

Influencia de un entrenamiento en discriminación de estímulos tonales en la conciencia fonológica de niños preescolares. Estudio piloto

Influence of tonal stimuli discrimination in the phonologic awareness of preschool children. Pilot study

Influência de um treinamento em discriminação de estímulos tonais na consciência fonológica de pré-escolares. Estudo piloto

Iris Xóchitl Galicia Moyeda

Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México,
México

iris@unam.mx

Resumen

Los problemas de lectura están fuertemente asociados con el desarrollo del procesamiento fonológico y en particular con la conciencia fonológica. En el procesamiento fonológico esta involucrado el procesamiento de propiedades tonales y temporales de estímulos auditivos de carácter verbal y no-verbal. Este trabajo explora, por medio de un muestreo intencional, los efectos de un entrenamiento en discriminación de propiedades tonales de estímulos musicales en la conciencia fonológica de 28 niños de tercer grado de preescolar. Se aplicó una Batería de Conciencia Fonológica y la prueba Primary Measures of Music Audiation antes y después del entrenamiento. Posterior a la primera aplicación de los instrumentos, los participantes fueron asignados azarosamente a dos grupos: control y experimental. Los resultados revelaron que el grupo que recibió el entrenamiento tuvo mejores puntuaciones de manera significativa solo en dos tareas de la conciencia fonológica: identificación de sílaba inicial e identificación de la rima, sugiriendo que los efectos del entrenamiento tonal no son contundentes en la discriminación tonal de estímulos

musicales ni en la conciencia fonológica. Relacionando estos resultados con lo reportado en otras investigaciones, se considera incluir otras actividades el entrenamiento.

Palabras clave: discriminación auditiva, lectura, preescolares, procesamiento fonológico, educación musical.

Abstract

Problems in acquisition of reading skills are strongly related to the development of phonologic processing and particularly to phonologic awareness. Phonologic processing is involved with the processing of verbal and non-verbal tonal and timing properties of auditory stimuli. This paper examined the effects that training in tonal property discrimination of musical stimuli had in the phonological awareness of 28 children in third grade of preschool. A Phonological Awareness Set and the Primary Measures of Music Audition test were administered before and after the training. After the first and second tools were used, participants were randomly assigned to two groups: control and experimental. Results revealed that the group that received training had significantly better scores in two tasks of phonologic awareness: initial syllable identification and rhyme identification, which suggests that the effects of tonal training are not conclusive with regards to both tonal discrimination of musical stimuli and phonological awareness. Upon relating these results with the reports of other research projects, the inclusion of other activities in training is yet to be decided.

Keywords: auditory discrimination, reading, preschool children, phonologic processing, musical education.

Resumo

Os problemas de leitura são fortemente associados ao desenvolvimento do processamento fonológico e, em particular, à consciência fonológica. No processamento fonológico, o processamento das propriedades tonais e temporais dos estímulos auditivos verbais e não-verbais está envolvido. Este trabalho explora, por meio de amostragem intencional, os efeitos de um treinamento na discriminação de propriedades tonais de estímulos musicais na consciência fonológica de 28 crianças do terceiro ano da pré-escola. Uma pilha de consciência fonológica e o teste de medidas primárias de audição de música foram aplicados antes e após o treinamento. Após a primeira aplicação dos instrumentos, os participantes foram distribuídos aleatoriamente em dois grupos: controle e experimental. Os resultados revelaram que o grupo que recebeu o treinamento teve pontuações significativamente melhores em apenas duas tarefas de consciência fonológica: identificação inicial da sílaba e identificação da rima, sugerindo que os efeitos do treinamento tonal não são conclusivos na discriminação tonal de estímulos musicais ou consciência fonológica. Relativamente a estes resultados com o que foi relatado em outras investigações, considera-se que inclui outras atividades no treinamento.

Palavras-chave: discriminação auditiva, leitura, pré-escola, processamento fonológico, educação musical.

Fecha Recepción: Enero 2017

Fecha Aceptación: Junio 2017

Introduction

It has been detected that children with reading problems have deficits in some of the skills related to phonological processing (Byrne, Fielding-Barnsley and Ashley, 2000, Bravo, Villalón and Orellana, 2011), among them phonological awareness, understood as the sensitivity to identify, isolate or associate phonemes or groups of phonemes in words (Treiman and Bourassa, 2000; Herrera and Defior, 2005).

Identifying why difficulties arise in carrying out these activities has been controversial. There are hypotheses in which temporal auditory processing of a general nature is involved, where verbal and non-verbal stimuli are included (Tallal, 1980). In this regard, Bretherton and Holmes (2003) conducted an investigation in which they conclude that some children with reading problems have difficulties in reproducing and ordering pairs of brief and complex non-verbal tones, however, such difficulties were not associated with discrimination of syllables. Furthermore, the scores obtained in phonological awareness tests did not correlate with the scores in the temporal discrimination. Similar data were obtained by Bolduc and Montésinos-Gelet (2005), who showed evidence that the discrimination of temporary modifications of nonverbal sounds is not associated with phonological awareness. Hence, there are those who mention that the difficulty is concentrated in the temporal processing exclusively of verbal stimuli (Studdert-Kennedy and Mody, 1995), although there is also evidence that such difficulties arise when there are faults or difficulties to temporarily discriminate auditory stimuli. non-verbal (Cohen-Mimran and Sapir, 2007).

On the other hand, there is a hypothesis that postulates that it is the tonal characteristics of the stimuli that are involved in auditory processing and phonological awareness skills. Attending to such tonal characteristics, but of non-verbal stimuli, the study of Lamb and Gregory (1993) provided evidence that the correct identification of musical tones is related to a good performance in tasks related to phonological awareness and reading.

Bolduc y Montésinos-Gelet (2005) They have shown data that reveal an important relationship between the distinction of changes in tones and heights of nonverbal sound stimuli and phonological awareness. They used the Gordon Musical Hearing evaluation to determine the level of tonal and rhythmic processing of preschool children, and noted a high and significant correlation only between the scores obtained in the tonal aspect in that evaluation with the scores obtained in an assessment. of phonological awareness. Anvari, Trainor, Woodside and Levy (2002) also found significant relationships between tonal-type musical abilities and phonological awareness in 5-year-old children. The correlations and regression analyzes performed by them strengthen the notion that these children's musical

abilities are also related to their reading skills.

As can be seen, there is evidence that the non-verbal aspects of auditory stimulation have an impact on auditory processing related to phonological awareness skills. The discrepancy lies in determining whether it is the temporal aspects or the tonal aspects of auditory stimuli that are involved in phonological awareness (Loui et al, 2011, Fonseca and Gómez, 2015).

The evidences provided by the studies referred to above are provided mainly by correlational studies, which is why they stimulate the study of the influence of the level of processing of non-verbal stimuli in the development of phonological awareness with a manipulative type of research. .

There are several manipulative studies that assess the effects of an intervention, but of verbal stimuli in phonological awareness, which usually use activities such as grapheme and phoneme equalization, as well as syllabic manipulation, to improve phonological awareness and some deficits. in reading (Moore, Rosenberg and Coleman, 2005, Cuadro y Trías, 2008, Arancibia, and Sáez, 2012). However, there is little evidence that a training in discrimination of tonal and / or rhythmic properties of non-verbal stimuli favors auditory processing related to linguistic processes. In the literature there are reports of interventions where musical activities are used in which jointly works with the discrimination of rhythmic and melodic elements, but performing activities that respond to objectives included in musical education programs, and its effects are valued in some processes included in phonological awareness (Bolduc y Montésinos-Gelet, 2005; Herrera, Defior y Lorenzo, 2007; Bolduc, 2009; Herrera y cols, 2011).

Thus, given the evidence presented, it is feasible to raise the hypothesis that a training in non-verbal tonal discrimination skills will improve the phonological awareness of schoolchildren. In such a way that this research intends to evaluate whether a training in discrimination of musical stimuli has effects on the phonological awareness of children who attend the third grade of preschool education. Particularly, it is intended to identify if there are changes in phonological awareness due solely to the discrimination of tonal properties of musical stimuli such as: a) differentiating melodic contours, b) discriminating

bass and treble tones and c) discriminating melodies.

Method

The study had an intentional sample and an intervention consisting of a training to discriminate three tonal properties of musical stimuli: a) melodic contours, b) bass and treble tones and c) short melodies. The design was pretest and post test with control group. The variables evaluated were tonal aptitude and phonological awareness.

Participants. We worked with 28 children enrolled in a school in the State of Mexico who were attending the third grade of preschool, whose age ranged from 4 years, six months and 5 years, three months. They were randomly distributed into two groups, one worked as an experimental group and the other as a control group.

Instruments. The Primary Measures of Music Audition (PMMA) (Gordon, 1986) values the musical aptitudes of children who attend preschool through third grade of primary school; for its application, it is not necessary to know how to read or have musical instruction. Its administration is done from 25 to 30 minutes. It consists of two parts: rhythmic and tonal. Each of them is constituted by 40 reagents that are formed by pairs of stimuli; half of them equal and the remaining half different, and they are arranged in a random way. Children take the test simply by listening to a CD with the tonal stimuli and a CD with rhythmic stimuli, where each CD is only 12 minutes long. In this study, only the tonal test was used. The children had to indicate if the pairs of tonal patterns they heard were the same or different by drawing a circle around the image on the answer sheet: a smiley face if they were the same and a sad face if they were different.

Battery of Phonological Awareness. From the Neuropsychological Battery for the Evaluation of Learning Disorders (Yáñez and Prieto, 2013) the Phonological Processing section was selected from which three processes were chosen: 1) Phonological discrimination; 2) Analysis of words, composed of three tasks: a) segmentation of words in syllables, b) elimination of a phoneme and c) elimination of a syllable; and 3) Phonemic analysis, which included two tasks: one to identify the initial syllable of the words and

another to identify the rhyme. In this section, half of the stimuli were drawings of words, and the rest were words presented orally by the examiner.

Process

It was informed and sought the authorization of the director and the teachers, as well as the parents of the children to carry out the planned activities. Once the authorizations were obtained, we worked in the multipurpose room of the educational center in a time prior to the school recess period. Twenty sessions were used, which lasted an average of 25 minutes. Six were assigned for evaluation and 14 for training.

Initially, three sessions were assigned for the first evaluation in which the PMMA was applied in small groups of three children, while the Battery of Phonological Awareness was applied individually. After the evaluation of all the children, they were randomly assigned to each group.

In the experimental group, collective work was carried out in the following order: two sessions aimed at the discrimination of ascending and descending melodic contours, four sessions to distinguish deep and acute sounds, five sessions to identify differences or similarities between pairs of melodies, a session to reinforce the discrimination of melodic contours, a session to discriminate acute and serious and the last session to distinguish melodic patterns. An example of the activities was to present the children with a musical stimulus through a recording and to indicate that it was an example of an ascending melodic contour. The presentation of that stimulus was associated with a bodily activity of the children, for example, raising the hand. If the contour was descending, that characteristic was mentioned and associated with another bodily activity, lowering the hand. Several tests were carried out to guarantee that the child had understood this dynamic, if there were errors or confusions the children were corrected. In general, an average of six trials were required for 85% of the children to respond correctly to the requested activity. Subsequently, the same activity was presented during 10 trials. It continued with other six trials, but associating the musical stimuli with other bodily activities; for example, the ascending contours touched the head and the descending knees. Once this activity was

understood, another 10 similar tests were carried out. The session ended when a total of 20 training trials were completed. We proceeded in a similar way with the discrimination of acute and severe stimuli, as well as with the melodic patterns.

At the end of the 14 training sessions, three more were used, in which the two instruments were applied as a post test.

In the control group, after the three pre-test sessions, 14 sessions were held with collective play activities of two types, which were presented alternately. One type of activities were games such as hide and seek, stop, sack race and jump rope. The other type of activities were children's rounds and involved singing a song: Doña Blanca, the Warming Game, Antón Pirulero, A mi donkey, my Donkey, among others. It should be noted that there was complete freedom so that children who did not want to sing the rounds did not do so. Those who did sing, were never stimulated so that the song had an adequate musical performance. Finally, three more sessions were used to apply the post test.

Results

The level of discrimination of tonal stimuli was similar in the two groups of children in the first evaluation. The values obtained in the totals and in each component (equal and different) are close to 50% of correct guesses, so that children can be considered as not having good tonal discrimination (see Table 1).

Table 1. Percentage of hits for the two types of reagents (equal and different) of the tonal section of the PMMA instrument obtained in the experimental group and the control group during the pretest and the post test.

PMMA	Pre test			Post test		
	Grupo experimental	Grupo control	significancia p	Grupo experimental	Grupo Control	significancia p
Igual	50	49.6	.944	60.05	57.7	.031
Diferente	45.35	49.2	.311	49.6	50	.917
Total	47-67	49.4	.320	54.82	53.85	.326

Source: elaboración propia.

The training given to the experimental group influenced slightly so that in the post test there was a better execution. However, the total scores and of each component, although they increased, continue very close to 50%. Applying the student's t test reveals a statistically significant increase only in the correct discrimination of pairs of equal stimuli.

Regarding phonological awareness tasks, it is observed that before the intervention, both control and experimental groups presented a similar performance, without significant differences between these groups (see Table 2). After the tonal training, an increase in the scores in the experimental group was observed in all the tasks except in the identification of rhymes when the stimuli were presented with drawings.

Table 2. Average of correct answers for each of the phonological awareness tests obtained in the experimental group (exp) and the control group (with) during the pre-test and the post-test.

CONCIENCIA FONOLÓGICA		PRE TEST		POST TEST		
		exp	con	exp	con	
Discriminación Fonológica		29.57	28.46	30.42	26.46	
Análisis de palabras	Segmentación	9.85	10.05	11.14	10.76	
	Eliminar fonemas	2.57	2.48	2.85	2.38	
	Eliminar sílabas	3.42	3.53	3.85	3.15	
Análisis Fonémico	Categorización fonémica					
	Identificación silaba inicial	dibujo	5.07	4.92	5.78	5.38
		palabra	5.07	3.76	6.50	3.61
	Identificación de rima	Dibujo	2.14	2.23	2.07	2.15
palabra		1.78	2	2.85	2.15	

Source: elaboración propia.

In contrast, the control group that was not exposed to tonal training showed decreases in most of the tasks, except two: the initial syllable identification with drawing and identification of rhyme with word.

On the other hand, it is necessary to mention that the significant differences are scarce (they are shaded in Table 2) and they occur in the phonemic analysis process when the stimuli present the words orally: a) in the initial syllable identification during the post test, the experimental group presents significantly higher scores ($p = .001$), differentiating from the control group and b) in the identification of the rhyme there was only a statistically significant difference between pre and post test, in favor of the experimental group ($p = .023$).

Discussion

The group that received training showed an improvement in the identification of tonal stimuli and in phonological awareness, unlike the control group, although not in a significant way. Therefore, it can be said that the effects of tonal training are not conclusive in the tonal discrimination of musical stimuli or in phonological awareness.

Discrimination skills of musical stimuli

With respect to the scores obtained in the PMMA, in this work coincidences with the results of other studies are presented. In the work carried out by Bolduc (2009), both the group with training and without it showed increases in the post test in the scores of the rhythmic and tonal aspects of the PMMA, being higher for the experimental group, but without registering significant differences. In the current work only the scores of the tonal aspects were contemplated and, although there was a little increase in the total, no significant differences were found either. However, if the reagents were considered in which similar stimuli were presented, they were easier to distinguish for children in the group with training than those who did not have it, since there were statistically significant differences in that aspect.

These data indicate that the incidence of both a training in discriminating tonal stimuli and a comprehensive music education program where various activities are contemplated (as was the case of the Bolduc study, 2009), are insufficient, from a statistical estimate, in modifying the tonal skills that are valued through the PMMA. It can be considered that the duration of exposure to the aforementioned program and to the training of this work was similar, of 12 weeks in the first case and of 10 weeks in the second.

Since the training was aimed exclusively at the discrimination of tonal properties of the stimuli, it is possible that the significant differences between the two PMMA evaluations in the same stimulus scores were achieved. It is feasible to suppose that if a longer training time were used, this would affect not only the discrimination of equal stimuli but also the different stimuli that are more difficult to identify, achieving a significant difference in the totals of said test. Therefore, it is suggested to replicate the study for a longer time to see the possible effects in the discrimination of tonal stimuli different from PMMA.

In relation to what was proposed in this paper, regarding the influence of tonal discrimination training in phonological processing, weak effects of training in phonological awareness were observed, as no statistically significant differences were identified in most of the skills evaluated. This may be due to the fact that with the training carried out there were no important advances in tonal discrimination and therefore it is not generalized to the linguistic sphere. The fact that in other researches there are substantial effects of musical training in phonological awareness may be due to at least two aspects that are analyzed below. One is related to the skills included in the assessment of phonological awareness in the various investigations and the other with the activities included in the training.

The skills included in the assessment of phonological awareness

With respect to the assessment of phonological awareness, it can be said that it differs depending on the instrument used in the various investigations, so it is preferable to take into account the skills evaluated. In the analyzed studies, a total of 12 different skills are identified, of which only two coincide in six investigations and they are the synthesis of phonemes and the identification of the rhyme. In this work the last one was also evaluated

and it was in the identification of rhyme where significant differences were found between the pre and post test in favor of the group that received the training.

Despite having analyzed common skills in the instruments used in other research, it should be noted that in the assessment of phonological awareness there is no general consensus on the skills that value it more adequately; so it is difficult to compare the results obtained in the different investigations (Leal and Suro, 2012)

Correlation studies (Anvari et al., 2002; Loui et al., 2011) describe the particular skills of the phonological awareness evaluated, but in the results only the total score of phonological awareness is correlated and the indexes are not disaggregated. of correlation obtained for each of the skills contemplated in it. In the studies in which the breakdown is carried out, it is where a musical training was applied (Herrera, Defior and Lorenzo, 2007, Bolduc, 2009) and in them it is reported that the biggest difference found between the pre and the post test was in the ability to identify rhymes. It seems that this is the skill most favored by musical training, whether it favors only the tonal properties of the stimuli, as was done in this work, or is combined with the rhythmic properties.

However, it is suggested to continue investigating more precisely which are the phonological awareness skills that are most likely to be favored by tonal training and analyze why rhyme is a skill that can be influenced by the tonal stimulus in particular and by other characteristics of musical stimuli or, well, if it is a skill easier to develop than the others that make up phonological awareness.

On the other hand, it is considered that the duration of training could be an element that influenced this work so that changes after it have been minimal. The time allocated to the training was very short, 20 sessions, carried out in two months and one week, due to the fact that it had to be carried out according to the permission granted by the school authorities. The correlational data provided by Lamb and Gregory (1993), Anvari and cols., (2002) and by Bolduc and Montésinos-Gelet (2005), with similar duration to the current work, would allow to suppose that the training with discrimination of tonal stimuli could have positive and significant effects on phonological awareness, however, the role of this

variable has been difficult to clarify (Fonseca and Gómez, 2015), so it is suggested to continue investigating in that line, exploring the duration of training.

The activities included in the training

In other studies in which musical interventions are performed with equal durations and greater than 20 weeks, favorable effects on phonological awareness have been found (Herrera, Defior and Lorenzo, 2007, Degé and Schwarzer, 2011). However, it should be noted that in these interventions a type of musical training different from that used in this work was used. In these interventions the musical training was not directed to a single isolated musical element, but it involved an integral training where diverse tasks were developed with at least two characteristics of the musical stimuli, the rhythmic and the tonal, and the children were trained in musical notation in a rudimentary way. It should be noted that all these activities were designed according to music education programs.

The data of such investigations strengthen the idea widely held by various scholars that the skills in distinguishing tonal and rhythmic properties of non-verbal stimuli favor the processes involved in phonological awareness, as supported by the hypothesis of Tallal (1980) in which Auditory processing of a general nature is involved, including the properties of verbal and non-verbal stimuli. However, the research data referred to above does not allow us to analyze which skills, rhythmic or tonal, are those that directly affect the phonological awareness. Regarding this last point, it seems that the development of both is demanded, but to affirm the above, it would be necessary to further exploration where training is compared to develop such skills separately and jointly.

On the other hand, it is necessary to point out another difference between the training carried out in this research and those mentioned above. In this work, apart from the fact that only the tonal properties were trained, their discrimination was only strengthened; that is, the child was only asked to identify either ascending and descending melodic contours, serious and acute sounds or differences or similarities between pairs of short melodies, without requesting another activity related to the presented stimuli.

In the training of the mentioned investigations, in addition to the discrimination, the children were asked to reproduce different tonal reasons. Thus, the difference would not only fall on the inclusion of rhythmic elements, but that apart from the passive discrimination, the reproduction of tonal and rhythmic patterns was also requested. In such a way that it would be necessary to explore if the training designed in this work were added activities in which the child reproduced tonal patterns or developed some tonal activities would enable not only improve their scores in the PMMA, but also be favored in the scores of various phonological awareness skills. This idea arises not only from the analysis of the cited research but also from the correlational type study carried out by Loui et al. (2011) in which it was detected that the scores obtained in the phonological awareness of children did not correlate with the identification of the tones, nor with the production of the same, but with an index made with both scores. In such a way that a study can be generated that assesses the performance of both activities (identification and production) in a joint and separate way not only of the properties of the tonal stimuli but also of the rhythmic ones to investigate in a more precise way the way in which the properties of nonverbal stimuli affect the phonological awareness of children.

Conclusions

Although there is evidence that the skills of phonological awareness can be favored by a musical training, in this work it is appreciated that the effects of a particular training in the discrimination of tonal characteristics of the stimuli are expressed only in two abilities of consciousness phonological: identification of initial syllable and identification of the rhyme.

It seems that the identification of the rhyme is the skill most favored by both verbal and non-verbal training, so it would be necessary to investigate if there are other abilities that could be modified by non-verbal training, in this case, of the tonal aspects of musical stimuli.

On the other hand, evidence is needed to identify possible differences in the effects of the tonal and rhythmic properties of musical stimuli on various skills of phonological awareness; which would allow to support some of the approaches in favor of the effect of one or the other type of non-verbal stimulus in phonological awareness.

Although the specific role of the practice and discrimination of the rhythmic and tonal properties of non-verbal stimuli in a particular phonological awareness process can not yet be determined from the field of basic research, this is no obstacle for the applied field Teachers are invited to incorporate musical activities -including both types of stimulus properties- in the last years of pre-school education and the first years of primary education so that children who practice them can benefit in the phonological awareness

Bibliography

- Anvari, S. H., Trainor, L. J., Woodside, J., & Levy, B. A. (2002). Relations among musical skills, phonological processing, and early reading ability in preschool children. *Journal of Experimental Child Psychology*, 83, 111–130.
- Arancibia, B., Bizama, M. & Sáez, K. (2012). Aplicación de un programa de estimulación de la conciencia fonológica en preescolares de nivel transición 2 y alumnos de primer año básico pertenecientes a escuelas vulnerables de la Provincia de Concepción, Chile. *Revista Signos*, 45 (80), 236-256.
- Bolduc, J., & Montésinos-Gelet, I. (2005). Pitch processing and phonological awareness. *Psychomusicology* 19, 3–14.
- Bolduc, J. (2009). Effects of a music programme on kindergartners' phonological awareness skills. *International Journal of Music Education* 27 (1), 37-47
- Bravo, L., Villalón, M., & Orellana, E. (2011). La Conciencia Fonológica y la Lectura Inicial en Niños que Ingresan a Primer Año Básico. *Psykhé*, 11(1), 175-182
- Bretherton, L., & Holmes, V. M. (2003). The relationship between auditory temporal processing, phonemic awareness, and reading disability. *Journal of Experimental Child Psychology*, 84(3), 218–243.
- Byrne, B., Fielding-Barnsley, R., & Ashley, L. (2000). Effects of preschool phoneme identity after six years: Outcome level distinguished from rate of response. *Journal of Educational Psychology*, 92, 659-667.
- Cohen-Mimran, R., & Sapir, S. (2007). Auditory temporal processing deficits in children with reading disabilities. *Dyslexia*, 13, 175–192.
- Cuadro, F., & Trías, D. (2008). Desarrollo de la conciencia fonémica: Evaluación de un programa de intervención. *Revista Argentina de Neuropsicología* 11, 1-8
- Degé, F. & Schwarzer, G. (2011) The effect of a music program on phonological awareness in preschoolers. *Frontiers in Psychology*. 2, 124, 1-7
<https://doi.org/10.3389/fpsyg.2011.00124> (consultada en abril, 2017)
- Fonseca, M.C., & Gómez, M. (2015). Instrumentos de investigación para el estudio del efecto de la música en el desarrollo de las destrezas lectoras. *Porta Linguarum*, 24,

121-134.

- Gordon, E. (1986). *Music Aptitude Test for Kindergarten and First, Second, Third and Fourth Grade Children*. Chicago: G.I.A. Publications
- Herrera, L. & Defior, S. (2005). Una aproximación al procesamiento fonológico de los niños prelectores: conciencia fonológica, memoria verbal a corto plazo y denominación. *Psykhé*, 14(2), 81-95.
- Herrera, L., Defior, S. & Lorenzo, O. (2007). Intervención educativa en conciencia fonológica en niños prelectores de lengua materna española y tamazight. Comparación de dos programas de entrenamiento. *Infancia y Aprendizaje*, 30 (1), 39-54.
- Herrera, L., Lorenzo, O., Defior, S., Fernández-Smith, G. & Costa-Giomi, E. (2011). Effects of phonological and musical training on the Reading readiness of native- and foreign- Spanish- speaking children. *Psychology of Music*, 39, (1), 68-81.
- Lamb, S. J., & Gregory, A. H. (1993). The relationship between music and reading in beginning readers. *Educational Psychology*, 13, 19–27.
- Leal, F. & Suro, J. (2012). Las tareas de conciencia fonológica en preescolar: Una revisión de las pruebas empleadas en población hispanohablante. *Revista Mexicana de Investigación Educativa*, 17 (54), 729 - 757.
- Loui, P., Kroog, K., Zuk, J., Winner, E. & Schlaug, G. (2011). Relating pitch awareness to phonemic awareness in children: implications for tone-deafness and dyslexia. *Frontiers in Psychology*, 2, (11), 1-5 <<https://doi.org/10.3389/fpsyg.2011.00111>> (consultada en abril, 2017)
- Moore, D. R., Rosenberg, J. F., & Coleman, J. S. (2005). Discrimination training of phonemic contrasts enhances phonological processing in mainstream school children. *Brain and Language*, 94, (1), 72-85.
- Studdert-Kennedy, M., & Mody, M. (1995). Auditory temporal perception deficits in the reading-impaired: A critical review of the evidence. *Psychonomic Bulletin and Review*, 2, (4), 508,514
- Tallal, P. (1980). Auditory temporal perception, phonics, and reading disabilities in children. *Brain and Language*, 9, 182–198.

- Treiman, R. & Bourassa, D. (2000). The Development of Spelling Skill. *Topics in Language Disorders*, 20, 1-18.
- Yáñez, G. & Prieto, B. (2013). *Batería Neuropsicológica para la Evaluación de los Trastornos del Aprendizaje*. México: Manual Moderno.