EFFECTIVENESS OF A READING MULTIMODAL TRAINING PROGRAM FOR DEAF CHILDREN

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INTRODUCTION AND OBJECTIVE

Deaf children have great difficulty with reading, and often, many of these children don't attain the same reading levels as hearing children.

The aim of this study was to determine the effectiveness of a reading multimodal training program to enhance the use of an alternative reading route based on the multimodal aspects of language.

METHOD

Participants:

A total of forty deaf children between 6 and 10 years of age participated in this study. Participants were assigned pseudo-randomly to two groups: the experimental group -EG- group (n = 19), which received the multimodal training program; and the control group -CG- (n = 21), which received the no-multimodal (only visual information) training program (see Table 1).

Table 1. Demographic and clinical characteristics of the experimental and control groups

Group	N	Age		Gender	IQ		Pre-locutive	Cochlear Implant
		M	SD		M	SD		
Control	21	8,95	0,28	13 boys	103,48	4,5	20	12
Experimental	19	8,95	0,27	10 boys	100,26	2,8	18	9

Procedure:

A quasi-experimental pre-test post-test design was used. The procedure was divided into three phases: a pre-evaluation phase, an intervention phase and a post evaluation phase. The *pre and post evaluation phases* lasted approximately 20 minutes, in which all the participants carried out three experimental tasks: a) visual lexical decision, b) phrase-picture pairing, and c) grammatical structures of the PROLEC-R battery (Cuetos, Rodríguez, Ruano & Arribas, 2007). These tasks were programmed with the E-prime software (Schneider, Eschman, & Zuccolotto, 2002), which controls the presentation of the stimuli and the collection of the responses of the participants. In *the intervention phase*, the experimental and control groups received a 6-months systematic training program (20 weekly sessions of 45 min). In each work session, the child had to perform by means of a laptop, between 5-8 computerized tasks, with increasing difficulty. The tasks were organized according to 4 specific programs (A, B, C, D), which were assigned according to age and experimental condition.

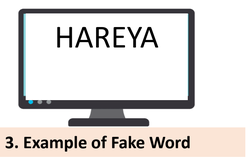
The 4 programs work and train the same basic processes: (I) Phonological recoding (phonological awareness); (II) Syntactic-semantic processes, and (III) Cognitive training. However, with Program A and C assigned to the *experimental group* (EG), the tasks use multimodal information (visual, proprioceptive and vibro-tactile), and those of Programs B and D assigned to the *control group* (CG) only visual information.

EVALUATION PRE AND POST

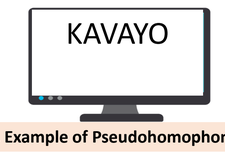
LEXICAL DECISION TASK

To measure lexical ability and pseudo homophone effect. The subjects had to decide if the word that appeared on the center of the screen existed or not.

The task had a total of 56 trials, the pseudohomophone effect was obtained with the difference between percentage of errors in pseudohomophone trials with fake words trials.



3. Example of Fake Word

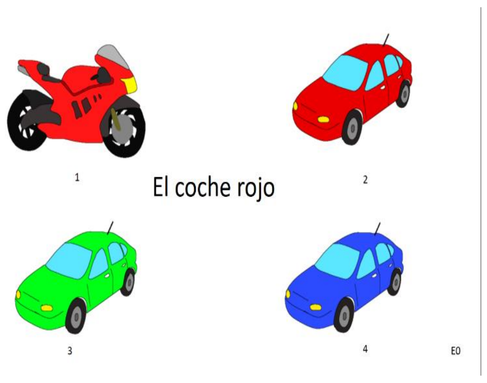


4. Example of Pseudohomophone

"PHRASE-PICTURE" TEST

Evaluates basic reading comprehension. Each trial presents a nominal phrase or a simple phrase (subject + verb + object) and four drawings.

The task has 10 trials: the first 5 with nominal phrases and the last 5 with simple phrases. Based on the total number of correct answers, a Total Score (TS) is obtained.



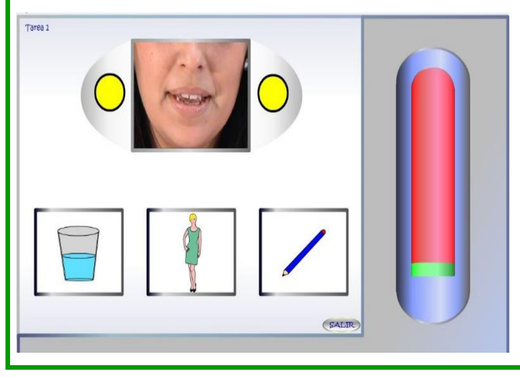
"GRAMATICAL STRUCTURE" TASK

Measures the ability of children to perform the Syntactic Processing of sentences with different grammatical structures.

The task consists of 16 essays, in which the child must read the sentence and select the drawing that corresponds to the sentence. Based on the total number of correct answers, a Total Score (TS) is obtained.

INTERVENTION

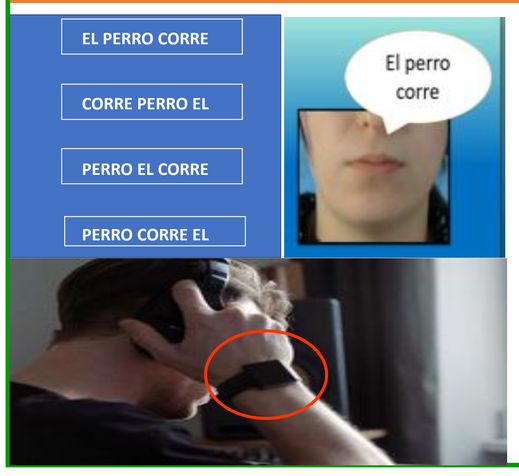
EXAMPLE OF PHONOLOGICAL CODING TASK WITH PROPIOCEPTIVE INFORMATION



The task is to identify the word spoken in the video and select the corresponding image.

The feedbak of the successes and errors committed are shown by means of a bar, in which the green color increases for the correct answers, or the red color for the errors

EXAMPLE OF SYNTACTIC-SEMANTIC PROCESSING TASK WITH PROPIOCEPTIVE AND VIBRO-TACTILINFORMATION



The task consist to select the phrase that appears in the video with the help of lip reading and vibro-tactil information trough the bracelet.

If you select an incorrect phrase, a negative vibro-tactile feedback will appear. If you select the correct one positive feedback will appear and you can continue with the next trial.

EXAMPLE OF COGNITIVE TRAINING; VISUOSPATIAL MEMORY TASK

A series of pseudowords will appear on the screen for a variable time (2-4 '') preceded by a 1 '' warning with the word "Ready" in the center of the screen, after this, there will be a variable time frame according to the level and a pseudoword will appear on the screen, which may have appeared before or not, in case it was before the subject must press the "m" key, otherwise "c"

RESULTS:

Subjects with a pseudohomophone effect should perform significantly worse in pseudohomophones than fake words, we only found a significant pseudohomophone effect in the post/evaluation of the experimental group Z=-2,978 p=0,003 (see figure 1). we also compared pseudohophone effect between pre and post to see if there was a significant increase, we only found it on the experimental group Z=-2,01 p=0,04 (see figure 2). We also tested improvement in grammatical comprehension comparing TS between pre and post evaluation. Only the experimental group improved significantly the performance in the picture-phrase test Z = -2,8 p = 0,005 (see figure 3) while both, the control group Z= -2,77 p = 0,006 and the experimental group Z= -2,31 P=0,02 increased significantly (see figure 4).

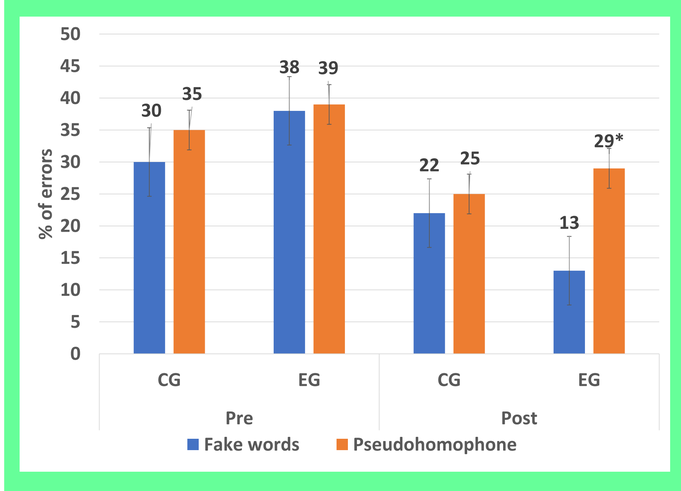


figure 1. Comparison of pseudohomophone errors and fake words across the groups and pre and post

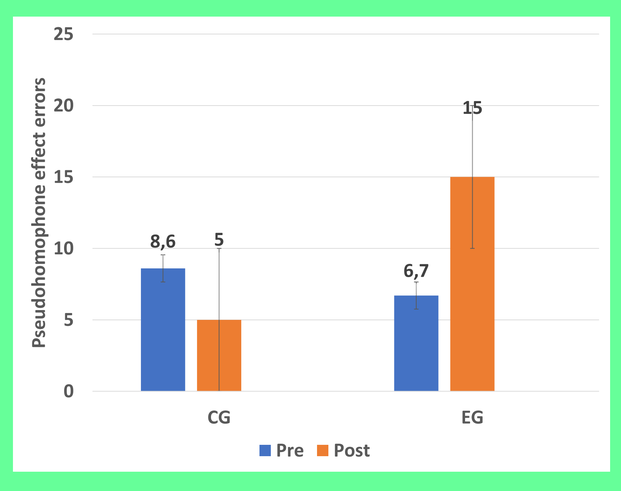


figure 2. Comparison of pseudohomophone effect with errors between pre and post evaluation in both groups

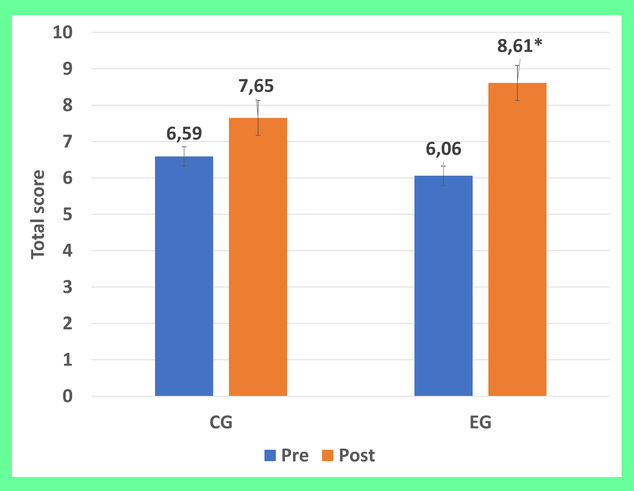


figure 3. Comparison of TS in the phrase-picture test between pre and post evaluation

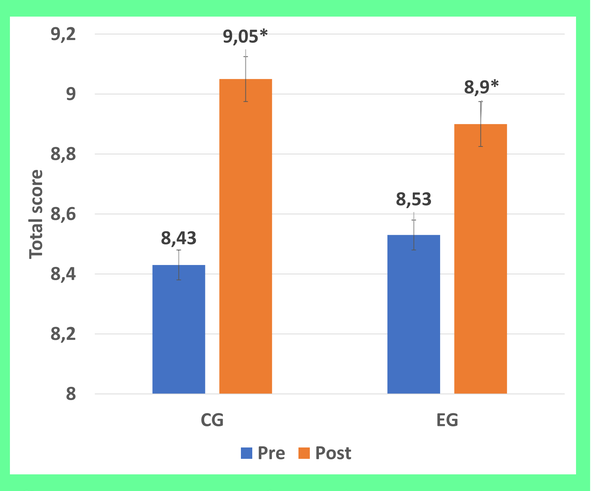


figure 4. Comparison of TS in the grammatical structure test between pre and post evaluation

CONCLUSIONS

These results suggest that the multimodal training program was effective to promote the use of an alternative route through the multimodal-phonological recoding training. The longer-term effects of this training could result in a higher level of reading skills as suggested by the improvement in the test of phrase comprehension, compared with children who do not receive the multimodal training.

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