

# Memória de trabalho, consciência fonológica e hipótese de escrita\*\*\*\*

## Working memory, phonological awareness and spelling hypothesis

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### Abstract

Background: working memory, phonological awareness and spelling hypothesis. Aim: to verify the relationship between working memory, phonological awareness and spelling hypothesis in pre-school children and first graders. Method: participants of this study were 90 students, belonging to state schools, who presented typical linguistic development. Forty students were preschoolers, with the average age of six and 50 students were first graders, with the average age of seven. Participants were submitted to an evaluation of the working memory abilities based on the Working Memory Model (Baddeley, 2000), involving phonological loop. Phonological loop was evaluated using the Auditory Sequential Test, subtest 5 of Illinois Test of Psycholinguistic Abilities (ITPA), Brazilian version (Bogossian & Santos, 1977), and the Meaningless Words Memory Test (Kessler, 1997). Phonological awareness abilities were investigated using the Phonological Awareness: Instrument of Sequential Assessment (CONFIAS - Moojen et al., 2003), involving syllabic and phonemic awareness tasks. Writing was characterized according to Ferreiro & Teberosky (1999). Results: preschoolers presented the ability of repeating sequences of 4.80 digits and 4.30 syllables. Regarding phonological awareness, the performance in the syllabic level was of 19.68 and in the phonemic level was of 8.58. Most of the preschoolers demonstrated to have a pre-syllabic writing hypothesis. First graders repeated, in average, sequences of 5.06 digits and 4.56 syllables. These children presented a phonological awareness of 31.12 in the syllabic level and of 16.18 in the phonemic level, and demonstrated to have an alphabetic writing hypothesis. Conclusion: the performance of working memory, phonological awareness and spelling level are inter-related, as well as being related to chronological age, development and scholarship. **Key Words:** Working Memory; Phonological Awareness; Spelling Hypothesis; Preschool; First Grade.

### Resumo

Tema: memória de trabalho, consciência fonológica e hipótese de escrita. Objetivo: verificar a relação entre a memória de trabalho, a consciência fonológica e a hipótese de escrita em alunos de pré-escola e primeira série. Método: a amostra foi composta de 90 alunos da rede estadual de ensino que apresentavam desenvolvimento lingüístico típico. Destes, 40 alunos eram da pré-escola, com idade média de seis anos e cinco meses, e 50 eram da primeira série, com idade média de sete anos e dois meses. A amostra selecionada foi submetida à avaliação das habilidades de memória de trabalho com base no Modelo de Memória de Trabalho de Baddeley (2000), envolvendo o componente fonológico. O componente fonológico foi avaliado através do subteste cinco, Memória Sequencial Auditiva, do Teste Illinois de Habilidades Psicolinguísticas (ITPA), adaptação brasileira realizada por Bogossian e Santos (1977), e da Prova de Repetição de Palavras sem Significado, elaborado por Kessler (1997). As habilidades de consciência fonológica foram estudadas a partir do teste Consciência Fonológica: Instrumento de Avaliação Sequencial (CONFIAS), elaborado por Moojen et al. (2003), considerando tarefas de consciência silábica e fonêmica. A escrita foi caracterizada conforme a proposta de Ferreiro e Teberosky (1999). Resultados: os pré-escolares apresentaram capacidade de repetir seqüências de 4,80 dígitos e 4,30 sílabas; em consciência fonológica, o desempenho em nível de sílabas foi de 19,68 e 8,58, em nível de fonemas; e hipótese de escrita pré-silábica, em sua maioria. Os alunos de primeira série repetiram, em média, seqüências de 5,06 dígitos e 4,56 sílabas, apresentaram desempenho de 31,32, em consciência fonológica em nível de sílabas, e 16,18, em nível de fonemas; e hipótese alfabética de escrita. Conclusão: o desempenho em memória de trabalho, consciência fonológica e nível de escrita se inter-relacionam, bem como estão relacionados com a idade cronológica, a maturidade e a escolaridade.

**Palavras-Chave:** Memória de Trabalho; Consciência Fonológica; Hipótese de Escrita; Pré-escola; Primeira Série.

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## Introduction

The working memory, phonological awareness, the quickness and precision in the lexical assessment in mind are abilities of phonological processing. According to Torgesen et al. (1994) and Capovilla et al. (2004), they refer to the way that the information are processed, stored and utilized. The phonological processing is considered a necessary ability to the literacy process as well as to ease the learning process of reading and writing. (Torgesen et al., 1994; Demont, 1997).

To Miller (1956), the working memory is limited regarding the capacity of immediate information storing. Thus, it is in evidence that this system of memory presents limitation regarding time, but may be maintained if activated by repetition of maintenance or by long-term memory transference. Tasks, which involve phonological awareness, as name letters and objects, recollect spoken sentences, listen to stories and child rhymes promote the memory abilities (Mann and Liberman, 1984; Santos and Siqueira, 2002). This way, they may facilitate the abilities to represent phonological inputs (phonological awareness), in the working memory.

The working memory is designated as a system able to retain and manipulate the information by a certain time, while participates of cognitive tasks as reasoning, comprehension and learning (Adams and Gathercole, 1995; Alloway et al., 2004).

Baddelley (2000) added to the model, which has an center executor, two supporting systems that are responsible for the temporary files and for manipulating the information; one of visual-spatial sketchpad and the other of phonological sketchpad; the fourth component named buffer episodic. This corresponds to a system of limited capability, in which the miss information of long-term becomes aware, permitting then dealing with the association among information kept in the supporting system and it also promotes integration with the long-term memory information.

The phonological loop processes the information codified verbally. For such it counts on two components: the phonological short-term memory and the sub vocal refeeding. The phonological component of the working memory, also called phonological loop makes the storing of verbal material, which deteriorates fast. The sub vocal refeeding or articulators loop permit to recover the verbal information in decline and keep the material in the memory. It is under influence of extension and frequency of the verbal material as well starts its development since 6 years old (Baddelley, 2003).

It is been said that the working memory plays an important role in the tasks that require the phonological awareness (Alloway et al., 2004; Morgado, 2005). It seems to occur, because during this task has been done it is necessary that the verbal material remains in the working memory, in order to the task succeed.

The present work is districted to the phonological component of the working memory that is one of the most studied aspects.

Investigating the capacity of working memory storing, Miller (1956) stated that the maintenance and durability capacity is fragile and limited to approximately a number of particles different from five to nine. Gathercole (1995) has observed that it is regarding to a short period of time, during which it is necessary to register and maintain the information stable for being comprehended and utilized; having the capacity to codify an average of seven to eight distinctive items and retain the information during a limited period of time.

The memory abilities tend to improve with the aging, (Gathercole, 1995), due to the maturity process (Hulme, Thomson, Lawrence, 1984; Baddelley, 2003) and the learning process (Etchepareborba e Abad-Mas, 2005; Gindri, Keske-Soares, Mota, 2005).

In the phonological component evaluation, tasks of repetition of sequential digits - digit span - and syllabus of nonsense words, also called nonwords are usual. Many authors affirm that the results of these tasks may be compared (Adams e Gathercole, 1995; Kessler, 1997; Baddelley, 2003). The repetition of nonsense words, according to Gathercole (1995), evaluates more precisely a phonological loop, being that deprived of lexical influences - phonology, semantics and syntax.

The phonological awareness is defined as the capacity of reflecting on the sound speech structure as well as manipulate its structural components, in other words it deals with the capacity of thinking and operate over the language as an object (Morais et al. 1998; Coimbra, 1997; Demont, 1997; Moojen et al., 2003).

Cielo (2002) says the phonological awareness is developed spontaneously and automatically, in a natural way, no demanding special attention during communication, although may be activated when there is a necessity to have control over the language. It occurs so the individual may focus on the form in the detriment of the content, either in the speech or in writing. Magnusson (1990) affirms that the role of the phonological awareness is more

evident to the development of the spelling language than to the speech. Gombert (1992) and Flores (1992) agree that for the oral and writing acquisition this ability is relevant.

Yavas (1989) says that the phonological awareness improves with the age; however, some levels require contact with alphabetic instruction. Morais et al. (1998) and Moojen et al. (2003) consider appropriate the hypothesis of casualty reciprocity between the learning of the spelling code and the development of abilities of phonological awareness. Maluf and Barrera (1997) from the psychogenetic perspective have shown to have significant correlation between the phonological awareness levels and the spelling language acquisition, independently the genre. Capellini and Ciasca (2000), Santamaria et al. (2004) point that the phonological awareness may be developed also in concomitance with the literacy process.

The introduction of an alphabetic system helps in the phonological awareness development, emphasizing its relevance to the phonemic abilities (Demont, 1997; Capovilla et al., 2004).

The phonological awareness is developed in a continuum complexity standard, in successive evolutive stages, not necessarily linear, integrating a progressive process. Roazzi and Dowker (1989) explain that the performance results in the phonological awareness tasks differ from the level of cognitive experiences that each one demands, that is, by the capacity of information processing required.

The abilities of syllabic awareness precede the capacity of a child to take in account the phonemes as linguistic unities (Magnusson, 1990; Capellini and Ciasca, 2000) Considering the differences as regards the difficulties observed between the syllabic analyses and the phonemic one, Coimbra (1997) suggests that the synthesis abilities, syllabic as much as phonemic, takes precedence over the segmentation abilities and of syllabics and phonemics manipulation, which are intermediate. The last ability to be developed is of transposition, syllabic as much as phonemic.

Many studies point that children who have phonemes awareness move forward easier and more productively in writing and reading (Santos and Navas, 2002; Ferreiro, 2004), meanwhile the ones who do not have it take the risk of not being able to learn how to read and write (Capellini and Ciasca, 2000; Santamaira et al., 2004). The activities of phonological awareness contribute to improve the child development; during its starting point in the reading learning process echoing positively in a

more advanced process; as well as training and therapy are factors that facilitate the acquisition of the alphabetic code (Lazarotto and Cielo, 2002; Capovilla et al., 2004).

The acquisition process of the spelling language is beyond the automatism. Santos and Navas (2002) added that the writing is a form of language expression, being one of its main functions, the symbolic communication. The abilities necessary to the writing acquisition depend on the level, in which the process is, by that is related to different internal and external factors of the individual (Morais et al., 1998; Dockrell and McShane, 1997; Etchepareborda and Aad-Mas, 2005).

Ferreiro and Teberosky (1999) propose that the writing construction results of a gradual process, in which are contrasted situations of drawing with situations of writing, experimenting and experiences. Four fundamental spelling hypotheses are: pre syllabic, syllabic, syllabic alphabetic and alphabetic level.

In the pre syllabic, the child believes that writing is to draw the object. Appear attempts of correspondence between the spelling and the referred object (nominal realism). Other features are: different styles, used in this starting phase of writing; the problematic as regards to spatial orientation to write; the difficult to establish the difference between activities of writing and drawing (either is the writing represented by letters or by drawing, or even, by both); the minimal quantity of characters required; the variety of these characters. This way each child can interpret just its own writing and not of any one else. Most of the children, average age six years old, makes the correct distinction between texts and drawings, knowing that what can be read contain letters. Some, although, still persist in the hypothesis that is possible to read letters as well drawings. They respect two basic requirements: the quantity of letters (never less than three) and the variety among them (can not be repeated).

The syllabic hypothesis has a main feature is the attempt to associate the sound value for each letter that compound the spelling. In this stage, the child passes by the period of most evolutive importance, in which a single letter is worth one syllabus. The child moves forward qualitatively, because overcome the global correspondence between the writing form and the oral expression, in order to make the correspondence between the parts of the text, which are the letters, and the parts of oral impressions, represented by syllabic cut of the name. The child considers that the writing represents the sound parts of the speech. Each writing done

corresponds to a pronounced syllabus, enabling to use letters or other kinds of writing.

The transition between the syllabic hypothesis and the alphabetic characterizes the syllabic alphabetic. The child abandons the first, and finds out the necessity to analyze other possibilities of writing. In this stage two important features of the preceding writing tend to disappear: the minimal quantity (an internal requirement of the own child) and the variety of characters (the minimal number of spelling). The child then starts to realize that writing is to represent, progressively, the sounding parts of the words even that cannot do it appropriately.

The alphabetic hypothesis is the final stage of the evolution of this psychogenesis. Arriving at this point, the child comprehends that each one of the characters of writing corresponds to sound values smaller than the syllabus. It is able to do, systematically, the phoneme sound analyses of the words that must to be written.

Santos and Navas (2002) propose that the spelling language has a close correlation to the oral language. Despite being quite easy, for the majority of the children, learn how to read and write, the linguistic and basic cognitive abilities, necessary for the process of learning are numerous and complex. It is accepted that the abilities of the spoken language constitute the basement for the reading and writing acquisition (Flores, 1992; Demont, 1997; Ferreiro, 2004).

The cognitive activities - as the formal learning of reading and writing, the comprehension and the reasoning - are done based on the working memory. The learning teaching process requires constantly the memory use (Morgado, 2005; Etchepareborba e Abad-Mas, 2005).

The alphabetic knowledge demands several phonological abilities. Firstly, the phonological awareness, that is the capacity to detect sounds of the speech similar in the words, allows the children represent the sound segments in the writing language. Learning how to read, although, demands more advanced kinds of phonological awareness. By the time the children become aware of different kinds of phonological unities, that is, syllabus, rhymes and phonemes and learn to manipulate them, there is also the reading evolution. (Morais et al., 1998; Santamaria et al. 2004).

The educational implications of the correlation between working memory, phonological awareness and writing are very relevant (Santos e Siqueira, 2002), nevertheless, the literacy programs still give less importance to the use of metaphonological

abilities as helpers for the acquisition of the writing code (Capovilla et al., 2004)

There are studies related to the working memory with the spelling, phonological awareness with the spelling as well as working memory with phonological awareness, but not the crossing of the three aspects. Therefore, this research aims to verify the correlation between working memory; phonological awareness and the spelling hypothesis of pre -scholar and first grade students from state schools of the urban area of Santa Maria - Rio Grande do Sul state.

### Method

This research was registered in the Projects Office of the Health Science Center of Federal University of Santa Maria (number 097/04) and was approved by the Ethics Committee.

In the visited schools in the urban area that agreed to take part in this study, as requirement, the school boards signed the informed Consent Institutional Term. After clarifying the research, an informed consent of parents or legal guardians was required and also signed.

In order to determine the sampling was done a statistical study just with the authorized students. Due to methodological difficulties regarding the signed consents to this study, many students were not included because they had no authorization from the parents even the schools showing interest in the evaluations. It has determined a sample by convenience.

It was used a simple sample by random in each group, selected on a draw, which was done in a presence of a judge, with the pre-scholar and first grade students previously authorized. This procedure was repeated, considering the variables, until the number expected to a statistically significant and representative study in the seven geographic areas of the urban zone of Santa Maria - Rio Grande do Sul was reached.

The students who took part in this study filled in the following criteria: have the parents' authorization to participate; present normal neuron-psychomotor development; present typical speech development; no history of scholar failure; not to present hearing or visual deviation; not to present psychological or neurological alterations suspect; not to present speech, language and hearing alterations, as learning difficulties, language delaying, phonetic or phonological deviation and mouth breathing; not be or have had preceding speech therapy; not be attending psycho-pedagogical meetings, school reinforcement or pedagogical accompaniment.

The sampling was compound of 90 students, being 40 pre-scholars and 50 first grades. Average age of pre-scholars was six years and five months old and from the first grade seven years and two months old. In terms of genre there were fourteen male pre-scholars and twenty-six female while in the first grade there were twenty-six male and fourteen female.

The procedures were done at the school environment, in silent rooms; with each student individually during the period of they were having classes. The evaluations were done a live, with intensity of a normal conversation, by the researcher, during the same period of school at pre-school and first grade. The registrations were done following the protocols specificities.

In order to know about the individual stories and check the requirement necessities to this study, it was done an anamnesis bringing about aspects related to neuron-psychomotor development, of language and speech; voice; orofacial habits; physiopathologic and family preceding; schooling and learning.

The speech-language pathology evaluation was done in order to verify if the child could be part of the study and involved language as well as orofacial myology and hearing aspects. The language was observed in an informal way using the figure "circus" proposed by Hernandorena and Lamprecht (1997) through spontaneous speech. In this evaluation, it was observed the phonological components, semantics, syntax and pragmatics of the language. It was also observed speech, fluency and voice. The students with no alteration in the oral language development and therefore with a typical linguistic development, were selected.

Concerning the orofacial myology, were observed the aspect, tonus, posture and mobility of the stomatognathic system (Marchesan, 2005).

In order to exclude any possible hearing alterations, was done an auditory screening, preceded by an otoscopy. The auditory screening was done using the Audiometer Pediatric Interacoustic PA2, with pure tonus, in frequencies of 500Hz, 1KHz., 2K and 4KH, and intensity of references of 20 dB NA, keeping distance approximately of 50 centimeters from the pinna, as recommended by the standard ANSI, 1969 9 Northern and Downs, 1989).

The students suspect of language, orofacial myology, hearing, neurological, ophthalmologic and psychological alterations were sent to complementary evaluations (otorhinolaringological, audiological, neurological, ophthalmological and psychological) and excluded of this study.

The students selected to this research were submitted to specific evaluations of spelling hypothesis, the phonological component of the working memory and phonological awareness.

#### The spelling hypothesis evaluation

In the spelling hypothesis evaluation, was asked the students to write their names and a sample of words and sentences, using the proposal of Phonological awareness: Instrument of Sequential Assessment Test - the student writes "castle", "skeleton" and "The ghost opened the door" (Moojen et al., 2003). Purposing to motivate the student for this task, was created a situation that there was a castle where lived a skeleton and in a certain moment a ghost arrived and opened the door. Besides it, the work of the students, specially the ones related to writing, were observed in class, being verified that they kept the relation to what was obtained during the evaluation applied.

Considering the production as a whole, that is, with the words and sentences components, was featured the writing with basement in the spelling hypothesis proposed by Ferreiro and Teberosky (1999) - pre syllabic, syllabic, syllabic alphabetic and alphabetic level.

#### Phonological component of working memory evaluation

In the evaluation of phonological component of working memory was utilized the subtest five of Auditory Sequential Test of Illinois Test of Psycholinguistic Abilities (ITPA), a Brazilian adaptation by Bogossian and Santos (1977) and the Test of Repetition of Nonsense Words (Attached 1), made by Kessler (1997), because these have been widely applied in recent studies in the Brazilian and foreigner literature (Kessler, 1997; Linassi et al., 2001; Gindri et al., 2005).

The subtest five of ITPA consists in the repetition of 28 sequential digits; distributed from two to seven digits, said aloud out of order, with a variety number of sequences for each quantity of digits, immediately after the researcher say them. The sequences were presented orally, in a linear rhythm of two digits for second. The sum of the points led to a first score that was converted to a scale score, according to the age and correspondent to the individual chronological age. The average performance of the reference group is equal, for the age in study, to the score of 36 points, and may vary six points for more or less. The scale score expected varied between 30 to 42 points.

Besides the scale score was also done the analyses of the maximum number of digits repeated correctly.

The subtest five auditory sequential memory, was done in the beginning of the evaluation of each student, in order to reduce the fatigue effect.

The test of repetition of nonsense words consists in the repetition of words formed by phonological sequences deprived of meaning. It is compound of thirty nonsense words, constituted by simple syllabic structure, the kind of consonant-vowel, following the phonological structure of Portuguese. The words are disposal in six lists, each with five nonsense words, conforming the number of syllabus that varies from one to six.

In the application of the referred test, the student was invited to pretend speaking another language, with words he did not know, but should repeat them immediately after the model. In this task, the parameter considered is of one point when the student can repeat the item, the same as it was presented. The attempt is considered incorrect when the student omits, substitutes, do not reproduce any phoneme or when cannot reproduce the item, as it was presented by the researcher. In these cases points are not given. In the analyses of the answers by lists, was considered the one with a greater number of syllabuses in which there was a correct repetition of five items.

#### Phonological awareness evaluation

In the evaluation of phonological awareness was used Phonological Awareness test: Instrument of Sequential Assessment, elaborated by Moojen et al. (2003). The instrument is compound of tasks of syntheses, segmentation, identification, production, exclusion and syllabic and phonemic transposition. The application followed the sequential proposal of starting by the tasks that involves syllabus awareness and later the ones that refer to the phoneme level, respecting its order. For this study were just used the results in level of syllabus, phoneme and the total.

The punctuation of the test is done in the answers protocol. The correct answers value one point and the incorrect zero. In the syllabus, the maximum of punctuation are 40 points and in the phonemes the maximum are 30, totalizing 70 points.

After collecting the data, the results were put into a table and analyzed, using statistical proceeding through a Software Statistics SPSS - 8.0 version (Barbetta, 2003). The test  $\chi^2$ , com  $p < 0,001$ , complemented by the Adjusted Residual Analyses, with  $p < 0,05$ , was used to verify the association between the level of spelling hypotheses of the students in relation school education. The results

obtained as regards the phonological component of working memory and the phonological awareness were analyzed through the test T of Student, considering  $p < 0,001$ .

#### Results and Discussion

The performance of pre-scholars and first grade students regarding the spelling hypothesis are presented in Table 1.

It was verified that the pre-scholar students are associated to the levels of pre syllabic and syllabic writing and the first grade to the alphabetic level of writing, having significant differences between the groups related to the spelling hypotheses (table 1). It is stated by Ferreiro and Teberosky (1999), because the child may start its knowledge on writing much before any attempt of formal teaching. It explains why pre-scholars were ahead, in relation to the first grade students as regards the spelling hypothesis. Despite not being receiving formal instruction for the acquisition of writing and literacy, 11 pres-scholars have shown acquisitions in writing.

Noticing there was a significant difference in the spelling hypothesis between the pre-scholars and the first grade students, based on Morgado (2005), the learning and memory are complex processes implied in each other.

To enable the possible comparison of the average performance of the pre-scholars and first grade students in the evaluation of phonological component of working memory and phonological awareness regarding the spelling hypothesis, the levels of writing pre syllabic and syllabic, and the levels of syllabic alphabetic and alphabetic levels due to the distribution of variable level of writing were associated, as few cases in the syllabic and syllabic alphabetic levels were observed. The pre syllabic and syllabic levels of writing are associated to the pre-scholars and the syllabic alphabetic and alphabetic levels to the first grades.

The performance of the phonological component of the working memory, as regards the sequence of digits, punctuation, and scale score correspondent, as well the number of syllabus and its punctuation, in relation to the spelling hypothesis of the students are shown in table 2.

Both pre-scholar and first grade students have demonstrate capacity to repeat sequences from four to six digits and from four to six syllabus of nonsense words, although the average of the results show a significant difference between the two levels as regards the tests, stated by Miller (1956), Gathercole (1995) and Baddeley (2003).

Gindri et al. (2005) compared the performance of pre-scholars and first grade students in terms of working memory. The pre-scholars were able to repeat sequences from three to five digits and nonsense words from four to six syllabus, while the first grade repeated sequences from four to six digits and nonsense words from four to six syllabus. The results of the present study are similar. It was agreeing also with Kessler (1997) that studying pre-scholars obtained an average of repetition of sequences of four digits and four syllabuses of nonsense words.

It was observed the expansion of the working memory capacity with the aging as Braddeley (2003) affirms that it is related with the increasing in the speech and language abilities.

The differences observed in the average performance between the pre-scholars and the first grade students were significantly in favor of the first grade, who are the older and the majority present alphabetic spelling, while the pre-scholars are younger and the majority present pre alphabetic spelling.

The similar performance in tasks of repetition of digits and nonsense syllabus agrees with the hypothesis that these tasks may be compared as was pointed by Hulme et al. (1984), Adams and Gathercole (1995).

Alloway et al. (2004) proposes that the features of the working memory are an important base for longer representations of new words. The correlation between working memory and phonological knowledge become more complex after five years old, as seen in table 2.

In table 3 is presented the performance obtained by the students with phonological awareness - with Phonological Awareness test: Instrument of Sequential Assessment application to syllabus, phoneme and total level - relating to spelling hypothesis.

It was verified that the average of the evaluated aspects of phonological awareness through Phonological Awareness test: Instrument of Sequential Assessment is significantly greater to the first grade students comparing to the pre-scholars (table 3). This better performance of first grades is in accordance with Yavas (1989) that points the role of school education as favorable, noticing the progress seen with the starting of the literacy process.

The results of the phonemic awareness and syllabic awareness tasks have shown that the abilities of phonological awareness are part of the continuous development, being the tasks that involve syllabus manipulation preceding the ones that involve phonemes manipulation (Cielo, 2002).

There was a significant difference in the abilities of awareness between pre-scholars and first grade students, based on Magnusson (1990) and Adams and Gathercole (1995) who affirm that the phonological abilities are tied to the cognitive development. The results are in accordance with the findings of Hulme et al. (1984); Roazzi and Dowker (1989) that relate them with the maturity process happening in this period of life. It is added that these ages are under influences of the school education time and it is favorable to the development of phonological awareness (Capellini and Ciasca, 2000; Capovilla et al., 2004)

The differences regarding the phonological awareness as in syllabic level as in phoneme and total performance may be explained by the fact that the older students (first grades) are in contact with alphabetization as this knowledge is shown being them in a more advanced spelling level (great majority in alphabetic spelling), based on Morais et al. (1989), Demont (1997) and Cielo (2002).

The students with the best performance in the awareness abilities are the ones who present the best performance in spelling (alphabetic level - first grades), in accordance with Flores (1992), Gombert (1992) and Coimbra (1997), the phonological awareness is part of the pre requirement for reading and writing learning.

The formal exhibition to writing, which occurs during the first grade, brings about the alphabetic spelling knowledge and helps the phonemic awareness abilities as observed in table 3. Before that, the child does not need to have consciously the phonological knowledge that the phoneme is a sound unity, because in order to speak it is not relevant (Moojen et al., 2003; Santamaria et al., 2004). It emphasizes that the introduction of the alphabetic system that happens in a formal way in the first grade, helps the phonemic awareness development (Maluf and Barrera, 1997; Lazzarotto and Cielo, 2002). The school education process is very important for the individual development, viewing the relevance of the learning process in the superior mental functions development, what justifies the best performance of first grade students (Torgensen et al., 1994; Gindri et al., 2005)

The working memory abilities and the phonological awareness are in favor of the alphabetic development, according to Mann and Liberman (1984), Santos and Siqueira (2002) Morgado (2005) and the results of the present research, as well the development of these abilities have some correlation with the learning process (Santos e Navas, 2002; Etchepareborba and Abad-Mas, 2005).

TABLE 1. The performance regarding the spelling hypothesis of pre-scholars and first grade students.

Spelling hypothesis	School level				Total	
	Pre-scholars		First grade students			
	n	%	n	%	n	%
Pre syllabic level	29*	72,5	0	0,0	29	32,2
Syllabic level	5*	12,5	0	0,0	5	5,6
Syllabic alphabetic level	1	2,5	2	4,0	3	3,3
Alphabetic level	5	12,5	48*	96,0	53	58,9
Total	40	100,0	50	100,0	90	100,0

$$\chi^2 = 68,96; p < 0,001$$

\*Adjusted Residual Analyses:  $p < 0,05$

TABLE 2. The performance in the working memory as regards the sequence of digits, punctuation and scale score correspondent as well the number of syllabus and its punctuation in relation to the spelling hypothesis of pre-scholar and first grade students.

	Spelling hypothesis								p
	Pre syllabic and syllabic				Syllabic alphabetic and alphabetic				
	Average	Standard deviation	Minimum	Maximum	Average	Standard deviation	Minimum	Maximum	
Sequence of digits	4,80	0,61	4	6	5,06	0,55	4	6	0,036
Punctuation in sequence of digits	21,95	5,23	11	34	24,86	4,32	16	35	0,005
Scale score in sequence of digits	36,48	3,95	30	46	37,12	2,94	31	43	0,393
Number of syllabus	4,30	0,52	4	6	4,56	0,61	4	6	0,031
Punctuation in number of syllabus	21,50	2,58	20	30	22,80	3,06	20	30	0,031

$p < 0,05$

TABLE 3. Average and standard deviation in the phonological awareness evaluation in syllabus, phoneme and total result levels to the spelling hypothesis of pre-scholars and first grade students.

Phonological awareness	Spelling hypothesis				p
	Pre syllabic and syllabic		Syllabic alphabetic and alphabetic		
	Average	Standard deviation	Average	Standard deviation	
Syllabus level	18,44	3,85	30,82	5,25	<0,001
Phoneme level	7,35	2,62	16,11	4,81	<0,001
Total	26,09	5,45	46,91	8,85	<0,001

p = maximum level of significance of test *T of Student*



## Conclusion

The working memory abilities and the phonological awareness have a correlation and depend on the chronological age and maturity of the individual. These abilities are favorable to the starting of the spelling acquisition by the preschoolers and first grade students in addition to the influence of school education stimulus.

## Attachement

Meaningless Words Memory Test made by Kessler (1997).

<i>1 syllabus</i>	<i>Emission</i>	<i>Production</i>	<i>4 syllabus</i>	<i>Emission</i>	<i>Production</i>
1. bó	[‘bó]		1. palifemo	[pali’femu]	
2. lum	[‘lʔ]		2. romutega	[Romu’tega]	
3. rau	[‘Raw]		3. pefisuni	[pefi’zuni]	
4. pin	[‘pʔ]		4. morinati	[mori’nači]	
5. fe	[‘fe]		5. jalopurti	[žalo’purči]	
<i>2 syllabus</i>			<i>5 syllabus</i>		
1. dalu	[‘dalu]		1. dojabefari	[dožabe’fari]	
2. leca	[‘leka]		2. ranocidomi	[Ranosi’domi}	
3. nusa	[‘nuza]		3. zalivemafu	[zalive’mafu]	
4. bunfe	[‘bʔfe]		4. gocipobilo	[gosipo’bilu]	
5. quewsi	[‘kewsi]		5. agucafire	[aguka’fire]	
<i>3 syllabus</i>			<i>6 syllabus</i>		
1. quentagi	[ken’taži]		1. femorituzoli	[femoritu’zóli]	
2. belsifi	[bew’sifi]		2. alcabinteroca	[awkab’te’róka]	
3. tonasso	[to’nasu]		3. zovibescofari	[zovibesko’fari]	
4. lanasi	[la’nazi]		4. gerobinfoquemi	[žerob’fo’kemi]	
5. gamalo	[ga’malu]		5. chedizatocaro	[šežizato’karu]	

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