, in the following examples the vowel is determined by the position of the stroke with respect to the surface of the water in the pool, as shown in the respective drawings (Fig. 2-5).

Figure 2 shows the position of the bather's head with regard to the surface of the water, giving rise to the following series of syllables: SA, SE, SI, SO, SU.

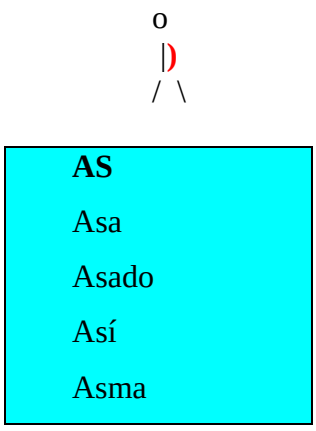
Figure 2: Syllables SA, SE, SI, SO, SU



o: Depending on its position with respect to the water's surface, this stroke is equivalent to the following syllables: **SA**, **SE**, **SI**, **SO**, **SU**.

Examples:

Figure 3: Syllables AS (The life jacket above the water)



In Figures 3-5 a bather's lifejacket is shown, represented by a stenographic stroke equivalent to the syllables AS, ES, IS, OS, US and whose position with respect to the surface of the water determines the vowel in these syllables.

Figure 4: Syllables ES, IS (The life jacket is floating)

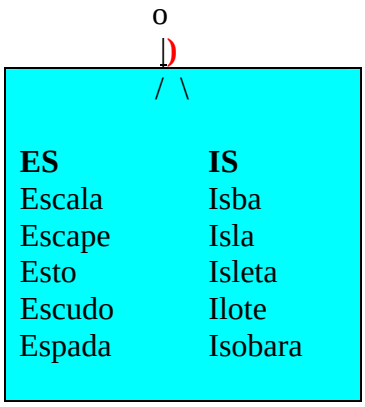
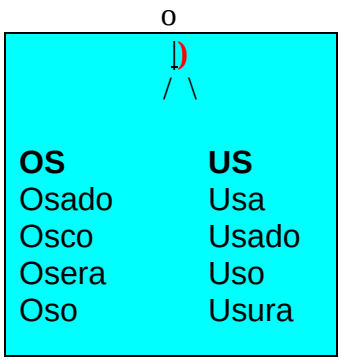


Figure 5: Syllables OS, US (The life jacket is below the water)



): According to the position of the life jacket with respect to the surface of the water, this stroke is equivalent to the syllables **AS**, **ES**, **IS**, **OS**, **US**

By way of contrast, the supporting image for the case of words beginning with the syllables SA, SE, SI, SO, SU uses a schematic drawing which shows a bather diving into the water. In this drawing, the bather's head is represented by a stenographic stroke (circle) equivalent to the syllables SA, SE, SI, SO, SU and whose position with respect to the surface of the water determines the vowel in each of these syllables.

In order to perform the reading tests for short words such as prepositions, articles or isolated letters, a series of drawings from Figures 6-12 were used.

Series of Linking Words

Figure 6. Preposition “of”

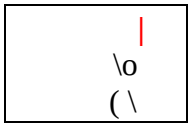


Figure 7. Conjunction “that”

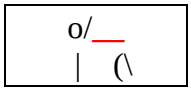


Figure 8. Preposition “with”

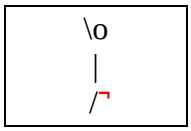
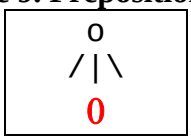


Figure 9. Preposition “in”



Series of Articles

Figure 10 Article “the”

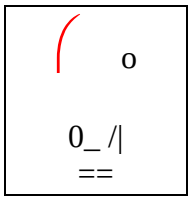


Figure 11 Article “a” or “an”

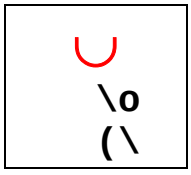


Fig. 12: Confusion of letters

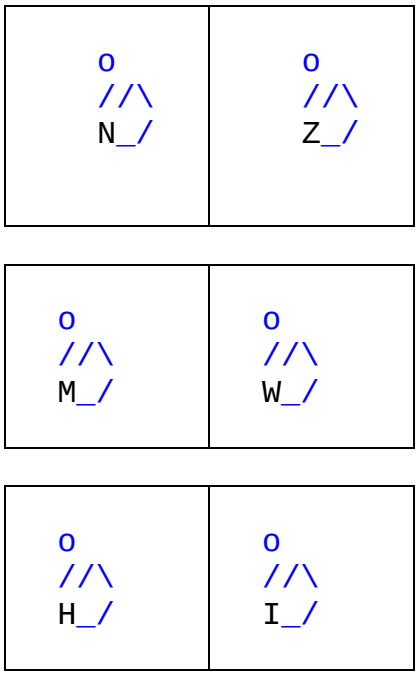


Figure 13: "Child head down"

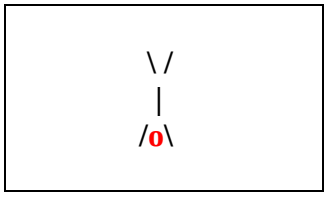


Figure 14: "Hunter without head"

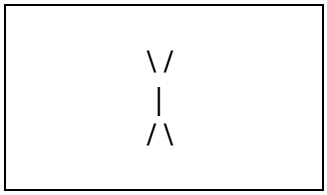


Figure 15: "Child raising arms"

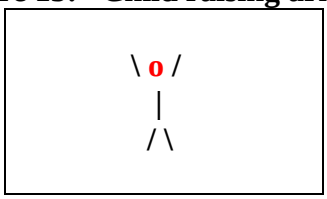


Figure 16: Game of tennis

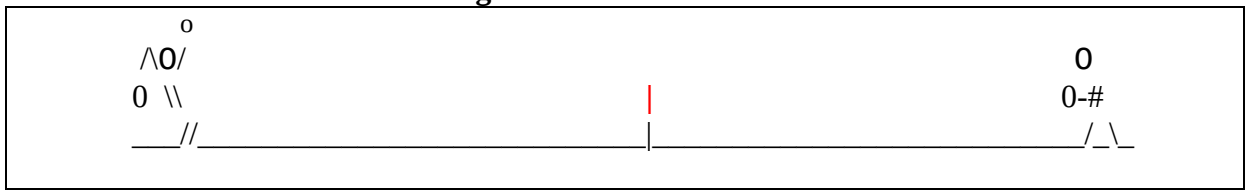


Figure 17: Letters in learning process

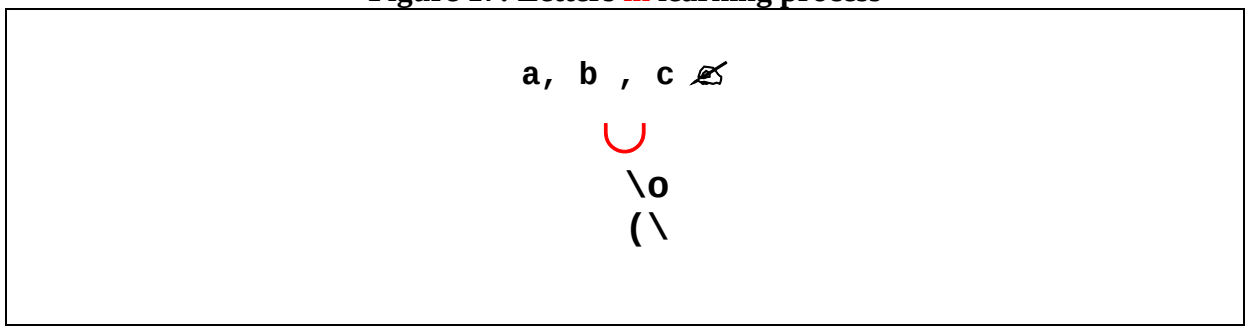
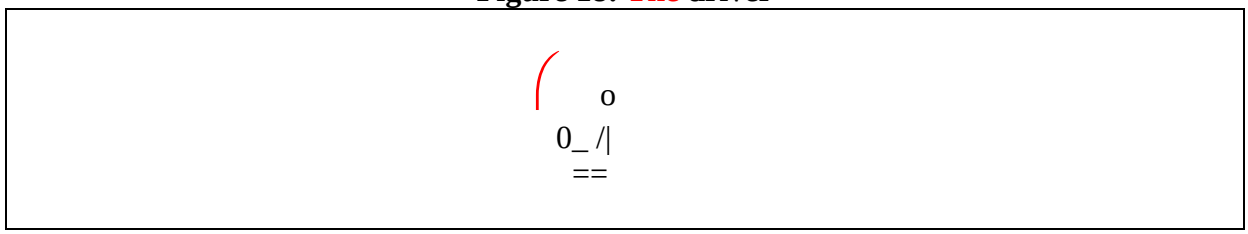
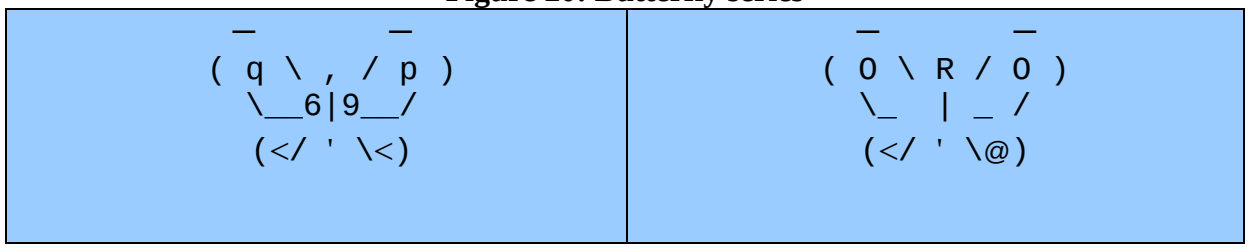


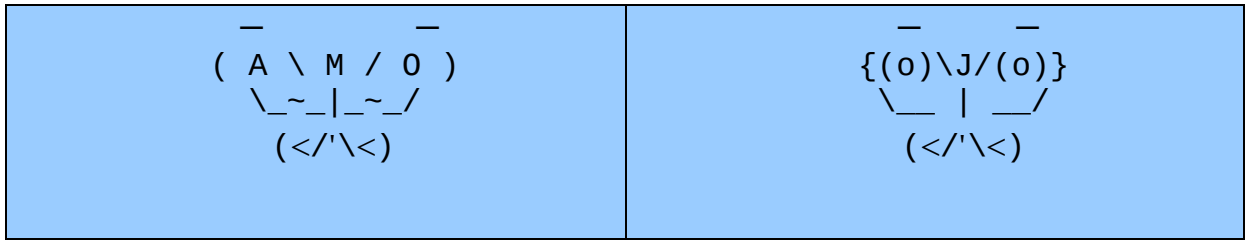
Figure 18: The driver

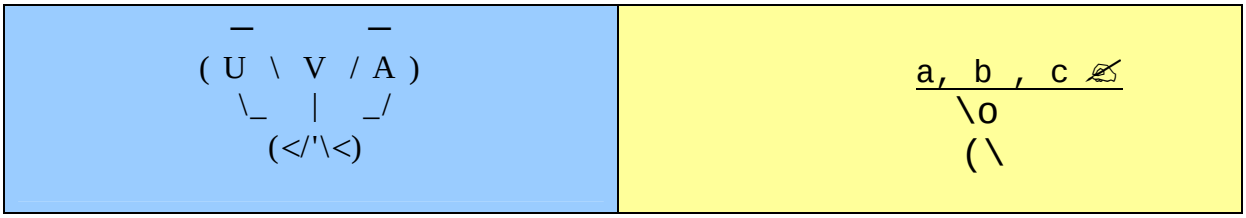


Series of drawings built with stenographs and combined with letters or short words:

Figure 20: Butterfly series







Tasks

The drawings presented in Figures 3-13 were combined with the TALE , which comprises several reading tests. Children took tests for reading letters, syllables and words from the Spanish language.

Letters test

In addition to the test of letters from the Spanish alphabet, pairs of letters from Figure 12 were added, accompanied by their respective figures as visual support.

Syllables test

In addition to the lists of syllables stipulated by the TALE, syllables from Figures 2-5 were added to the syllables test.

Test of isolated words

The words test requires correct identification of a list of common words (Tables 5 and 6), to which words from Figures19 and 20 were added, accompanied by their respective visual support. Many authors consider that the best way to detect reading problems is the test of isolated words (Olson, Wise, Conners et al., 1989; Siegel & Heaven, 1986; Siegel, 1986; Perfetti, 1986). However, it must be noted that this method is affected (Baluch & Berner, 1991; Forster & Chambers, 1973) either by the case of opaque orthographies (e.g. French, English, etc.) or by transparent ones (Finnish, Spanish, Italian, etc.).

Both groups of children underwent tests that required them to read possible letters, syllables or words as quickly as they could. The group which had the visual aid was prepared previously with just the basic rudiments regarding syllable equivalencies for the stenography strokes used in the schematic drawings on the tests. The dyslexic children easily and unambiguously interpreted the schematic drawings (i.e., SA, SE, SI, SO, SU). In order to analyze the

frequency of errors made, scores were assigned at the same time as the children were performing the respective tests.

Errors were classified according to the reading model proposed by Coltheart (1978), in the following fashion: (a) errors that might be expected in the case of reading aloud (e.g., errors of a morphological, visual or lexicalization type); (b) errors that could reflect sublexical cases in reading aloud (e.g., word transformed into a pseudo-word, phonological substitution errors, omissions, additions, repetitions, or reversals). Scores were assigned according to the following criteria:

1. Word/Pseudo-word. It was considered an error when a pseudo-word was read instead of a word (e.g.: *marcial* [martial] as "*murcial*" [nonword]).

2. Phonological errors as a result of misapplication of phonological rules, leading to a change in pronunciation (e.g.: *foro* as *forro*; *maña* as *manía*; *empañar* as *empanar*).

3. Visual errors were counted when there was no semantic relationship with the word read (*barro* [mud] as *barrio* [neighborhood]).

4. It was considered a morphological error in those cases where a different word was read, but one related to the written word (*marchar* [to march] as *marcho* [I march]). Errors relating to the plural of the written word were not counted.

5. Substitution errors included vowels or consonants being substituted by other letters (*pomada* [ointment] as *posada* [inn]).

6. Omissions were counted as those errors where a vowel or a consonant was not pronounced by the child (*colocada* [placed] as "*colo-ada*" [nonword]).

7. Additions were counted as those errors where a phoneme unrelated to the word was pronounced (*remar* [to row] as "*rempar*" [nonword]).

8. Repetition errors were counted in cases where the child repeated a part of a word (*relacionar* [to relate] as "*re-la-la-cionar"* [nonword])

9. Reversal errors were scored when a word, or part of a word, was read from right to left (e.g., ruta [route] as "taru").

10. The scoring of reading errors in pseudowords was based on the following criteria:

a) Lexicalizations arose when a pseudoword was converted into a word (e.g., delce [nonword] as “dulce” [sweet]).

b) Substitutions, omissions, additions, repetitions, phonological and reversal errors were also computed as pseudowords. The same scoring of reading errors for words was also used for pseudowords.

Tests of phonological knowledge. Three tests of phonological knowledge were carried out in this study: (1) test of improper repetition, (2) phonemic segmentation, and (3) phoneme reversal.

(1) *test of improper repetition*. This test, based on the work by Bowey and Francis (1991), was carried out with the aid of the schematic drawings formed with stenographs, in order to examine intra-syllabic phonological knowledge.

Instructions given to each of the children from Group A were as follows:

I’m going to show you a drawing. Look carefully at the drawing. Tell me what the drawing is called. This is an *abeja* [bee], an *elefante* [elephant], an *iguana*, an *oso* [bear], an *urraca* [magpie]. Now you have to say what letter each of the words starts with. This is an *abeja*, what letter does it start with? It starts with an /a/. This is an *elefante*, what letter does it start with? It starts with an /e/. This is an *iguana*, what letter does it start with? It starts with an /i/. This is an *oso*, what letter does it start with? It starts with an /o/. This is an *urraca*, what letter does it start with? It starts with a /u/.

Instructions given to each of the children from Group B were as follows:

Here are three boxes. Each one has five drawings inside. You yourself will take them out one by one and will tell me the name of each drawing. In the first box there is an *abeja*, in the second there is an *elefante* and an *iguana*, and in the last box there is an *oso* and an *urraca*. Now you have to tell me what letter each of these words begins with. Finally, you have to put the cards back into their own boxes.

In this test, the examiner did not provide any additional help while the child had to identify the image which began with a different vowel. This test contained 3 examples, indicated respectively by three positions of a bather (Fig. 2): before entering the water, about to enter the water and after entering the water. These examples contained 10 tasks with 4 drawings each. This test dealt with isolating the following consonants: /k/, /l/, /ll/, /m/, /p/, /r/, /t/.

(2) *Phoneme segmentation test*. In this test, the pupil had to count both the phonemes and the words which were indicated to him orally with the help of a pointer. In the two examples for this test, the examiner pronounced a word, at the same time tapping with the pointer and pointing to the schematic drawing created for that purpose. The instructions were as follows: "Listen to this word: *pato*. How many parts make up this word? It's made up of four parts. The parts are: /p/-/a/-/t/-/o/. Do you understand the game? If you need help you can use the pointer, tapping with it the way I just did, OK?" The pupil had no other help. Each of the words was pronounced, one by one, and the examiner asked the child to say how many parts made up the word that he pronounced. This test had two examples and 14 tasks.

(3) *Phoneme reversal test.* In this test the child had to count the phonemes, reversing the order of phonemes for each word. In the examples, the examiner pronounced a word and gave the following instructions: "Listen to this word: *peso*. How many parts does this word have? It has four parts, right? The four parts are: /o/-/s/-/e/-/p/. Do you understand the game?" The pupil received no further help from the examiner. Each word was pronounced one by one, and the examiner asked the child to say how many parts made up the word. This test contained 2 examples with 14 tasks for each of them.

Phonological-visual reading tests. These tests, as performed by Siegel (1992), were readapted to the needs of the experiment. The tests were composed of 32 attempts, where two stimuli were presented for each attempt. In this test type the child was asked to specify which of two words presented [word-pseudoword pair] sounded like the correct word (for example *carta* [letter] vs *catra* [nonword], *coer* [nonword] vs *comer* [to eat]). In the case of visual tests, the child was presented with a correct word and a pseudo-word (e.g., *arroz* [rice] vs *aroz* [nonword], *barrato* [nonword] vs *barato* [cheap]) and he or she was asked to specify which of the two seemed like the correct word.

Procedure

In order to perform a comparative analysis, latency times (LT) were computed individually, divided by the number of letters in each word or pseudo-word.

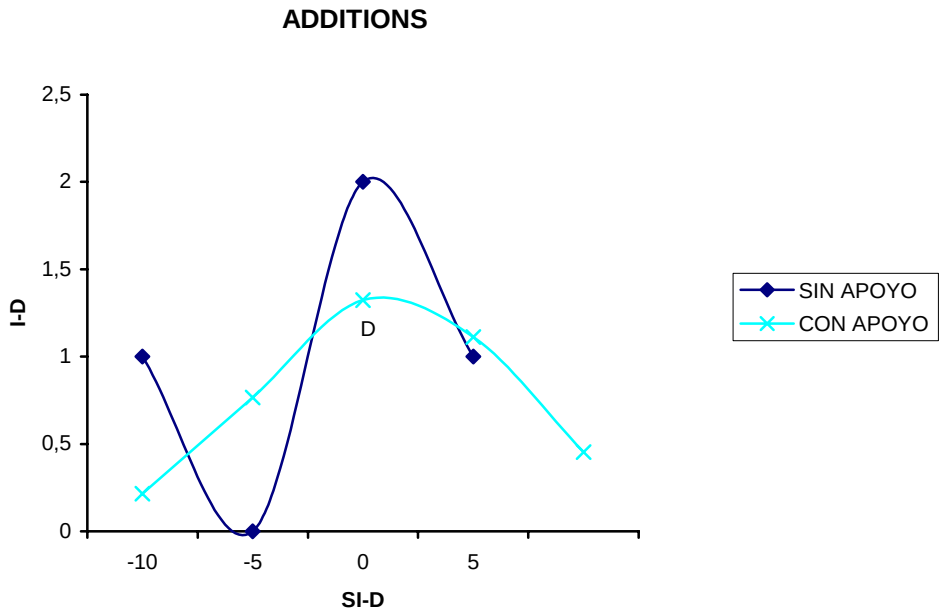
Statistical analysis

Means and standard errors of the means were calculated and plotted, and the statistical significance of the difference between groups was estimated by using the log linear model. The level of statistical significance was taken at the 95% ($P < 0.05$) confidence level.

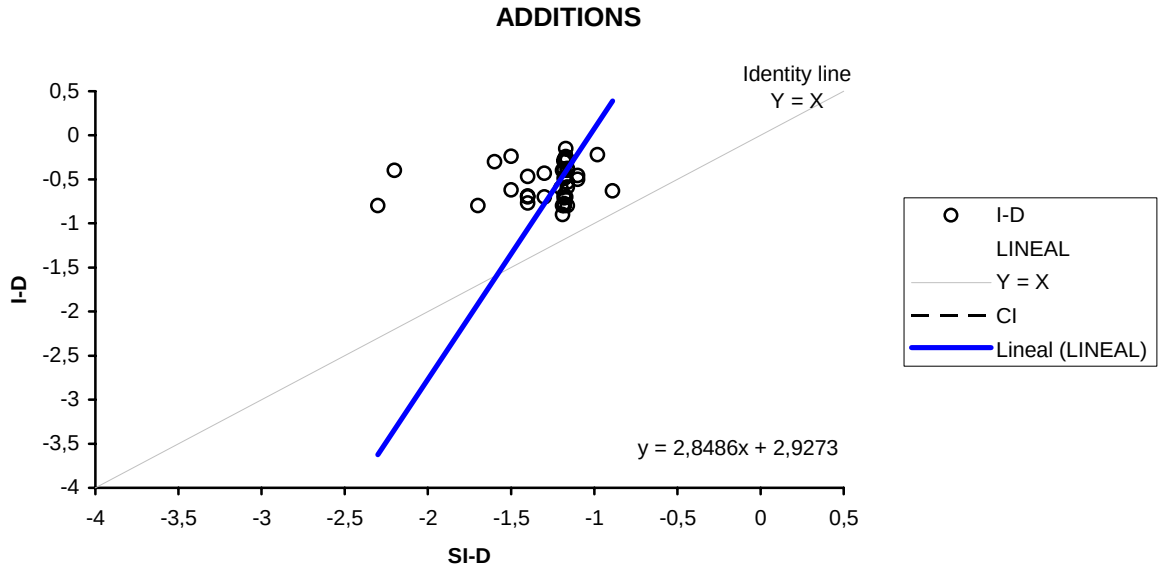
Results

Next we explain the mechanism, the lexical strategy, whose application is suggested by this proposed methodology. We might also clarify that the reading process explained earlier forms part of the optic cycle (Pennington et al., 1987).

[SIN APOYO: *WITHOUT SUPPORT* -- CON APOYO: *WITH SUPPORT*]



Graph nº 1 (a)



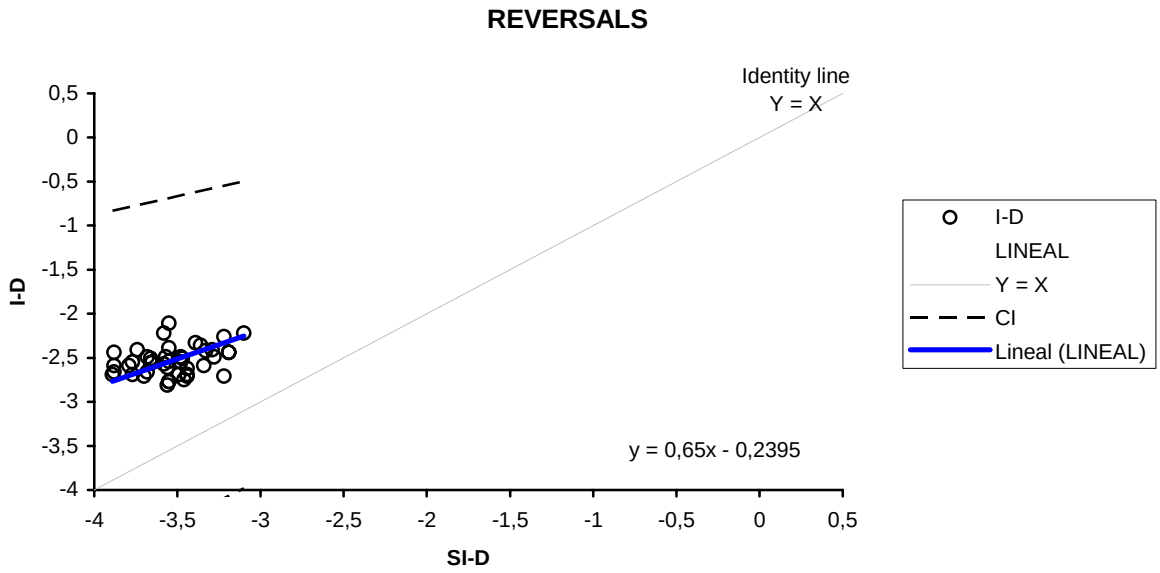
Graph n° 1 (b)

In Tables 2-4, the means and standard deviations of these variables are shown, according to Group and Time, and corresponding to the entirety of tests performed by 22 dyslexic children using visual aids and another 22 dyslexic children, who performed the same tests without visual aids.

A multivariate analysis of variance was performed for Group (CF, PH/CF, GC) x Time (pretest, post-test). Dependent variables were: phonemic awareness, perception of speech, reading of words and pseudo-words, verbal working memory and speed in accessing phonological information.

As for the effect of training in phonemic awareness, we find an interaction of group by time [$F(2.47)= 8.15$; $p <.001$]. The simple effects tests confirmed that post-test scores of the groups PH/CF and CF were higher than those of the control group ($p<.001$), but there were no differences between the PH/CF group and the CF group ($p >.10$). These results indicate that training in phonemic awareness with visual support of letters improved phonemic awareness of groups who underwent the tests, independently of whether the intervention included instruction in speech perception.

When we analyzed the effect of training on the total score of reading words and pseudo-words, we found the interaction of group by time [$F (2.47)= 7.91$; $p <.001$]. *A posteriori* contrasts revealed that the PH/CF group obtained better scores after training than did the control group ($p<.05$), but no differences were found between the CF group and the control group. In other words, training in phonemic awareness with visual support of letters did not improve reading. Developmental dyslexic persons who improved in reading of words and pseudo-words are those who participatd in the PH/CF program, which includes instruction in speech perception along with training in phonemic awareness with visual support.



Graph n° 2

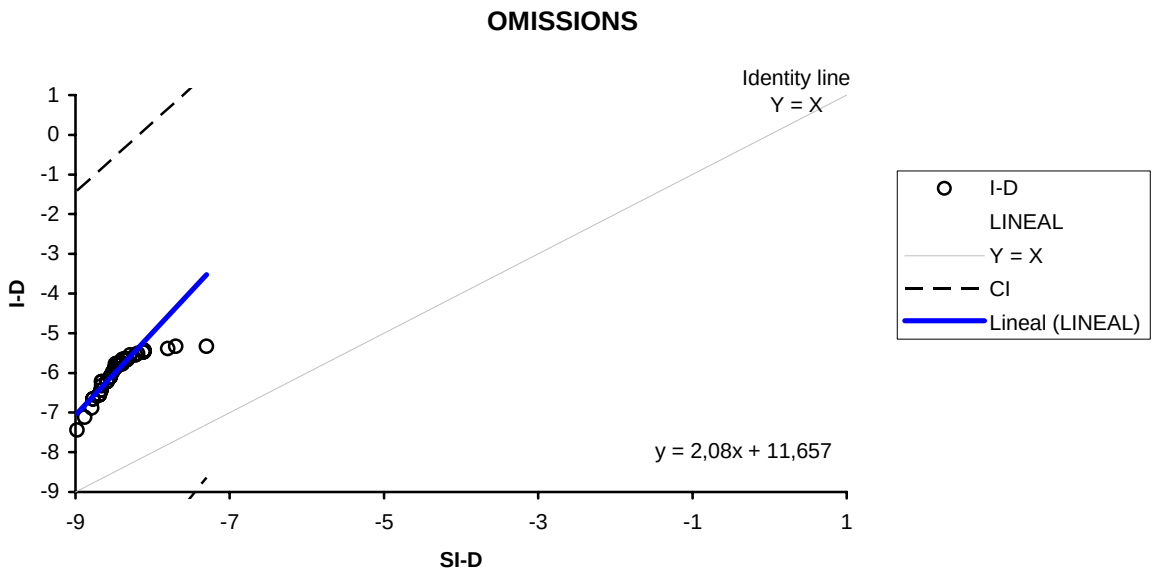
In the analysis of intervention effects on the rest of the dependent variables, we only found main effects of the time variable: speech perception (p<.05), verbal working memory (p< .01) and naming speed (p< .001). These results indicate that all groups obtained better performance on these tasks in the post-test, but training did not have any effects on these variables.

In this study's methodology, the normal reading process was taken into account, but from the perspective of the dyslexic child. This process consists of a movement which is divided into three different activities: fixation, saccadic movements and return sweep. The three movements are included in the optical cycle of the lexical strategy:

a) Fixation takes place when the eyes stop; this is the only occasion available to the dyslexic person for reading.

b) Movements between fixations are called saccadic.

c) When the eyes reach the end of the line, the return sweep saccade is produced.



Graph n° 3

Now then, we remember everything that we can visualize, imagine, or give a form or a design to. This demonstrates that we think with images. The brain does not simply record words, since they are abstract and cannot be imagined, this is why we forget 70% of what we study.

Within the reading process, this method is assigned to the moment of fixation, which takes place when the dyslexic person's eyes are stopped.

Before looking at some specific cases, for example those of an omission and a reversal, let us proceed to break down a simple schematic drawing into separate strokes that show a child, head down (Fig. 13), and which was explained to the group of dyslexic children.

The syllabic value of the figure is as follows: tu, es, pe, jo

Breakdown of the drawing into separate strokes (stenographs):

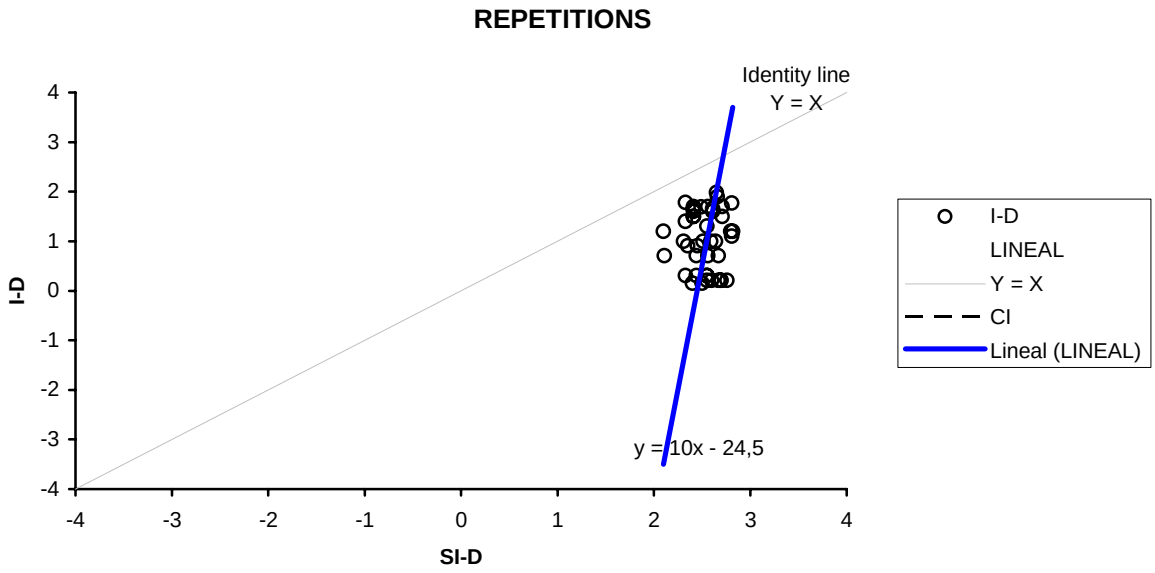
| : tu

o : es

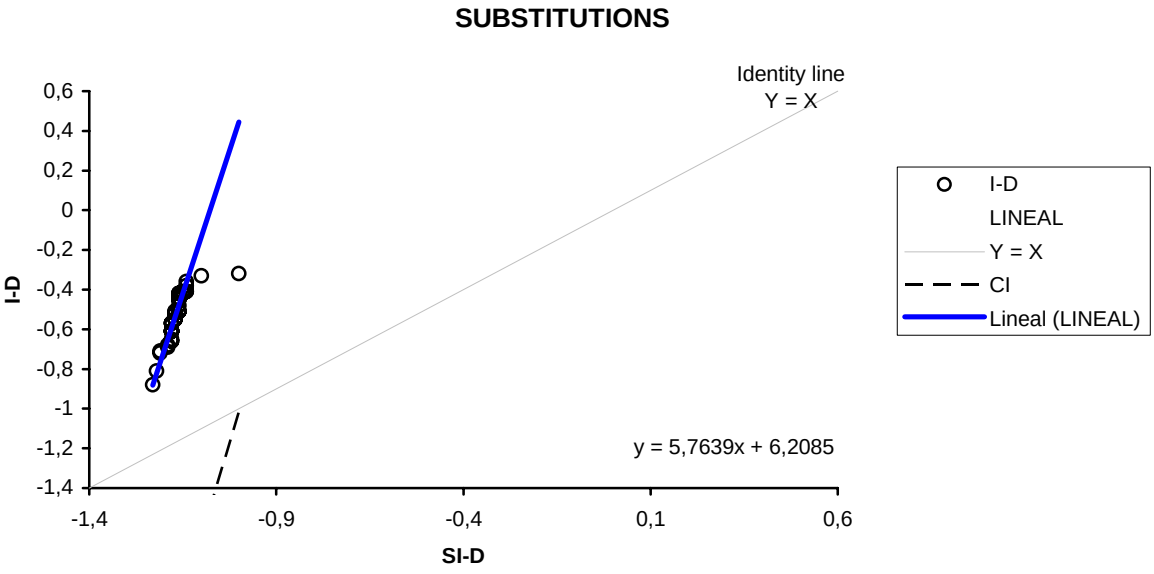
\ : pe

/ : jo

When breaking down the drawing into separate strokes we obtain the phrase: “Tu espejo” [your mirror], according to the value of each of the strokes in the stenography alphabet (Fig. 1).



Graph n° 4



Graph n° 5

Let us now look separately at the strategy to be adopted in the case of an omission, and another for the reversal case.

a) Case of syllable omission

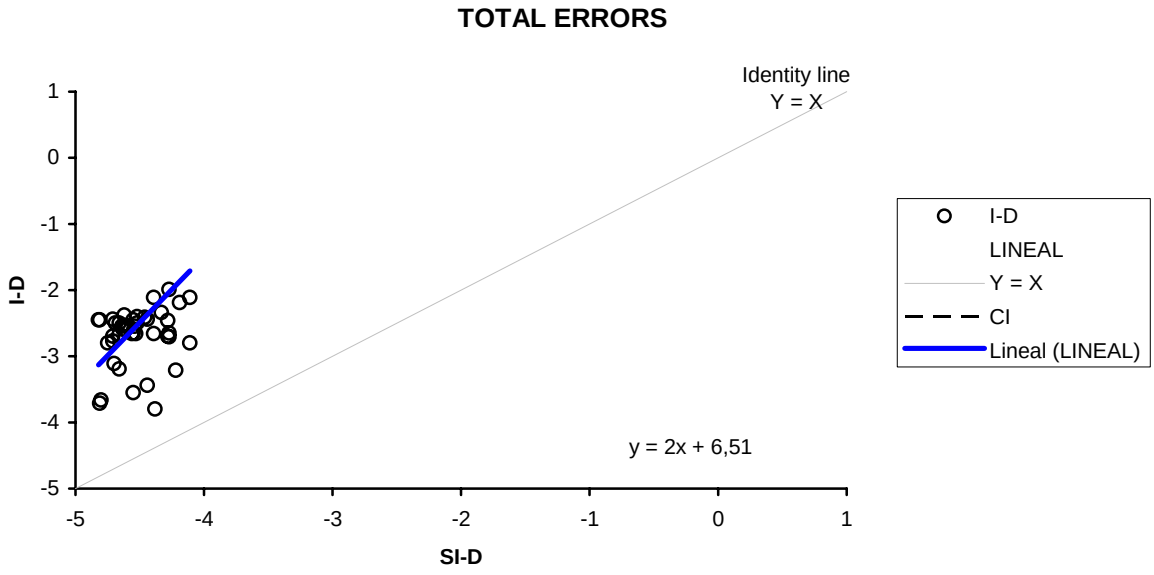
In the case that the dyslexic child writes “Tu pejo”, omitting the first syllable of the word “espejo”, the child undoubtedly will not notice his mistake. The drawing in Figure 14, however, appears without the head (which is equivalent to the syllable “es”), resulting in a figure of a child with no head.

In the eyes of the dyslexic child, the omission of the syllable “es” will appear in the drawing clearly, obviously, and with no ambiguity.

In the same way that this omission, directly related to the person’s head in the drawing, could mean a different syllable, dropping a leg or an arm from the person in the drawing also would change the symbol which the drawing expresses.

b) Reversal case

In the case that the dyslexic were to write: “Tu pejoes” (instead of “Tu espejo”), he or she may not recognize the error.



Graph n° 6

However, if the drawing in Figure 15 were to show the head up (equivalent to the syllable “es”), the image would completely change meaning, resulting in the figure of a child whose head is placed above its shoulders.

In the eyes of the dyslexic child, this reversal of the syllable “es” would appear clearly and unmistakably in the drawing, since the head would appear up instead of down.

Similarly, this reversal would involve another syllable completely changing the meaning of the drawing; for example, a different position of the person’s leg or arm in the drawing would clearly alter the signal which the drawing expresses.

Another example is when syllable reiterations are produced: “cocicina” instead of *cocina* [kitchen]. In this case, reiterating a syllable in the drawing, that is, adding another arm or leg to the person in the drawing, would make the error much more evident for the dyslexic person.

Thus, the possibility of showing the equivalent of a syllabic error in the drawing itself, that is, in the image itself, allows the stenograph to fill in the missing link in the chain which connects syllables to their words and their images.

c) Case of isolated words that cannot be associated with an image

The case of short words represents an obstacle for putting thought into an image.

Some examples are given below of how to associate the following categories of words with an image: articles, prepositions, conjunctions or auxiliary verbs (to be and to have).

Figure 16 shows two persons playing tennis, where the net that separates the two players is represented by a stenographic stroke equivalent to the syllable (preposition) “OF” (Fig. 16).

| : stroke equivalent to the preposition “of”

In the case of the preposition “IN”, a schematic drawing was used which shows a person holding a horseshoe represented by the curve stroke from the stenography alphabetic, equivalent tothe syllable “IN” (Fig. 17).

 : stroke equivalent to the preposition “in”

In the case of the article “THE”, a schematic drawing is used which shows a driver at the wheel of the vehicle, where the windshield is represented by a curved sign from the stenography alphabet, equivalent to the syllable “THE” (Fig. 18).

 : Windshield from the drawing, stroke equivalent to the article “the”

Table 1. Means and standard deviations for each of the two groups who took the TALE tests

Categories		M	SD
Letters	RL	1.48	0.57
	A	3.64	0.51
	DG	1.49	0.56
Syllables	RL	1.43	0.89
	A	3.75	0.57
	DG	1.41	0.73
Words	RL	1.49	0.82
	A	3.81	0.39
	DG	1.59	0.61

Ref. RL = Reading level; A = Chronological age; DG = Dyslexic groups

Table 2. Means, standard deviations, and "t" values according to age, pseudo-words (in ms/word), phonological incapacities, and total errors committed with words and pseudo-words.

				t	
	Group	M	SD	RL	A
Age	RL	81.2	4.15		
	A	104.81	5.05	21***	
	SI-D	105.05	7.03	15.95***	-1.81
	I-D	93.05	7.77	5.28***	-1.91
Word (latency time)	RL	272	92		
	A	163	43	-6.61***	
	SI-D	367	186	2.89**	6.41***
	I-D	53	89	-.64	5.15***
Pseudo-word (latency time)	RL	277	89		
	A	213	49	-3.81	
	SI-D	307	189	1.79	
	I-D	76	109	2.19	4.12***
Total errors (by words)	RL	5.89	2.78		
	A	3.55	3.13	-3.14	
	DG	19.98	10.09	8.11***	8.89***
Total errors (by pseudo-words)	RL	12.88	8.15		
	A	4.12	1.89	-7.01	
	DG	22.02	8.88	4.78***	10.89***
Omissions	RL	8.23	1.89		
	A	9.09	1.11	2.33*	
	DG	6.87	2.34	-3.88***	-4.87***
Reversals	RL	7.33	2.31		
	A	8.77	1.05	3.11**	
	DG	4.99	3.15	-2.79***	-7.02***

References: RL = Reading level (latency time); A = Age; DG = Both Dyslexic Groups; I-D = Dyslexics with image support; SI-D = Dyslexics without image support
*p< 05; **p<01; ***p<001

Table 3. Means, standard deviations and "t" values according to age, pseudo-words (in ms/word), for each error category of words analyzed.

				t		
	Group	M	SD	A	SI-D	I-D
Additions	RL	1.01	1.61	4.1***	.89	.8
	A	.27		.52	9.19***	
	SI-D	1.09	1.11		-5.03***	.03
	I-D	.81	.21		-.13	
Substitutions	RL	.33	.55	2.98**	3.01**	.18**
	A	.31	.23		-.53	.08
	SI-D	.08	.28		.02	.06
	I-D	.02	.22			.02
Morphological errors	RL					
	A	.20	.49	.33		.81
	SI-D	.2	.46		.88	.55
	I-D	.15	.37		.07	
Reversals	RL	.10	.31		-1.10	-.49
	A					
	SI-D	.19	.39		.17	-.55
	I-D	.25	.44			
Omissions	RL	.06	.16	-3.61***	-7.66***	-.12***
	A	.76	1.26		-6.28***	-.20***
	SI-D	9.31	7.56			.3
	I-D	1.70	1.66		.77	.06
Repetitions	RL	3.46	2.11		1.27	.17
	A					
	SI-D				.67	.04
	I-D	.05	.22		.56	.34
Total errors	RL	5.90	2.89	3.4***	-8.91***	-1.02***
	A	3.57	3.08		-9.97***	-1.95***
	SI-D	21.27	10.45		.66	-.88
	I-D	9.80	11.78		.17	-.09

References: RL = Reading level (latency time); A = Age; DG = Both Dyslexic Groups; I-D = Dyslexics with image support; SI-D = Dyslexics without image support
*p< 05; **p<01; ***p<001

Table 4. Means, standard deviations and "t" values according to age, pseudo-words (in ms/word), for each error category of pseudo-words analyzed.

				t		
	Group	M	SD	A	SI-D	I-D
Additions	RL	.77	.88	1.77	-1.08	-1.2
	A	.54	.69		-1.89	-.22**
	SI-D	1.21	2.21			.22
	I-D	1.25	1.25			
Reversals	RL	.98	.34	-.09	-3.51***	-.49***
	A	.12	.71		-3.15***	-0.96**
	SI-D	.77	1.12	-.07	1.66	.44
	I-D	.09	1.33			
Omissions	RL	1.09	2.39		-8.11***	-.68***
	A					
	SI-D	12.06	6.03			1.22
	I-D	2.80	1.16		-1.09	
Repetitions	RL	.22	.59	-13.15***	1.49*	.79
	A	2.55	.82		19.81***	2.09
	SI-D	.018	.09			
	I-D					
Substitutions	RL	5.19	4.44	.6**	-1.48	-.10*
	A	.31	.78		-7.73***	-1.15***
	SI-D	6.21	4.58		-3.03	-1.36
	I-D	.85	4.2		-.53	-0.88
Total errors	RL	12.99	8.60	6.41***	-3.11***	-.19**
	A	4.61	2.00		-11.05***	-1.81***
	SI-D	22.04	9.62	2.09	-1.03	.18
	I-D	5.50	3.40	1.03	-.08	.07

References: RL = Reading level (latency time); A = Age; DG = Both Dyslexic Groups; I-D = Dyslexics with image support; SI-D = Dyslexics without image support
*p< 05; **p<01; ***p<001

Discussion

Results of this study indicate that the majority of dyslexic children with reading disability, as were the object of this research, do not present difficulties in interpreting our proposed method. Consequently, it seems evident that the practice of subjecting dyslexic children to the traditional syllabic reading method, which itself is undergoing constant improvement, is not the most helpful approach for these children in learning to read.

In order to find the link between syllable and image, the dyslexic person must see the syllable, itself an abstract concept, as something which can be associated with an image which is also abstract, unreal, that is, something like fiction. On the other hand, words devoid of meaning for the dyslexic are those which he or she cannot associate with an image.

In effect, for dyslexic persons to be able to remember the logical order of syllables within a word, there is a link missing in the chain. One must develop a strategy that helps them find and retain the correct order of syllables in order for the word to have meaning, that is, in order for the word in turn to be associated with an image.

It is not a question of lack of memory, but rather a technique, a way of reasoning, or better put, an exercise which allows the dyslexic person to be able to memorize, and so remember the order of syllables within the word -- which syllable goes first, which one after, so as not to fall into omission or reversal of syllables.

For example, if the dyslexic person remembers that before “pa-to” he or she must write the syllable “za”, and that only then can it be associated with the corresponding image for the word “zapato” [shoe], the same would occur with “serita” and “señorita”, or with reversals, such as: “parajito” and “pajarito”, “catera” and “cartera”.

Given this logic, syllables -- meaning nothing more than a part of a word -- represent for the dyslexic person a transitory state where he or she is powerless to associate an image with the word composed of these syllables (Ferreiro et al.). What the dyslexic person does not understand is how it is possible for a word to be fragmented, the word being for him a whole image, indivisible, something impossible to break down into pieces.

Thus, a technique is required which will allow the dyslexic person to break a word down into syllables without having to abandon associating it with an image. This study, then, is based on a strategy which allows the syllable, which is part of the word, to also be part of an image.

By way of synthesis, that is, as a final conclusion, the result of this study, apparently simple, encompasses a whole series of assessments which were made over the course of the investigation. Their purpose is to evaluate the LT of the pupils being studied, and to determine their additions, substitutions, reversals, omissions and repetitions.

In order to limit final conclusions to those that respond to the research problem put forward, we have followed lines of thought that proceed from the theoretical framework of dyslexia in all data collection, processing and analysis.

All the information analysed was taken into account when drawing final conclusions as shown below, including notes that were drawn up and partial findings that were recorded from the reading tests earlier described.

For the statistical tables, findings from each table were compared to all others which were related to it. This allowed us to reach more and more generalized conclusions, less partial ones. For this purpose, summary tables were developed, synthesizing the most important information which was dispersed throughout, thus being able to present to our readers a clearer panorama. Tables 3 and 4 show results that corroborate values obtained by Jiménez González and Ramírez Santana in their research on dyslexic subtypes (Jiménez González et al., 2002), referring to those pupils who did not have the advantage of image support.

Final conclusions were drawn, which reflect the overall behavior of the variables of interest. This synthesis is expressed as a function of these variables, in concise fashion, only making note of the essential. We have attempted to present the synthesis in an orderly, precise fashion, so that the reader can clearly appreciate results obtained with the use of schematic drawings in the tests performed with the group of dyslexic pupils. Therefore, conclusions were related with correlations, keeping the original research formulation in mind, with corresponding tables and graphs (additions, substitutions, reversals, omissions and repetitions). Thus the data gathered from the reading tests allow us to deduce that the schematic drawing based on stenographs allows the dyslexic child to find a link to permit association of certain short words or syllables with the image of the corresponding word.

Furthermore, we must note that for the case of secondary data, we have proceeded as it were to try and compose or to build up the general study out of partial elements that were available. Indeed, this synthesis is an eminently constructive labor, performed partially for each of the points described in the results obtained, seeking to highlight each aspect which can reasonably be affirmed in each case, as well as the support elements which were available and which are the conclusions of the case.

Toward this end, we have written up our conclusions schematically, first in partial form and then encompassing more and more elements, until we develop the final synthesis of

this study. For the final synthesis we have progressively observed the correspondence of each of the points already analyzed, studying to what extent they complement or oppose one another and how they may be organized as a coherent whole within the complex reality of dyslexia.

The first conclusion, generally speaking, is that children studied tended to see the stenographic strokes present in the images (schematic drawings) not as abstract symbols, but as an integral part of the corresponding images, accelerating LTs, as can be seen in the data shown in Tables 2-4 and Graphs 1-6. In this respect, we must clarify that the educators charged with performing the reading tests collaborated in this sense, that is, not leading the dyslexic child to see the strokes as abstract signs, but rather, precisely as integral parts of the image in question. Several studies exist which show dyslexic children's poor ability to evoke the name of an object presented visually (Katz, 1986). It is also pertinent to remember that dyslexic persons can be slower and less precise in converting written information into a code based on phonemes (Catts, 1986).

Corroborating the opinion of some specialists, one can observe in this study that poor readers show lesser ability to repeat digits, letters, syllable sets without meaning, words or phrases. Likewise they show difficulty in discriminating among similar phonemes when repeating words (Cohen et al., 1981).

Moreoever, we would say that on the reading tests performed, different reading strategies were observed for approaching written text, since it is possible that a reading problem is due to an inadequate strategy on the part of the dyslexic individual. This study also takes into account the alexia variant, so called superficial dyslexia, where reading errors show relevance in the phonological route. On the other hand, profound dyslexia is characterized by several specific error types (paralexias) in reading isolated words. Such errors include semantic paralexias during oral reading (e.g. "heavy" becomes "light"), visual errors ("pollito" [little chicken] becomes "bollito" [little pastry]), or derivative paralexias ("running" becomes "run").

We observed this especially with multiple syllables, for example, "drala" becomes "ladra", or in the case of short words with no image. The image support helped the dyslexic individual fight against omission and reversal mistakes, which may have to do with phonemes

within a syllable or syllables within a word. The latter is what takes the name of dynamic reversals.

Therefore, the reading process during the tests performed was characterized as though it were a “linguistic game”, understood generally as a process of searching for meaning and for construction. In this sense, reading implies both processes of interpretation as well as of understanding and learning, respectively. In order for these processes to occur, the reader puts into play a so-called “lexical strategy”, as mentioned earlier, that is, the general manner in which a text is approached in order to understand it.

To end, then, more than as a criticism, it would be helpful to suggest that certain points of this study’s results could be developed more fully in future research efforts, especially with regard to certain types of dyslexia.

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Appendix

The series of 50 schematic drawings illustrated below have been built entirely with stenographs drawn from the Stenography Alphabet (see Fig. 1).

Figure 19: Series of 50 schematic drawings

o /|\ / \ (looking to the side) 31	\ o __ | / \ (swordsman) 32	__ o __ | / \ (gymnast) 33	__ o __ | __ / (tightrope walker) 34	o __ | / \ (marksman) 35
o | / \ (no arms) 36	o /|\ \ (without one leg) 37	o |) / \ (with a backpack) 38	\o | /\ (waving) 49	\o/___ /\ (playing) 40
__o|__ /\ (swordsman) 41	o _ /| == (sitting) 42	o |\ / \ (walking) 43	o__ |_ (kneeling) 44	\o/ __ |__ (jumping) 45
\o | /¬ (leaping) 46	\ o ⌠ | / \ (hockey player) 47	\ o ⌠ | / \ (shepherd) 48	o /3\ | / \ (woman) 49	o / | \ 0 (the cup of tea) 50

Table 5. List of familiar words used in the tests

	Group A		Group B	
	FL	M	SD	M	SD
Arroz [rice]	3.63	848	344	1680	811
Boda [wedding]	3.76	1004	464	1794	873
Cama [bed]	3.83	1128	940	1186	289
Comer [to eat]	3.76	843	335	1329	628
Gato [cat]	3.90	1142	2276	1360	651
Ojo [eye]	3.89	801	244	1167	459
Patio [patio]	3.67	1118	1180	1610	774
Plato [dish]	3.76	839	237	1475	784
Árbol [tree]	3.85	1300	1483	2094	1385
Cine [cinema]	3.78	1226	564	2120	1319
Fuego [fire]	3.85	884	327	1762	1021
Huevo [egg]	3.73	1454	2954	1731	712
Jugar [play]	3.82	985	419	1713	813
Largo [long]	3.69	1072	487	1874	848
Leche [milk]	3.71	1012	315	1747	1217
Abecedario [alphabet]	3.81	1584	2132	2196	1470
Adelante [ahead]	3.65	1183	498	1914	917
Amarillo [yellow]	3.65	1083	447	2345	1601
Apellido [surname]	3.81	1130	560	2095	1487
Camiseta [T-shirt]	3.81	119	660	1735	793
Divertido [fun]	3.68	1029	467	1705	942
Habitación [room]	3.73	1185	468	2156	1426
Plastilina [playdough]	3.78	961	314	1756	939
Ascensor [elevator]	3.67	992	521	1537	686
Lápiz [pencil]	3.75	1188	934	1718	848
Descalzo [barefoot]	3.76	1002	592	1939	800
Funcionar [to function]	3.68	1007	509	1735	653
Lágrima [tear]	3.66	978	372	1584	993
Desayuno [breakfast]	3.87	934	345	1807	1268
Navidad [Christmas]	3.80	1012	418	1913	878

References: FL = familiarity coefficient; A = age; RL = latency time; D = dyslexic group
M = mean; SD = standard deviation

Table 6. List of pseudo-words used in the tests

		Group A		Group B	
		M	SD	M	SD
Redas		1111	439	1592	629
Nate		1151	530	1532	695
Proce		1104	275	1949	1128
Pona		1283	1171	1598	775
Esco		1058	337	1583	791
Sunos		1146	452	1594	762
Alnes		1067	523	1395	428
Seron		1149	404	1663	792
Indos		1016	378	1538	584
Delce		1062	468	1465	490
Lasda		1237	717	1619	706
Losmo		1710	3917	1920	1677
Vendor		1527	653	2049	866
Golmar		1721	850	1929	1165
Noslla		1657	1034	1884	925
Troros		1364	678	2077	1232
Genmor		1545	671	2069	1129
Palchos		1321	539	1897	955
Polton		1411	648	1812	769
Ritgo		1307	450	1871	963
Tesgro		1328	409	1685	807
Dulle		1497	592	2092	1015
Brufas		1455	570	1793	926
Lartia		1471	1146	1763	813
Pomacos		1166	408	1586	641
Sucires		1138	347	1862	824
Jomanto		1542	1782	1802	1019
Delnico		1331	521	1817	958
Bocueto		1403	554	2300	1388
Protuto		1375	724	1913	781
Socanos		1138	27	1767	1001
Codidas		1660	961	1928	1129
Setudad		1246	420	1637	824
Unsiles		1319	1073	1656	825
Inbiles		1745	1060	2320	1583
Portuto		1383	616	2511	2203
Renpertal		2012	1437	2325	2168
Talgunbros		1647	866	1877	1382
Linsosrial		1679	1083	2080	1366
Mestruyen		1712	983	2514	1690
Benmacer		1345	541	2381	1572
Choflegio		1628	804	2166	1600
Berciclas		1528	634	2154	1182
Dosglubis		1765	975	2234	1004
Dengelio		1478	694	2045	978

References: FL = familiarity coefficient; A = age; RL = latency time; D = dyslexic group
M = mean; SD = standard deviation

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