Scliar Early Literacy System: its Successful Application to Public Schools in Brazilian Northeastern

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Abstract: In the last Pisa evaluation, in 2015 (OECD, 2016), among the 73 participating countries, Brazil occupied the 66th place. Such data demonstrate that Brazilian schools are not preparing its students to become citizens, capable of critical judgment, nor able to the qualified labor market, not to mention exclusion from the information society and the aesthetic pleasures that literature provides. As a linguist and psycholinguist, reflecting on the low education quality in Brazil, I concluded that the main cause is inadequate early literacy teaching. It lacks scientific foundations, based on cutting-edge sciences such as neuroscience, linguistics, psycholinguistics and neuropsychology; educators' continuing education, based on such fundamentals and pedagogical material, both for educators and students, prepared by specialists applying such fundamentals. I present *Scliar Early Literacy System* and its successful application to public schools in Brazilian Northeastern. The priority was to accompany educators, particularly those from Sergipe and Alagoas, because these two states were among the four worst performance in reading and writing in the last National Literacy Assessment in 2016 (INEP, 2017).

1. Introduction

The latest assessments on reading competence, both globally and nationally, report the calamity situation in Brazil. The latest report [1] (INAF, 2018) published by the most accredited institution in Brazil on functional literacy, the National Institute of Functional Literacy, INAF, showed a setback in relation to the 2009 data: in 2018, 29% of the population could not understand absolutely none of the texts that circulate socially and only 12% were fully able to understand them. In the last Pisa evaluation, in 2015, published by [2] OECD, 2016, among the 73 participating countries, Brazil occupied the 66th place!

Such data demonstrate that Brazilian schools are not preparing its students to become citizens, capable of critical judgment, nor able to the qualified labor market, not to mention exclusion from the information society and the aesthetic pleasures that literature provides. These data put researchers in the learning to read and write area the task of seeking solutions to so serious problems.

As a linguist and psycholinguist, reflecting on the low quality of education in Brazil, I came to the following conclusion: The main cause is inadequate early literacy teaching. It is at the beginning of the process that it is decided whether the student will be a good reader and whether he will be able to write the necessary texts in his/her future life. Public Brazilian policies have been inept to guarantee excellent early literacy, because they lack: (i) scientific foundations, based on cutting-edge sciences such as neuroscience, linguistics, psycholinguistics and neuropsychology; (ii) educators' continuing education, based on such fundamentals; (iii) pedagogical material, both for educators and students, prepared by specialists who apply such fundamentals.

In view of these failures, the strategy consists of working directly with the Public School Districts (acronym in Brazilian Portuguese, SEMED), which are responsible for elementary school education in Brazil. They will support early literacy teachers' continuing education and appropriate pedagogical material for both teachers and students, based on neuroscience, linguistics, psycholinguistics and neuropsychology advances.

I based the Scliar Early Literacy System foundations on theory and practice of the sciences that deal with verbal language recent advances, which are:

(i) Oral system acquisition occurs naturally and spontaneously in children who do not have major sensorimotor, perceptual or cognitive disorders: first words occur at around one year of age, while prepared educators teach the written system at school in a systematic, intensive way, when the child has reached a certain cognitive, linguistic and emotional maturity.

While oral communication is a question of man's survival, since the humanization process began, writing, understood as a secondary mode, distinct from painting, drawing or other recording means, appeared very recently (approximately 5,000 years BC).

Application: in most cases, the child needs coming to school, mainly, for learning to read and write, including mathematical symbols.

(ii) In all learning, in order to know how to produce a text, one must first know understanding it, that is, before speaking, the child must understand what adults say to him/her and thus start mastering the language, so that h/she can then say his/her first words. The same thing happens with written language: without knowing how to read, the child will not be able to understand even what h/she 'wrote'.

Application: early literacy cannot begin with the isolated teaching of writing. It can even start almost simultaneously with writing, as long as the child learns to recognize the differences between letters and the grapheme values in reading.

(iii) One of the great neuroscience discoveries is the innate neuron biopsychological programming for processing visual images, symmetrizing information [3] (Dehaene, 2012: 98). However, for the letter recognition, that is, the differences they present with each other, it is necessary recycling the neurons so that they learn to distinguish the direction of the letter features.

This requires thorough and continuous work. Therefore, I develop [4] Montessori's (1997) proposal using the various sensory inputs to the maximum to win the battle of asymmetrizing the features that differentiate letters and mathematical symbols from each other.

Application: children scroll the letter with their finger, following the teacher's commands.

(iv) Another great difficulty for a child while learning alphabetic systems is that h/she perceives speech as a continuum, that is, there is no separation between words, nor between consonants and vowels inside the syllable. To overcome this obstacle, the child must gradually understand that writing represents speech, but not exactly as perceived and that, in writing, blanks separate words. H/she should also learn that one or two letters (for the teacher, a grapheme) have a sound value (for the teacher, a phoneme). Sometimes a grapheme can always have the same value, like <**f**>, which always represents phoneme /**f**/. Other times it can have more than one value like grapheme <**c**>, which before the graphemes <**u**> <**o**> <**a**> has phoneme /**k**/ value, as in 'cube', 'color', 'case', but before graphemes <**i**> or <**e**> has phoneme /**s**/ value, as in 'cinema' or 'center' although letter 'c' continues the same, no matter its position.

Application: At the same time the child scrolls the letter with his/her finger, following the teacher's commands, h/she says the sound corresponding to the phoneme (this part concerns the phonemic awareness development), or the name of the mathematical symbol. Sensory information processed by sight, hearing, touch, somesthesia and proprioception is mutually reinforcing.

(v) In order to recognize the written word in addition to knowing how to assign values to each grapheme (formed by one or more letters) the child must know where stress falls, because in Portuguese, it may fall on the last (oxytones), penultimate (paroxytons) or antepenultimate syllable (proparoxytons). It is necessary consciously analyzing speech in this respect (phonological awareness). In addition, it is also necessary to overcome another obstacle: recognizing that words without stress (clitics), in speech attached to a stressed word, in written texts have their limits separated by blank spaces.

Application: For developing phonological awareness, by learning to assign the correct stress, in reading, children learn to clap harder on the stressed syllable and weaker on the unstressed syllables, reading aloud the key words. To automate the clitics recognition in the written text, children read them aloud, since those whose letters have already been worked on are bold in each chapter of [17] Scliar-Cabral's (2014) storybook.

(vi) To get an idea of the early literacy for writing complexity, consider all the processes involved in writing: it begins with somebody in front of a blank sheet: however simple it be, it is up to the writer to produce the text. This implies planning for what h/she is producing the message (pragmatic intentions), what h/she will write (the essential concepts) and how h/she will write, as there are several choices to make, depending on whom h/she is going to write for, the support used (phone, computer, paper, etc.). Then, h/she must develop a plan with the keywords, in the order that will guide the sequence in the ideas writing (paragraphing), whose words h/she chooses from his/her mental dictionary and gathered according to the syntax. Teachers should progressively teach all of this in early literacy for written production, choosing the simplest genres, such as invitation, notice, note, without neglecting the processes that the child must automate: the conversion of phonemes into graphemes, the gestures motor program for handwritten letters or for scanning. The final, decisive process is the review.

2. Establishing the Brazilian Portuguese alphabetic system principles

Based on the assumption that the writing system of Brazilian Portuguese is alphabetical, in order to substantiate the material for teacher's and early literacy student's training courses and the teaching material respective preparation, it was necessary, firstly, establishing the Brazilian Portuguese alphabetic system principles: the rules for converting graphemes into phonemes, for reading, and converting phonemes into graphemes, for writing. So, I [5] (Scliar-Cabral, 2003a) exhaustively formalized the Brazilian Portuguese (BP) written system decoding and encoding rules. For the PB phonological system description I followed [6] Mattoso Camara Jr. (1953), [7] Lopez (1979) and [8] Quicoli (1990). For the Portuguese orthographic system, I followed the first ruler [9] Viana (1904) and the most recent orthographic reforms.

2.1 BP written system decoding rules

BP written system is quite transparent for decoding. I classified its rules in four types:

(i) graphic context-independent, for instance, <**p**> ➤/**p**/, which reads: grapheme <**p**> wherever it appears on the written text, always represents phoneme /**p**/;

(ii) graphic context-dependent, for instance, <**om**> /_₊ <**b**>, <**p**> ➤ /**õ**/, which reads: grapheme <**om**> when it appears in the graphic context syllable final position, before graphemes <**b**> or <**p**>, always represents phoneme /**õ**/;

(iii) dependent on metalanguage and/or morphosyntactic and semantic textual context, for instance, the word in Portuguese standard canonical form, as to stress, is the paroxyton word, that is, when stress falls on the penultimate syllable. As a result, every word without a graphic stress mark, with two syllables or more, ending with the letters 'a', 'e', or 'o', whether or not followed by 's', must be read as paroxyton. This is the case of the most frequent nouns, verbs and adjectives in written BP, for instance, *casa* (house), *escreve* (he/she writes), *alto* (high).

The grapheme <**e**>, in PB, has the greatest number of decoding possibilities. For this reason, any rule that makes it easier to decide which choice is the correct is of great help for those who are learning to read. Thus, the choice between /**e**/ or /**ɛ**/, the two possible alternatives when <**e**> occupies the position in the penultimate strongest syllable, is decided between /**e**/ or /**ɛ**/, applying the morphosyntactic rules and / or semantic knowledge. It will be /**e**/, if it is the second person singular of indicative perfect tense (morphosyntactic rule), meaning 'You read', in the sentence '*Tu leste o poema muito bem*' (You read the poem very well). It will be /**ɛ**/, if it is a proper name (morphosyntactic rule), meaning 'East' (semantic knowledge), in the sentence '*New York fica ao Leste*' ('New York is to the East').

(iv) Exceptions that we need to memorize, recording them in the orthographic mental lexicon, such as: '*lixo*' ('garbage'), '*máximo*' ('maximum'), '*fixo*' ('fixed') and '*muito*' ('very')'.

2.2 BP written system encoding rules

BP written system is not so transparent for encoding rules as it is for decoding ones, but it is still very transparent. I classified its rules in five types:

(i) phonologic context-independent, for instance, /**p**/ ➡□ □ ◁**p**>, which reads: phoneme /**p**/ wherever it appears on the oral text, always converts in grapheme <**p**>;

(ii) exclusively phonologic context-dependent, for instance, /**s**/ **/#_** [+**post V, SV**]➡ <**s**>, which reads: phoneme /**s**/, when it appears in the phonologic context word initial position, before posterior vowels or semivowel phonemes always converts in grapheme <**s**> as in /su´miw/ ➡<**sumiu**> (it's gone), /´sõda/ □➡□<**sonda**> (probe), /´swava/ □ □<**suava**> (sweat).

(iii) alternatives in competition: This is the most complicated situation for the phonemes conversion into graphemes, when, to a single phoneme, in the same phonological context, several encodings can compete. For instance, /**ʒ**/ **/#_, +_** [-**post V, SV**] ➡ <**g**>, <**j**>, which reads: phoneme /**ʒ**/, when it appears in the phonologic context word or internal syllable initial position, before anterior vowels or semivowel phonemes may convert either in grapheme <**g**>, or <**j**>, as in /ʒe´lava/ □ □<**gelava**> ((it) froze), /ʒeo´va/ □ □<**Jeová**> (Jehovah), /ʒjogra´fia/ <**geografia**> (Geography).

The following two rules help minimizing competitive phonological contexts difficulties, when converting phonemes into graphemes.

(iv) dependent on morphosyntax and phonemic context. For instance, all verbs in the third person plural end in a nasalized diphthong. If the diphthong center is the unstressed nasal vowel /**ã**/ (it is the most frequent position), the unstressed vowel /**ã**/ is coded as <**a**> and the nasalized semivowel is coded as <**m**>.

For instance, /ʒe´lavãw/➡ <**gelavam**> ((they) froze). If the diphthong center is the stressed nasal vowel /**ã**/ (this occurs in all oxytone words, as in the indicative present future and in the stressed monosyllables in very few verbs, in the indicative present), the stressed vowel /**ã**/ is coded as <**ã**> and the nasalized semivowel is coded as <**o**>. For instance, /ʒela´rãw/ □ □<**gelarão**> ((they) will froze), /eS´tãw/ □ □<**estão**> ((they) are), /´vãw/ □ □ <**vão**> ((they) go).

(v) morphological derivation. Morphological derivation rules avoid overloading the orthographic mental lexicon, even in competitive contexts. Once we memorize the irregular primitive forms registered in the orthographic mental lexicon, these forms remain in the derivation, however, obeying the restrictions imposed by the new phonological context.

This is the case for tenses derivation belonging to the past tense system that are all forms of the past tense itself, the indicative more-than-perfect, and the Subjunctive past imperfect and future. For instance, all the derived forms from the primitive forms /ki´zɛ/ □ □ <**quise**> (belonging to the verb '*querer*' (to want)), /fi´zɛ/ > <**fize**> (belonging to the verb '*fazer*' (to make)) keep respectively <**s**> or <**z**>. For instance, '*Eu quis*' (I wanted) and '*Eu fiz*' (I made); '*Eu quisera*' (I was wanting) and '*Eu fizera*' (I was making); '*Se eu quisesse*' (If I want) and '*Se eu fizesse*' (If I make) and '*Quando eu quiser*' (When I want) and '*Quando eu fizer*' (When I make).

3. Structuring the Scliar Early Literacy System

3.1 Writing pedagogical material, both for educators and students

The Scliar Early Literacy System (SSA) consists of two modules, one with emphasis on reading, other with emphasis on writing. For each one, I have prepared four volumes: [10] (Scliar-Cabral, 2013), [11] (Scliar-Cabral, 2020a), are the books for scientifically substantiating educators on the processing of reading and writing and their learning. [12] (Scliar-Cabral, 2018a), [13] (Scliar-Cabral, 2020b) are the books that contain the lesson plans and instructions on how to apply each Unit, including activities for integral and interdisciplinary education. [14] (Scliar-Cabral, 2018b), [15] (Scliar-Cabral, 2020c (2018b new version), [16] (Scliar-Cabral, 2020d) are the books that contain the sheets for children to carry out activities.

Finally I wrote two storybooks [17] (Scliar-Cabral, 2014), [18] (Scliar-Cabral, 2019) for Elementary School first and second grade children, respectively, both fully illustrated, with texts of increasing difficulty, for the student to learn to read fluently and with pleasure.

3.2 Educators' continuing education

I have delivered numerous online courses, aiming at educators' continuing education for understanding and applying the most recent science findings that deal with language, in particular, with learning to read and write and adopting adequate methodologies. It is worth mentioning: The online four Courses on the SSA, sponsored by the Federal University of Santa Catarina, were weekly, lasting 1 hour, for six months and started in 2016, with an average of 400 participants enrolled in each course.

With more profound social repercussions are the weekly orientation courses for educators who are applying SSA to the Elementary School 1st and 2nd grades, belonging to the public schools in Brazilian Northeastern. The priority was to accompany these educators, particularly those from Sergipe (SE) and Alagoas (AL), because these two states were among the four worst performance in reading and writing in the last National Literacy Assessment in 2016 [19] (INEP, 2017).

In the 2016 National Early Literacy Assessment (ANA) (INEP, 2017), 2,160,601 students from Brazilian public schools were evaluated at the end of the 3rd grade of the Early Literacy Cycle, in reading and writing, among whom only 12.99% reached the aimed level (4) in reading and only 8.28% reached the aimed level (5) in writing.

Sergipe State, according to the aforementioned evaluation, had ranked last in Brazil, with only 3.02% of students at the aimed level (4) in reading, and antepenultimate place in writing, with only 1.84% at the aimed level (5). Alagoas State ranked the 4th worse place with only 4.46% of students at the aimed level (4) in reading and was the worse in writing, with only 1.68% at the aimed level (5).

I started the online guidelines for a small group of two teachers and three pedagogical advisors, who attended three classes of the 1st grade with 75 six years old children, from Lagarto, SE. By the end of their first year, in 2017, seventy children were reading with fluency and comprehension and, above all, with pleasure.

The success was so great that, in 2018, the Public School District of Lagarto increased the number of schools that received the SSA: 24 teachers and supervisors of the 1st grade started to receive my weekly guidelines online as well as the 2017 group, now attending the 2nd grade. At the 2018 end, 365 children from the 1st year could read and 65, who had learned to read in 2017, now attending the 2nd grade were planning and writing legible invitations in cursive.

In 2019, the Public School District of Lagarto increased still more the number of schools that received the SSA: 30 teachers of the 1st grade received my weekly guidelines online and those attending the 2nd grade reached the number of 13, while the number of supervisors went up to 7. The project benefit more than 1000 children in 2019.

4. Scliar Early Literacy System Validation

4.1 Method

In order to test Scliar Early Literacy System validation, two master degree students have developed an experiment guided by Scliar-Cabral: first graders from two primary schools in Florianópolis, Brazil belonged to an experimental (EG) and a control group (CG). They spent three hours each week training the teacher and an additional three hours in the classroom.

The EG 16 subjects (10 girls and 6 boys, mean age 6.02) were 1st grade students at a private primary school in Florianópolis (Ingleses neighborhood). Most of the subjects' families lived in the neighborhood and consisted largely of self-employed workers and service providers. Regarding the parental education level, most of them had completed high school and a minority had some higher education. The teacher was a pedagogue with specialization in early childhood education and initial elementary education, serving as a teacher for four years. It was the first time that she had taught 1st grade children, using SSA.

The CG 16 subjects (7 girls and 9 boys, mean age 6.10) were 1st grade students at a private primary school in another Florianópolis neighborhood (Santinho neighborhood). Most of the subjects' families lived in the neighborhood and consisted largely of public employees and business executives. Regarding level of education, most parents had higher education. The teacher was a pedagogue with a specialization in early childhood education and initial elementary education. She had been working with elementary grade students for eight years, four of them with Early Literacy

learning. She consistently adopted Emilia Ferreiro's Piagetian approach. There was no researchers' intervention in the Control Group.

The experimental and intervention research began in 2011. The research instruments included a psycho-sociolinguistic questionnaire, the instruments of pedagogical intervention, and the assessment instrument, the battery [20] (Scliar-Cabral, 2003b: 119-250), *Reception and production of verbal language* consisting of nine tests, as follows: The test of auditory reception, The test of oral sentence comprehension, The test of word oral production, matching with pictures, The test of sentence oral production, matching with pictures, Grapheme-phoneme test, Phoneme-grapheme test, Reading aloud a story and Reading comprehension test.

4.2 Results

Due to lack of space, I will only present the results of the grapheme-phoneme test. It is, however, worthnoting that, among the 16 subjects in the EG, twelve of them became literate after seven months of exposure to SSA and only four did not. At the end of experiment, the twelve subjects fluently read a story presented to them for the first time and their performance filmed and recorded. Only one of the subjects in the CG managed to read fluently.

You may see data for the grapheme-phoneme test in Figure 1. These are the hypotheses:
H0: The grapheme-phoneme test average values of the two groups are statistically identical and the differences between them are determined randomly.
H1: The grapheme-phoneme average values of the group that used SSA are statistically greater than the average values for the group that did not use it.

Using the confidence level of 5% ($\alpha = 0.05$), with degree of freedom (df) 30, we obtained a p-351 value of 0.01 as a result of a t test (independent samples, two-tailed test, equal variances). This value is below the limit for acceptance of the null hypothesis, that is $p > \alpha = 5\%$. Thus, there is no more than 1% chance that the differences between the averages of data from the two classes are randomly determined. The effect size was large, with a Cohen's d value of 0.97.

The test results indicate that the application of SSA influenced the EG performance.
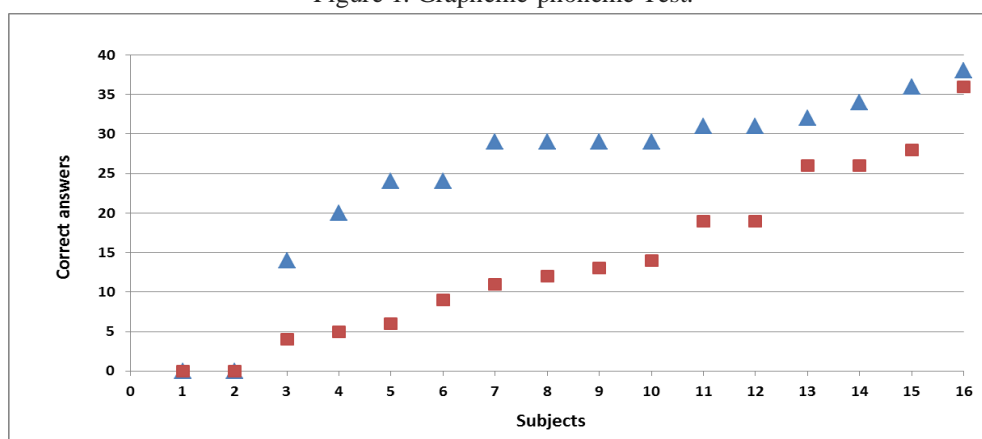
Figure 1. Grapheme-phoneme Test.

Figure 1.Total number of correct answers, given to 38 questions, reflecting grapheme-phoneme correspondences for two independent groups of subjects. (The triangular points show the results for EG that used the SSA and the squared points show the CG that used Emilia Ferreiro's Piagetian approach). Within each group, you observe ordered points from the lowest to highest scores along the x-axis.

Only one subject belonging to the EG got all the answers correct and two belonging to the EG and the CG got almost all the answers. The other eight subject's performance in the EG was better than that of the following three subjects in the range, and the following two subjects in the EG performed better than the next ten subjects in the CG. The four subjects belonging to the EG who fared the worst have problems in their exposure to the intervention or display cognitive and behavioral problems.

5.   Concluding remarks

All these data led us to question the educational policy in Brazil for early literacy development - the decisive occasion for deciding students' reading and writing competence, therefore, to become citizens, capable of critical judgment, able to the qualified labor market, not to mention inclusion in the information society and able to enjoy the literary aesthetic pleasures.

Consequently, I designed Scliar Early Literacy System aimed at forming and training of personnel involved with early literacy, as well as the preparation of teaching materials for educators and children. As it turned out, the design is based on a new approach, firstly, recycling neurons so that they learn to distinguish which, how many and how the invariant letter features combine; secondly, developing phonemic awareness, automating the grapheme-phoneme relations; thirdly, developing phonologic awareness, assigning stress to words, as well as developing the ability to delimit words, including clitics. Another contribution is to highlight the difference between processing and learning to read and write.

I sought such contribution foundations in the most recent findings of the sciences concerned with the verbal language processing and its learning: neuroscience, linguistics, psycholinguistics and neuropsychology.

To conclude, I would like to demonstrate the change that can be achieved in two years (in the Elementary school 1st and 2nd grades), when preparing teachers and material for educators and students, based on scientific advances and with the support of Public School District policies.

Remember that in the National Literacy Assessment (ANA), [19] (INEP, 2017) in 2016, the State of Sergipe occupied the last place in reading. Almost half of the children were at level 1 (45.28), that is, they could not even read a word.

At the end of 2018, a new national assessment was applied to children who were completing their second grade, called More Early Literacy [21] (Ministério de Educação, 2018), this time with three levels for reading. See how children from the two Lagarto schools, who received SSA benefit, performed:

Level:	1	2	3 (aimed)	4 (aimed):
ANA, 2016 Sergipe	45,28			3.02
MAIS ALFA, 2018 Lagarto				
Schools: **Raimunda Reis**	8.7	56,5	34.8	
Manoel de Paula Menezes Lima	9.1	59.1	31.8	

Table 1. Reading performance results in Sergipe (2016) and Lagarto (2018).

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