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Validating Scliar's early literacy system: The grapheme-phoneme relation

Validação do Sistema Scliar de alfabetização: a relação grafema-fonema

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Abstract: The main purpose is discussing Scliar's Early Literacy Development System (SSA) first validity evidence. Method: Sixteen subjects (10 girls and 6 boys) comprised the Experimental Group, EG (mean age 6.02) and 16 subjects (7 girls and 9 boys) formed the Control Group, CG (mean age 6.10). At the experiment beginning, the EG was submitted to an intervention program based on SSA. Two master degree students developed the experiment, guided by Scliar-Cabral, during 2011. They visited the EG's school twice each week. After this intervention, both groups read aloud a list of 38 pseudo-words with four or five graphemes, one of the tasks composing the *Battery of Reception and Production of Verbal Language* (Scliar-Cabral, 2003b, 119-250). Each pseudo-word was signaled by the experimenter. The task was designed to assess children's ability to convert a grapheme into its correspondent phoneme. Results: Using the confidence level of 5% ($\alpha = 0.05$), with freedom (df) degree 30, we obtained a p-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 the null hypothesis acceptance, that is $p > \alpha = 5\%$. Thus, there is no more than 1% chance that the differences between the data averages from the two classes are randomly determined. The effect size was large, with a Cohen's d value of 0.97. Test results indicate that SSA application influenced the experimental group performance.

Keywords: Scliar's Early Literacy Development System (SSA); intervention program; grapheme-phoneme test; validity; effect size.

Resumo: O objetivo principal é discutir a primeira evidência de validade do Early Literacy Development System (SSA) de Scliar. Método: Dezesseis sujeitos (10 meninas e 6 meninos) formaram o Grupo Experimental, GE (média de idade 6,02) e 16 sujeitos (7 meninas e 9 meninos) formaram o Grupo Controle, GC (média de idade 6,10). No início do experimento, o GE foi submetido a um programa de intervenção baseado em SSA. Dois alunos de mestrado desenvolveram o experimento, orientados por Scliar-Cabral, durante o ano de 2011. Eles visitaram a escola do GE duas vezes por semana. Após essa intervenção, ambos os grupos leram em voz alta uma lista de 38 pseudopalavras com quatro ou cinco grafemas, uma das tarefas que compõem a Bateria de Recepção e Produção da Linguagem Verbal (Scliar-Cabral, 2003b, 119-250). Cada pseudopalavra foi sinalizada pelo experimentador. A tarefa foi projetada para avaliar a capacidade das crianças de converter um grafema em seu fonema correspondente. Resultados: Utilizando o nível de confiança de 5% ($\alpha = 0,05$), com liberdade (df) grau 30, obtivemos um valor de p de 0,01 como resultado de um teste t (amostras independentes, teste bicaudal, variâncias iguais). Esse valor está abaixo do limite de aceitação da hipótese nula, ou seja, $p > \alpha = 5\%$. Assim, não há mais de 1% de chance de que as diferenças entre as médias dos dados das duas classes sejam determinadas aleatoriamente. O tamanho do efeito foi grande, com um valor de d de Cohen de 0,97. Os resultados dos testes indicam que a aplicação do SSA influenciou o desempenho do grupo experimental.

Palavras-chave: Early Literacy Development System (SSA) de Scliar; programa de intervenção; teste grafema-fonema; validade; tamanho do efeito.

Introduction

The motivation for building Scliar Early Literacy System (SSA) was the alarming results presented on the performance of Brazilians in reading and writing, both in international and national assessments.

When the experiment was applied to validate the SSA, the results obtained by INAF, the most accredited Brazilian institution on functional literacy, were released. According to Paulo Montenegro Institute's classification (*INAF*, 2012), there are four levels of functional literacy: level 1, illiterate, who cannot perform simple tasks involving decoding of words and phrases; level 2, rudimentary level, people who can read titles or phrases with explicit information, level 3, basic level, people able to read a short text with explicit information or requiring a low inference processing, and level 4, full level, people able to read longer texts, to find and to relate more information, comparing several texts and identifying sources. The numbers of functionally literate individuals in Brazil, according to 2012 INAF's data, were alarming: 6% of illiterate persons were found in the age group 15-64 years, 21% people in the rudimentary level, 47% at the basic level and only 26% achieved the full level. This means that only 26% of Brazilians could be considered included in the contemporary society - the information society. Additionally, the PISA report, from 2011 (Oecd, 2011) stated the very low performance of Brazilian students in the 15 years old age group in language, math and science.

Such data demonstrated that Brazilian institutions were not preparing its students to become citizens, able for 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 me the task of seeking solutions to so serious problems.

As a linguist and psycholinguist, reflecting on the low quality of basic education in Brazil, I came to the following conclusion: The main cause was 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 had been inept to guarantee excellent early literacy, because they lacked: (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 could apply such fundamentals.

Consequently, I formulated the SSA, based on the cutting-edge sciences advances that deal with the oral and written verbal language structure, functioning, acquisition and learning: neuroscience, linguistics, psycholinguistics and neuropsychology. The essential theoretical foundations are explained below.

1. Theoretical framework

An excellent early literacy aims at preparing readers able to critically understand texts, which circulate socially and able to write what is adequate to their intentions, in different communicative situations.

For this purpose, the SSA was created, with methodology, scripts for applying the Units, reading and writing books for teachers and students and their respective activity notebooks, scientifically based.

Reading neuroscience has proven (Dehaene, 2012) that the processing at the lowest levels, the filling of invariant features allows us differentiating one letter from another in the left ventral occipital-temporal area (the Visual Word Form Area, VWFA). It demonstrated that neurons in mammals are programmed to process the visual signal symmetrically, since, for survival it is economically efficient to disregard the differences that may eventually exist between cues to the left and to the right side, or between bottom and top for perceiving any object at sight (Tamura, Tanaka, 2001). So, in order to develop early literacy, left ventral occipital-temporal area visual neurons must be recycled for recognizing those feature differences, sometimes the sole one between two letters, as, for instance, in the stimulus 'pudo', which could be read as /'budU/, or /'kudU/, instead of the correct /'pudU/, if the child's reading

neurons had not been recycled by an efficient early literacy.

During the learning alphabetic principles first year, the Visual Word Form Area (VWFA) appears in the left occipitotemporal ventral area, as demonstrated during neuroscience experiments (Monzalvo et al., 2012) and other neuroscience studies (Dehaene et al., 2010, Polk & Farah, 2002). During the course of learning how to read, neurons located in this region must learn how to block the brain mechanisms underlying mirror generalization in favor of recognizing relevant differences among feature directions, when processing written words. The break-down of symmetric processing takes place only for written word recognition.

However, recognizing the invariant features that differentiate one letter from another, in the case of written Portuguese, which adopts the Latin alphabet, the most widespread worldwide, among alphabetic systems, is not enough: a more abstract and complex processing is necessary, that of graphemes; they indissolubly represent phonemes, into which they are converted during reading, both distinguishing meanings, in the written and oral words, respectively. In our mind, phonemes are synthesized into phonetic syllables undergoing numerous modifications, due to the co-articulation between the segments (internal sandhi) and the sociolinguistic variety to which the speaker belongs, and these into words, which, in turn, are synthesized in the word, in the 'inner speech', forming sentences, temporarily processed by working memory.

In their three-component working memory model, Baddeley and Hitch (1974) propose the phonological cycle, also known as articulatory, which is responsible for the acoustic verbal representation, that is, the internal speech (Baddeley, 1992). Levelt (1989) proposes that inner speech has a phonetic representation, therefore, after phonetic encoding.

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. I (Scliar-Cabral, 2003a) exhaustively formalized the Brazilian Portuguese (BP) written system decoding and encoding rules. For the PB phonological system description I followed Mattoso Camara Jr. (1953), Lopez (1979) and Quicoli (1990) proposals. For the Portuguese orthographic system, I followed its first ruler, Vianna (1904) and the most recent orthographic reforms, except the Portuguese Language New Orthographic Agreement (*Novo Acordo Ortográfico da Língua Portuguesa*), signed on 1990, but only officially adopted in Brazil, on January 1st, 2006, after my 2003a book.

As written Brazilian Portuguese (BP) is quite transparent for reading, many graphemes will always be converted into a single respective phoneme, as it is the case of <p> converted into /p/; <b> converted into /b/; <t> converted into /t/; <d> converted into /d/; <f> converted into /f/; <v> converted into /v/; <á> converted into /´a/ and <ss> converted into /s/.

Other conversions will be dependent on graphemic context, such as grapheme <c> value before [+post] or [-post] vowel context, as in <*cacei*> (Eng. I hunted); they can also be dependent on the metalanguage and/or the morphosyntactic and semantic context, such as the first grapheme <o> conversion in the word <*gosto*> in <*Eu gosto de música*> (Eng. I enjoy music), or in <*O gosto por música*> (Eng. The taste for music).

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 indicative perfect tense second person singular (morphosyntactic rule), meaning 'You have read', in the sentence '*Tu leste o poema muito bem'* (Eng. You have 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*' (Eng. 'New York is to the East').

There are exceptions that the student needs to memorize, recording them in the orthographic mental lexicon, such as: '*lixo*' (Eng. garbage), '*máximo*' (Eng. maximum), '*fixo*' (Eng. fixed) and '*muito*' (Eng. very).

In conclusion: letter is not the same as grapheme. In the word 'missa' (Eng. mass), we have five letters and four graphemes <m>, <i>, <ss>, <a>, the last ones representing four phonemes: /'m/, /i/, /s/, /a/.

In addition to a new approach to phonemic awareness development, I added to it developing phonological awareness, namely, developing the ability to delimit words, including clitics, as well as assigning stress to words, while reading.

While the SSA works with neuronal recycling at the moment when, under the educator's commands, the child follows the letter tracing with his finger, grapheme recognition occurs simultaneously when the child emits the sound that performs the phoneme represented by the grapheme (phonemic awareness). As can be inferred, to support learning, Montessori's (1997) proposal was used for triggering the various sensory inputs to get asymmetrizing the features that differentiate letters and mathematical symbols from each other and to develop phonemic awareness.

Phoneme is not synonymous with sound, a common confusion in academic literature, although, for the child, we used expressions such as "the sounds of letters", due to the terms 'phoneme' and 'grapheme' abstract nature.

Since this paper main purpose is discussing SSA first validity evidence, we will examine its methodology.

2. Methodological framework

Method: Sixteen subjects (10 girls and 6 boys) comprised the Experimental Group, EG (mean age 6.02) and 16 subjects (7 girls and 9 boys) formed the Control Group, CG (mean age 6.10). At the experiment beginning, the experimental group was submitted to an intervention program based on SSA.

Two master degree students, Miriam Maia de Araújo Pereira (2012) and Lidiomar José Mascarello, developed the experiment, guided by Scliar-Cabral, during 2011. They visited the EG's school twice each week. After this intervention, both groups read aloud a list of 38 pseudo-words with four or five graphemes, which is one of the tasks that compose the Battery of Reception and Production of Verbal Language (Scliar-Cabral, 2003b, 119-250). Each pseudo-word was signaled by the experimenter. The task was designed to assess children's ability to convert a grapheme into its correspondent phoneme.

Each word was built to measure written words recognition specific abilities. For instance, with the 'zogo' stimulus, we were testing whether the child, instead of recognizing the letter that performs the grapheme, which represents the phoneme /z/, reading /'zogU/ guesses the word, accessing /'ʒogU/ directly in his/her phonological mental lexicon. On the other hand, if he/she have been taught by the letter name, he/she would read the third grapheme <g> performed by letter 'g' as /'ʒ/ and will convert the second and fourth graphemes <o> into phoneme /ɔ/, which appears in the letter name, resulting in /zɔʒɔ/.

The EG´s sixteen subjects were 1st grade students at a private primary school in Florianópolis (Ingleses neighborhood). The researchers identified that the two subjects, who failed to become early literate showed cognitive and behavioral problems, which required more serious intervention. Most of the subjects' families lived in the neighborhood and consisted largely of self-employed workers and service providers. Regarding the parents' education level, most of them had completed high school and a minority had some higher education.

The teacher was trained in pedagogy with a specialization in early childhood education and initial elementary education and had served as a teacher for four years. It was the first time that she had taught 1st grade children, using SSA.

The control group sixteen subjects were 1st grade students at a private primary school in another

neighborhood Florianópolis (Santinho). Most of the subjects' families lived there and consisted largely of public education employees and business executives. Regarding the parents' education level, most of them had higher education. The teacher was trained in pedagogy 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, adopting Brazilian Emilia Ferreiro's approach. There was no researchers' intervention in the CG.

The experimental and intervention research began in 2011. Before starting it, researchers obtained consent from the school chief-officers and from the children's parents. The second step was establishing the theoretical fundamentals for the experimental group teacher, as well as her training for intervention with children. The training was offered twice a week: on the first day the weekly plan was discussed and activities organized together with learning materials, and theoretical questions were answered; on the second day the two researchers worked directly at classroom, observing teacher and students' performance and intervening in the activities.

The research instruments included a psycho-sociolinguistic questionnaire to get a profile for each subject, the pedagogical intervention tools already mentioned and the assessment battery, "Reception and production of verbal language", applied at the end of the experiment, in both Groups to assess the intervention effects, using SSA. The battery consisted of nine tests, as follows:

- The auditory reception test aimed at detecting whether the subject perceived the phonetic features that distinguish word meanings in Brazilian Portuguese, BP. The experimenter (E) sat behind the child and said a word, which the child had to match to one of six pictures.

- The oral sentence comprehension test aimed at evaluating the subject's competence understanding either simpler sentences or more complex ones. The experimenter sat behind the child and said a sentence, which the child had to match to one of four pictures.

- The oral word production test, matching with pictures, aimed at detecting the subjects' control of their sociolinguistic variety articulating gestures. The experimenter pointed to one of six pictures and the child had to label it.

-The oral sentence production test, matching with pictures, aimed at detecting the subject's competence to plan and execute either simpler sentences or more complex ones. The experimenter pointed to one of six pictures and the child had to produce a sentence.

- Grapheme-phoneme test: The subject had to read aloud a pseudo-word with four or five graphemes, signaled by the experimenter and designed to assess the subject's ability to convert a grapheme into its corresponding phoneme, following the Brazilian Portuguese alphabetic system principles and/or their ability to perceive written features distinguishing each letter from the others, in particular, letters that mirror each other.

- Phoneme-grapheme test: The subject had to point to one of five specially designed words, after hearing an oral stimulus delivered by the experimenter, to verify in a controlled manner whether the learner had automated the coding rules of phonemes into graphemes. Observe the five first words of the test, from which the subject must choose after hearing the oral stimulus /´pudo/:

Chart 1. Phoneme-grapheme test.

pudo	**budo**	**qudo**	**lopa**	**pude**

Source: Scliar-Cabral, L. (2003b, 195).

Depending upon which item the subject pointed to, the experimenter could infer whether the subject was illiterate when he/she systematically pointed to the pseudo-word whose graphemes did not represent the stimulus phonemes. For instance, in the list of five bold words, when the experimenter said /´pudo/, if he/she pointed to lopa, this would indicate an absence of the coding rules.

One could also verify if the subject was unable to convert phonemes into graphemes, when, listening to an unfamiliar word, he/she was only able to write memorized words, pointing systematically to words that were already in his/her mental lexicon (for instance, if the experimenter said the pseudo-word in English /sɪd/ and the subject signaled the word sit; in the list of five bold words, when the experimenter said /ˊpudo/, he/she pointed to *pude* (I could, in English)).

- Reading aloud a story: This test allowed the experimenter to check whether the subject had or not automated the rules for grapheme-phoneme correspondence, presenting fluent reading with appropriate intonation patterns and whether he/she showed no inadequate pauses or hesitations, or, on the contrary, whether he/she showed pauses or hesitations detecting disfluency. The reading passage was an unknown fictional narrative, containing a setting, three characters, and three episodes, one of them with dialogue.

- Reading comprehension test: The story was read silently, then there were correct and incorrect inferences from the story material, among which the child had to mark the correct ones.

4. Results

The application of the oral, auditory reception, oral sentence comprehension, oral word production and sentence oral production test results demonstrated that there was no significant difference between the experimental group and the control group. Only those in which the SSA came into play showed significant differences in the other tests. However, taking into consideration the number of tests applied and for sake of brevity, only the detailed results for one of the tests is presented in this paper - the grapheme-phoneme correspondence test.

It is, however, worth noting that, among the sixteen subjects in the experimental group, twelve of them became literate after seven months of exposure to SSA and only four did not, for reasons to be explained later. At the experiment end, the twelve subjects who did attain literacy were able to fluently read a story presented to them for the first time; their performance was filmed and recorded. The readings were phonetically transcribed and then analyzed according to categories to detect lack of fluency. Only one of the subjects in the control group managed to read with fluency.

Of the four subjects in the experimental group, who did not develop early literacy, the first one, after two months of the school year start, moved with his family to Uruguay and only returned in October, having not been instructed with SSA. The second subject started attending school only in April (observe that Brazilian Elementary school starts in February), when the other students were already well advanced in the System. In addition, the child's family, unlike other students' families, never attended the school meetings, and there was no learning reinforcement at home.

The other two subjects who failed to become literate showed cognitive and behavioral problems that required more serious intervention, as mentioned previously. An inclusion policy in Brazil results in such children receiving equal attention from the teacher, but he/she is not able to give them the special treatment.

Data for the grapheme-phoneme test are shown in Figure 1 with the following 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 the SSA are statistically greater than the average values for the group that did not use the system.

Using the confidence level of 5% ($\alpha = 0.05$), with degree of freedom (df) 30, we obtained a p- 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 experimental group performance.

Figure 1. Grapheme-phoneme Test.

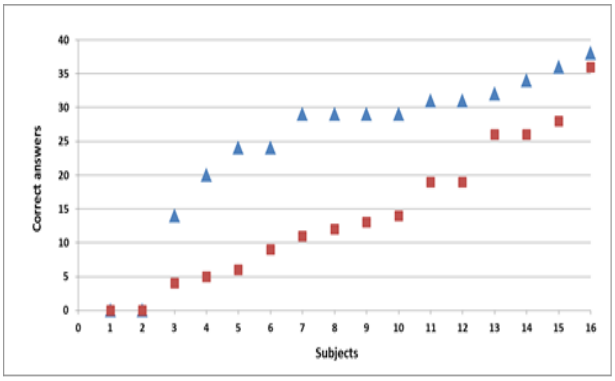

Figure 1. Correct answers total number, given to 38 questions, reflecting grapheme-phoneme correspondences for two independent groups of subjects. (The triangular points show the results for the experimental group that used the SSA and the squared points show the control group that used Brazilian Emilia Ferreiro's approach). Within each group, the points are ordered from the lowest to highest scores along the x-axis.

As can be seen from Figure 1, only one subject belonging to the experimental group got all the answers correct, and two belonging to it and to the control group got almost all the answers, but the performance of the other eight subjects in the experimental group was better than that of the following three subjects in the range, and the following two subjects in the experimental group performed better than the next ten subjects in the control group. The four subjects belonging to the experimental group who fared the worst have already been discussed in this paper.

3. Discussion

I sought to investigate what programs had achieved the best results in preventing functional illiteracy, and the advances made by science to better understand the processes involved in reading and their learning. As a consequence, I designed SSA aimed at personnel involved with early literacy forming and training, as well as the teaching materials for children preparation. The Scliar training program was inspired by Dehaene's work, who has reported fMRI data: emphasis was focused on vision neuronal recycling for automating the invariant features that distinguish letters recognition and also on a new approach to phonemic awareness and phonological awareness development, expanding the last one with developing the ability to delimit words, including clitics, as well as assigning stress to words. It was particularly important to distinguish between phonemic awareness and sound discrimination.

Another contribution was drawn from Montessori's concept on multisensory learning, in which the more senses are triggered, the better the learning. So, extending Montessori's ideas, vision, hearing, touch, proprioception, and kinesthetic senses were driven to help the child's direction of letter features recognition and the grapheme phoneme association.

However, this system needed to be validated, which occurred during the 2011 experiment reported in this paper.

Unfortunately, the situation did not improve in Brazil, as public literacy policies continued to insist on theories without a scientific basis, such as that there is a continuity in the transition from oral to written language, which we can infer from the Brazilian Education Ministry's National Common Curriculum Base (BNCC) statement: "Language has two dimensions: it is oral and written. Thus, their learning considers the continuum between orality and writing" (Brasil, 2017, 63).

But, on the contrary, discontinuities prevail between the spontaneous oral system acquisition and the reading and writing learning, which therefore requires very well-founded educators, as well as all the pedagogical material based on scientific advances to face early literacy challenges.

The latest report (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 OECD, 2016,

among the 73 participating countries, Brazil occupied the 66th place!

4. Conclusions

The discussed data referred namely to the grapheme-phoneme test, which demonstrated SSA positive effect on the EG, compared to the CG. For this part, the subject had to read aloud a pseudo-word with four or five graphemes, signaled by the experimenter and designed to assess the subject's ability to convert a grapheme into its corresponding phoneme, following the BP alphabetic system principles and/or his/her ability to perceive written features that distinguish each letter from the others, and in particular, mirroring. The test results indicated that the application of Scliar's Early Literacy Development System influenced the EG 's performance, since the effect size was large, with a Cohen's d value of 0.97.

The four subjects belonging to the EG, who fared worse have already been discussed as displaying problems in their exposure to the intervention, or having cognitive and behavioral problems.

These results are similar to those obtained in the test of reading aloud, although the data were not presented in the current paper. In this test, categories were computed as number of full and empty pauses, repetitions, guessing, closed external sandhi rupture, and mistakes. It was also checked if the reader had monotone or expressive reading.

The experimental results validated Scliar's Early Literacy Development System and indicated the need to redesign Early Literacy Development methods, supporting teachers involved in it and developing suitable teaching material for the student.

References

Baddeley, A. (1992 Jan 31). Working memory. *Science*, *255*(5044), 556–559. doi: 10.1126/science.1736359

Baddeley, A. & Hitch, G. (1974). Working memory. In G. H. Bower (Ed.), *Psychology of learning and motivation*. Academic Press (pp. 47–89).

Brasil, Mec. (2017). *Base Nacional Comum Curricular* (BNCC). http://base nacional comum. mec.gov.br/.

Dehaene, S., Pegado, F., Braga, L. W., Ventura, P., Nunes Filho, G., Jobert, A., Dehaene-Lambertz, G., Kolinsky, R., Morais, J. & Cohen L. (2010 Dec 3). How Learning to Read Changes the Cortical Networks for Vision and Language. *Science*, *330*(6009), 1359-64. doi: 10.1126/science.1194140

Dehaene, S. (2012). *Os neurônios da leitura* - Como a ciência explica a nossa capacidade de ler. Consultoria, trad. e supervisão de L. Scliar-Cabral. Penso.

Inaf. (2012). Inaf 2011-2012, Instituto Paulo Montenegro e Ação Educativa mostram evolução do alfabetismo funcional na última década. *Boletim INAF*, 2012. http://www. ipm.org.br/index.php?mpg=undefined&ver=por.

Inaf. (2018). Inaf Brasil 2018. Resultados preliminares. https://drive.google.com/file/d/1ez-6jrlrRRUm9JJ3MkwxEUffltjCTEI6/view.

Levelt, W. J. M. (1989). *Speaking from intention to articulation*. MIT Press.

Lopez, B. A. (1979). The sound pattern of Brazilian Portuguese (Cariocan Dialect). PhD. Dissertation. L Univ. of California.

Mattoso Camara Jr. (1953). *Para o estudo da fonêmica portuguêsa*. Simões.

Montessori, M. (1997). Basic ideas of Montessori's educational theory: extracts from Maria Montessori's writings and teachings. Comp. Paul Oswald; GÃ/4Inter Schlz-Benesch. Trans. Lawrence Salmon, Clio Press.

Monzalvo, K., Fluss, J., Billard, C., Dehaene, S. & Dehaene-Lambertz, G. (2012). Cortical networks for vision and language in dyslexic and normal children of variable socio-economic status. *Neuroimage*. February, 61(1), 258—274.

Oecd. (2011). OECD in figures. PISA, 2011. http//ocde.p4siteinternet.com publications/doi files/012005061T032.xls.

Oecd. (2016). Education at a glance 2016. Organization for Economic Cooperation and Development, online, 2016. http://www.oecd.org/edu/education-at-a-glance-19991487.htm>.

Pereira, M. M. de A. (2012). Observação da aplicação do sistema Scliar de alfabetização: uma pesquisa piloto. Unpublished master dissertation. Univ. Federal de Santa Catarina.

Polk, T. A. & Farah, M. J. (2002 Mar). Functional MRI evidence for an abstract, not perceptual word-form area. *J Exp Psychol Gen*, *131*(1), 65-72. doi: 10.1037//0096-3445.131.1.65

Quicoli, A. C. (1990 Jan 1). Harmony, lowering and nasalization in Brazilian Portuguese. *Língua*, *80*, 295-331. DOI:10.1016/0024-3841(90)90036-K

Scliar-Cabral L. (2003a). *Princípios do sistema alfabético do português do Brasil*. Contexto.

Scliar-Cabral, L. (2003b). Bateria de Recepção e Produção da Linguagem Verbal (Verbal Language Reception and Production Battery). In: *Guia prático de alfabetização*, baseado em Princípios do sistema alfabético do português do Brasil. Contexto, 119-250.

Tamura, H.; Tanaka, K. (2001 May 1). Visual response properties of cells in the ventral and dorsal parts of the macaque inferotemporal cortex. *Cerebral Cortex*, *11*(5), https://doi.org/10.1093/cercor/11.5.384

Vianna, A. R. G. (1904). *Ortografia Nacional*. Simplificação e uniformização sistemática das ortografias portuguesas. Viúva Tavares Cardoso.