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Longitudinal Study on the Development of Literacy Skills During Literacy☆

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ABSTRACT

There are many studies carried out in recent years on the process of learning to read. But there are very few works centered on the writing system and on the elements that favor this learning. The objectives of this study were to know the skills that facilitate access to learning the written code. A longitudinal quasi-experimental design was used, which showed the progress of 426 students from 5 to 7 years in the learning of writing. The results indicate that oral language, phonological awareness and naming speed are elements that favor this learning and reduce the risk of learning difficulties in the writing system.

Estudio longitudinal sobre el fomento de las habilidades de escritura en el periodo de alfabetización inicial

Palabras clave:
Lenguaje oral
Lenguaje escrito
Escritura
Alfabetización
Enseñanza de la escritura

RESUMEN

Durante las últimas décadas han sido numerosas las investigaciones que se han centrado en el estudio de las habilidades que favorecen el proceso de adquisición de la lectura. Sin embargo, son escasos los estudios efectuados con relación al aprendizaje de la escritura y al conocimiento de los factores que contribuyen a este aprendizaje. El objetivo de este estudio se ha centrado en determinar qué variables facilitan la adquisición de la escritura en los primeros momentos en los que se accede al aprendizaje del código escrito. Se ha empleado un diseño cuasiexperimental de corte longitudinal que permite observar la evolución de 426 estudiantes desde los 5 hasta los 7 años de edad. Los resultados apoyan el desarrollo de modelos didácticos que integren el desarrollo del lenguaje oral, la conciencia fonológica y la rapidez de denominación tanto para la mejora del aprendizaje de la escritura como para la prevención de dificultades en esta habilidad lingüística.

Introduction

Research on the literacy process has allowed us to identify the relationships between oral language development and written language learning in early ages (Ainsworth, Welbourne, & Hesketh, 2016; Axpe, Acosta, & Moreno, 2012; Gutiérrez & Díez, 2015), which has offered important advances in the knowledge of the skills involved in learning to read and write. The studies carried out in recent years have focused mainly on the initial learning of reading while research destined to the learning of writing in early ages (Gutiérrez, 2017; Vernon, 1998) is very scarce. This situation may be due to the general tendency to conceive reading and writing as two complementary skills (Magán-Hervás & Gértrudix-Barrio, 2017; Marí, Gil, Ceccato, & Cisternas, 2014) as a consequence of the similarities and characteristics that they share, since when reading, a message that comes from the spoken language is decoded and when writing a message from the same language is coded.

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However, it has become clear that different cognitive mechanisms are involved in reading and writing learning (Gutiérrez & Díez, 2016; Jiménez, Naranjo, O'Shanahan, Muñetón-Ayala, & Rojas, 2009).

Phonological awareness has been one of the most studied skills in early ages regarding learning of written language, especially in relation to reading (Bravo, 2016; Defior & Serrano, 2011; Ouellette & Haley, 2013). Both longitudinal and correlation studies in different languages have shown that there is a significant relationship between phonological awareness measures and learning to read (Arancibia, Bizama, & Sáez, 2012; Compton, 2003; Defior & Serrano, 2011; Gutiérrez & Díez, 2016; Landerl & Wimmer, 2008), to the point of being considered at present as the best predictor of this learning (González, López, Cuetos, & Vilar, 2017; Suárez-Coalla, García de Castro, & Cuetos, 2013). It has been evidenced that the intervention on phonological awareness must follow a sequential process, initially it must start from the manipulation of the larger units (words and syllables) to later accede to the management of the smaller elements (intrasyllable units and phonemes) (Gutiérrez & Díez, 2015; Schuele & Boudreau, 2008).

Another area of interest in recent research related to phonological awareness has been the rapid designation of visual stimuli. The denomination velocity is also an important predictor of learning to read in transparent orthographies because it intervenes in the speed with which long-term phonological information can be retrieved (Defior & Serrano, 2011; Suárez-Coalla et al., 2013). Longitudinal studies have found that previous performance in naming speed allows predicting subsequent success in reading (Kirby, Parrila, & Pfeiffer, 2003). However, most studies of predictive skills in written language have focused on learning to read, unlike what has happened with writing.

The relationship between naming speed and learning to write has been studied less (Cuadro & Berná, 2015) and with the presence of conflicting results. Some researchers have found no influence of the automatic and rapid designation on writing (Landerl & Wimmer, 2008; Suárez-Coalla et al., 2013), while other authors have observed influences between both variables (González, Cuetos, Vilar, & Uceira, 2015; Plaza & Cohen, 2004), suggesting the need for new research that may address the study of this interaction.

In the case of phonological awareness and naming speed, there is an agreement that oral language intervenes to a great extent in the development of written language (Gutiérrez & Díez, 2016). To access the written code, it must be noted that the letters are graphic signs that correspond to sound elements, since each letter is associated with a sound unit (Defior & Serrano, 2011). In this achievement, the different components of language are involved: phonological, morph syntactic, semantic and pragmatic, which allow the individual to develop his/her communicative capacity and acquire the skills to gradually separate the sentence structure from its meaning (Guarneros & Vega, 2014). The relation of the development of the component of the form (phonology, morphology and syntax) with the learning of the written code has been the most analyzed factor, however, few studies are oriented to the study of the different facets of oral language and its repercussion in the learning of writing.

The importance of phonological awareness and naming speed in the acquisition of reading is widely documented (Defior & Serrano, 2011; González et al., 2017), however, there are hardly any studies that analyze the influence of these skills and the different components of oral language with the learning of writing. Similarly, there are no longitudinal studies in Spanish that establish a causal effect of such skills and access to the writing system. Establishing if there are differences regarding the sex of the students in the process of acquiring writing abilities has not been an aspect that has been given special attention.

This study has focused on analyzing the effect that joint intervention in phonological awareness, naming speed and oral language have on the initial learning of writing and whether there are differences in this learning process according to sex. To do this, two groups of students are compared from the beginning of the third level of preschool education until the end of the second year of primary education, one that receives instruction on the indicated variables and another that follows the curricular program established in the official regulations. Our hypothesis is that students belonging to the group that is trained will obtain a better performance in the learning of writing.

Method

Participants

The study has 426 students aged between 5 and 7 years ($M = 6.42$, $SD = 0.54$), of which 48.6% are boys and 51.4% are girls. All of them attend six state and semi-private educational centers that share the characteristic of being located in a socio-cultural context of average level. Of these, three schools were assigned to the experimental group (212 students) and the other three to the control group (214 students), considering that there was a similar distribution in both groups of students attending semi-private and state centers. Of the 212 experimental participants, 47.4% were male and 52.6% were female, while of the 214 participants in the control group, 48.6% were male and 51.4% were female. The contingency analysis (Pearson's chi-square) between condition and sex did not show statistically significant differences ($X^2 = 0.48$, $p > .05$).

Instruments

Navarre-revised oral test (PLON-R) (Aguinaga, Armentia, Fraile, Olangua, & Úriz, 2005). It is a standardized test that allows the evaluation of different components of language: form (phonology, morphology and syntax), content (semantics) and use (pragmatic). The direct scores of each of the dimensions are transformed into typical scores organized into three categories: "below average", "needs improvement" and "normal" for each age. This test has a Cronbach coefficient of reliability of .80. The results show high composite reliability (CR = .91), mean extracted variance (VME = 54.73%) and McDonald's Omega coefficient ($\Omega = .63$).

Test for the Evaluation of Phonological Knowledge (PECO) (Ramos & Cuadrado, 2006). This test evaluates the levels of phonological knowledge (syllabic and phonemic), each of which consists of three distinct tasks: identification, addition and omission. It includes three subtests with syllables and phonemes, with a total of 30 items. The maximum score that can be obtained is 30, one point for each correct answer. The reliability, measured through Cronbach's alpha coefficient, is .80. The results showed that the composite reliability was high (CR = .93), the mean extracted variance higher than .50 (VME = 57.48%) and the McDonald's omega coefficient ($\Omega = .71$) implying that a high percentage of variance is explained by the construct.

Speed of naming. The Rapid Automatized Naming Test (RAN) (Wolf & Denckla, 2003). The RAN test is an individual application test. The objective of the task is to name 200 stimuli as fast as possible, grouped into four subtests: digits, letters, colors and drawings. The RAN task records the time it takes to name the stimuli of each card and the number of errors made when naming them. With these two data, an efficiency index is performed for each of the four types of subtests presented, according to the procedure used by Compton (2003), which converts the scores into digits per second, letters per second, colors per second and drawings per second. This test has a Cronbach coefficient of reliability of .80. The results showed

the composite reliability (CR = .88), the mean variance extracted (VME = 63.48%) and the McDonald's omega coefficient (Ω = .74).

Proescri-Primaria (Assessment Test of Cognitive Processes in Writing) (Artiles & Jiménez, 2007). It evaluates the lexical processes, through the tasks of: dictation of letters, generating words, dictation of words, dictation of words subject to orthographic rules and dictation of pseudo words. In each of these tests a point is awarded for each correct answer. According to the Cronbach procedure the coefficient of reliability is .85. In addition, a confirmatory factor analysis was performed through the composite reliability (CR = .91), the mean variance extracted (VME = 59.52%) and the McDonald's Omega coefficient (Ω = .78).

Data analysis

The SPSS Statistics 21 statistical program was used to analyze the data. Initially descriptive statistics were obtained with the purpose of analyzing the average scores and the typical deviations of the subjects in each of the measured variables. Subsequently, the main analyses of the study were carried out through the mixed ANOVA of repeated measurements $6 \times (2 \times 2)$. The factors that have been included in the model are the period of each evaluation (pretest–post-test: E1, E2, E3, E4, E5, E6), the group (experimental–control) and sex (boy–girl). The relevant *F* statistics are obtained, according to the fulfillment of the sphericity assumption calculated through the Mauchly (1940) test. Likewise, Bonferroni post hoc tests were performed to determine the levels of variables that were significant. On the other hand, a unifactorial ANOVA of repeated measures, including as a factor, the E1, E2, E3, E4, E5, E6, is used to obtain intra-group data. Finally, we estimated the size of the effect (index *d*) proposed by Cohen (1988) that allows quantifying the magnitude of the differences found between the groups over time. Low effects ($.20 \leq d \leq .49$), moderate ($.50 \leq d \leq .79$) and high ($d \geq .80$) were established.

Design and procedure

The study uses a quasi-experimental and longitudinal design with pretest–post-tests (six measurements) and phases of intervention (three periods) with an experimental group (to which the intervention program is applied) and a control group (following the official curriculum of the second cycle of preschool education and primary education of the Valencian Community).

The evaluation periods established are six, at the beginning and at the end of each school level (third year of preschool education, first and second year of primary education). The evaluations have been carried out with the same tests and each subject has been evaluated individually, always by the same teacher, during class time and in a classroom equipped for this purpose, these evaluations have been carried out by four education professionals (language and psych pedagogic specialists) who had been trained for two sessions prior to the study, thus facilitating their training and homogeneity in data collection.

The study respected the ethical values required in research involving human beings (informed consent of relatives and participating educational institutions, right to information, protection of personal data, guarantees of confidentiality, non-discrimination, gratuity and the possibility of abandoning the program in any of its phases).

During the intervention period the students of the control group followed the official program developed by the Ministry of Education and Culture (Decree 38/2008 and 108/2014 of the second cycle of preschool education and primary education respectively) of the Valencian Community. The contents of preschool education are oriented to the approach of written language along with the development of oral language and in primary education to the promotion of written language through the domain of the linguistic units of our code through the development of lexical, semantic and morph syntactic. The subjects of the experimental group had the intervention program designed (during 5 sessions per week). It consists of 75 sessions of 50 minutes and is focused on the development of the different components of oral language (form, content and use), phonological awareness and the rapid nomination of visual stimuli, following a sequence of progressive complexity in each of the courses. The tutor of each group has been in charge of the application of the program elaborated through a dossier that detailed the whole work plan.

For the linguistic stimulation, different ludic proposals were implemented oriented to the development of the different components of oral language: form, content and use. The phonological component, morphological and syntactic (form) has been worked through activities of naming images, completing phrases from a series of words and illustrations given, invention of titles and characters of children's stories and joint creation of small narrative stories.

In relation to the semantic development (content) tasks have been carried out oriented to the recognition of everyday elements and objects in images, search games of words from a series of slogans, classification of objects by semantic fields, recognition of intrusive words in sentences and search for synonyms and antonyms in narrative texts.

The communicative capacity (use) that had as a purpose to promote the use of functional language has been exercised through situations of symbolic play centered on the expression of feelings, desires and personal opinions, explanation of everyday events of the school and social reality, communicative situations of role playing and group exhibitions on certain centers of interest.

Based on oral linguistic development, alphabetic knowledge has been favored by teaching the names of the letters through mixed phonetic methods with proposals aimed at learning the names of classmates, the development of the vocabulary of everyday objects and dynamics centered in the knowledge of titles, characters and events of children's stories.

The development of phonological awareness was centered in the implementation of different ludic activities oriented to the improvement of lexical, syllabic, intrasyllabic and phonemic level extracted from the materials Avanza (Espejo, Gutiérrez, Llambés, & Vallejo, 2008) and Avanzados (Espejo, Gutiérrez, Llambés, & Vallejo, 2015).

The denomination velocity has been performed using templates that contained four rows with eight stimuli each in the first year, five rows with nine stimuli in the first year of primary education and six rows and ten stimuli in the second year of primary education. The stimuli in pre-school were images of everyday objects, numbers up to ten, primary colors and the letters studied. In the first year of primary education, the objects of the school and social environment, numbers up to fifty, primary and secondary colors, letters and two and three syllable words. In the second year of primary education, the images related to the content and characters of narrative stories, numbers up to one hundred, primary, secondary and tertiary colors, letters, words and pseudo words, both with two and three syllables, in structure CV, VC, CVC and CCV. All these stimuli were presented on the digital whiteboard to be evoked nimbly by the students both individually, in a small group, and collectively.

Results

Table 1 shows the descriptive statistics of the variables oral language, phonological awareness, naming speed and writing processes, with mean scores and standard deviations of the experimental group and the control group in the six evaluation periods.

Table 1
Descriptive statistics and mixed ANOVA results of repeated measures of evaluation and group comparisons

	Experimental		Control		Phase comparison		
	M	*SD*	*M*	*SD*	*F* 1,37		
					Evaluation	Group	Evaluation × group
Oral language							
E1	2.12	0.16	2.15	0.26			
E2	3.23	0.31	2.76	0.65			
E3	3.34	0.27	3.02	0.31	27.41***	14.23**	11.42**
E4	3.84	0.23	3.43	0.47			
E5	4.02	0.41	3.54	0.33			
E6	4.68	0.52	3.76	0.28			
Phonological awareness							
E1	1.08	0.34	1.11	0.28			
E2	1.71	0.65	1.27	0.72			
E3	1.79	0.23	1.33	0.25	65.27***	42.51***	54.18***
E4	2.52	0.42	1.63	0.61			
E5	2.60	0.73	1.68	0.31			
E6	3.04	0.16	2.12	0.62			
Naming speed							
E1	2.07	0.34	2.06	0.51			
E2	2.67	0.32	2.18	0.35			
E3	2.72	0.65	2.23	0.43	23.15***	12.05**	8.62**
E4	3.52	0.32	2.52	0.51			
E5	3.61	0.54	2.62	0.67			
E6	4.15	0.67	3.02	0.37			
Process of writing							
E1	1.10	0.38	1.12	0.51			
E2	1.52	0.23	1.27	0.34			
E3	1.57	0.42	1.30	0.51	56.42***	27.14***	31.26***
E4	2.12	0.53	1.76	0.36			
E5	2.21	0.41	1.80	0.54			
E6	3.38	0.72	2.12	0.46			

*$p < .05$.
** $p < .01$.
*** $p < .001$.

As can be seen, the same table includes the *F* statistics obtained from the mixed ANOVA of repeated measures in the evaluation factor, group and the evaluation-group interaction. On the other hand, Table 2 shows the typical measures and deviations of each of the variables analyzed, according to the sex of the participants. Likewise, the statistics *F* of the factors sex, evaluation-sex, and group-sex are included in the table. Data from the longitudinal study obtained using the mixed ANOVA of repeated measures $6 \times 2 \times 2$ and of the intragroup ANOVA performed with each variable are set out below.

Oral language

The mixed ANOVA of repeated measures indicates a significant main effect of the evaluation factor $F(1, 37) = 27.41$, $p < .001$ as participants improved their results over the three years of intervention. Within the experimental group, intra-group ANOVA indicates a main effect of the evaluation factor $F(1, 37) = 34.27$, $p < .001$. Post hoc tests indicate significant differences from E1 to E2 ($p < .001$), from E3 to E4 ($p < .001$) and from E5 to E6 ($p < .01$). No significant differences were found from E2 to E3 ($p < .038$) or from E4 to E5 ($p < .064$). In the control group, there is also a main effect of the evaluation periods $F(1, 37) = 12.51$, $p < .001$, in this case post hoc tests indicate significant differences from E1 to E2 ($p < .001$), from E3 to E4 ($p < .01$) and from E5 to E6 ($p < .01$). The overall change in scores from T1 to T6 (initial assessment, before implementation of the intervention program and final evaluation, after the application of the program) is significant in the experimental group ($p < .001$) and in the control group ($p < .001$). A main effect of the group factor $F(1, 37) = 14.23$, $p < .01$, has also been found, showing differences between the experimental and control groups over time, with the experimental group obtaining the highest scores. In addition, there are significant interaction effects between the evaluation-group factors $F(1, 37) = 11.42$, $p < .01$, which, together with Bonferroni's post hoc test, indicate significant differences in favor of the experimental group in E2, E4 and E6. The magnitude of the differences between the groups from E1 to E6 is moderate as indicated by the effect size estimator ($d = 0.57$). As for sex, there are no effects on this factor $F(1, 37) = 11.67$, $p = .071$. There is also no interaction effect group × sex $F(1, 37) = 5.58$, $p = .43$. The interaction evaluation × group × sex is not significant $F(1, 37) = 6.47$, $p = .235$.

Phonological awareness

In this variable the mixed ANOVA analysis showed the existence of main effects of the evaluation factor $F(1, 37) = 65.27$, $p < .001$. Intragroup analysis also indicates a major effect of this factor in the experimental group $F(1, 37) = 32.51$, $p < .001$, with significant differences from E1 to E2 ($p < .001$), from E3 to E4 ($p < .001$) and from E5 to E6 ($p < .001$). There are no differences from E2 to E3 ($p = .423$) nor from E4 to E5 ($p = .273$). In the control group there is also an evaluation effect $F(1, 37) = 8.42$, $p < .01$ with significant differences from E3 to E4 ($p < .01$) and from E5 to E6 ($p < .001$). The overall change from E1 to E6 is significant in both groups at a level $p < .001$. As for the group factor, the analysis points to a main effect $F(1, 37) = 42.51$, $p < .001$. Participants in both groups increased their phonological awareness scores, although the subjects in the experimental group scored higher, as an interaction effect was obtained × group evaluation $F(1, 37) = 54.18$, $p < .001$. The post hoc tests evidenced the existence of significant differences in favor of the experimental group in E2, E4 and E6. The effect size when comparing groups is moderate ($d = 0.62$). As for sex, there are no effects on this factor $F(1, 37) = 10.63$, $p = .349$. There is no effect of group sex interaction $F(1, 37 = 9.37$, $p = .237)$ The comparison × group × sex ratio is not significant $F(1, 37 = 5.21)$, $p = .436$.

Naming speed

The mixed ANOVA of repeated measures indicates a significant main effect of the evaluation factor $F(1, 37) = 23.15$, $p < .001$, indicating that the participants improve their results throughout the intervention. Within the experimental group the intragroup ANOVA indicates a main effect of the evaluation factor $F(1, 37) = 42.27$, $p < .001$. Post hoc tests indicate significant differences from E1 to E2 ($p < .001$), from E3 to E4 ($p < .001$) and from E5 to E6 ($p < .01$). No significant differences were found from E2 to E3 ($p < .052$) and from E4 to E5 ($p < .061$). In the control group, there is also a main effect of the evaluation periods $F(1, 37) = 15.41$, $p < .001$, in this case post hoc tests indicate significant differences from E1 to E2 ($p < .05$), from E3 to E4 ($p < .001$) and from E5 to E6 ($p < .01$). The overall change in scores from T1 to T6 is significant in the experimental group ($p < .001$) and in the control group ($p < .001$). A major effect of the group factor $F(1, 37) = 12.05$, $p < .01$, has also been found, showing differences between experimental and control groups over time, with the experimental group obtaining higher scores. In addition, there are significant interaction effects between the evaluation-group factors $F(1, 37) = 8.62$, $p < .01$, which together with Bonferroni's post hoc test indicates significant differences in favor of the experimental group in E2, E4 and E6. The magnitude of the differences between the groups from E1 to E6 is moderate as indicated by the effect size estimator ($d = 0.62$). As for sex, there are no effects on this factor $F(1, 37) = 9.23$, $p = .236$. There is also no interaction effect group × sex

Table 2
Descriptive statistics according to sex and mixed ANOVA results of repeated measures of the comparisons, evaluation, group and sex

	Experimental		Control			Phase comparison	
	Boy *M* (*SD*)	Girl *M* (*SD*)	Boy *M* (*SD*)	Girl *M* (*SD*)	Sex *F* 1,37	Evaluation × sex *F* 1,37	Group × sex *F* 1,37
Oral language							
E1	2.08 (0.52)	2.14 (0.43)	2.11 (0.52)	2.19 (0.37)			
E2	3.18 (0.32)	3.28 (0.24)	2.71 (0.41)	2.81 (0.57)			
E3	3.29 (0.62)	3.39 (0.73)	2.98 (0.46)	3.06 (0.56)	11.67	7.53	5.58
E4	3.88 (0.12)	3.80 (0.28)	3.44 (0.34)	3.42 (0.53)			
E5	4.04 (0.47)	4.00 (0.58)	3.58 (0.63)	3.50 (0.42)			
E6	4.67 (0.31)	4.69 (0.53)	3.74 (0.42)	3.78 (0.46)			
Phonological awareness							
E1	1.06 (0.21)	1.10 (0.37)	1.08 (0.41)	1.14 (0.68)			
E2	1.67 (0.62)	1.75 (0.35)	1.19 (0.43)	1.26 (0.64)			
E3	1.86 (0.35)	1.72 (0.43)	1.32 (0.45)	1.35 (0.62)	10.63	8.52	9.37
E4	2.56 (0.21)	2.48 (0.24)	1.61 (0.53)	1.66 (0.47)			
E5	2.58 (0.43)	2.62 (0.62)	1.65 (0.51)	1.71 (0.82)			
E6	3.07 (0.32)	3.01 (0.36)	2.15 (0.62)	2.09 (0.53)			
Naming speed							
E1	2.04 (0.52)	2.10 (0.31)	2.05 (0.72)	2.07 (0.53)			
E2	2.70 (0.43)	2.64 (0.42)	2.16 (0.33)	2.20 (0.58)			
E3	2.70 (0.27)	2.74 (0.32)	2.25 (0.52)	2.21 (0.63)	9.23	7.54	8.23
E4	3.50 (0.48)	2.54 (0.38)	2.49 (0.26)	2.55 (0.27)			
E5	3.58 (0.57)	3.64 (0.54)	2.58 (0.37)	2.64 (0.42)			
E6	4.19 (0.35)	4.11 (0.41)	2.98 (0.32)	3.04 (0.57)			
Process of writing							
E1	1.09 (0.35)	1.12 (0.62)	2.14 (0.38)	2.09 (0.24)			
E2	1.50 (0.47)	1.54 (0.26)	1.29 (0.22)	1.25 (0.54)			
E3	1.60 (0.41)	1.54 (0.52)	1.28 (0.73)	1.32 (0.43)	8.12	6.27	6.39
E4	2.09 (0.51)	2.15 (0.41)	1.79 (0.32)	1.73 (0.64)			
E5	2.23 (0.34)	2.19 (0.41)	1.82 (0.42)	1.79 (0.37)			
E6	3.41 (0.62)	3.35 (0.71)	2.10 (0.21)	2.14 (0.58)			

*$p < .05$.
**$p < .01$.
***$p < .001$.

$F(1, 37) = 8.23$, $p = .172$. The comparison evaluation × group × sex is not significant $F(1, 37) = 6.57$, $p = .451$.

Cognitive processes of writing

In this variable, the mixed ANOVA showed the existence of main effects in the evaluation factor $F(1, 37) = 56.42$, $p < .001$, which indicates that the participants improve their results during the three years of intervention. Within the experimental group the intragroup ANOVA indicates a main effect of the evaluation factor $F(1, 37) = 63.27$, $p < .001$. Post hoc tests indicated significant differences from E1 to E2 ($p < .001$), from E3 to E4 ($p < .001$) and from E5 to E6 ($p < .001$). No significant differences from E2 to E3 ($p < .521$) or from E4 to E5 ($p < .362$) were found. In the control group, there is also a main effect of the evaluation periods $F(1, 37) = 14.36$, $p < .001$, in this case post hoc tests indicate significant differences from E1 to E2 ($p < .05$), from E3 to E4 ($p < .01$) and from E5 to E6 ($p < .01$). The overall change in scores from T1 to T6 is significant in the experimental group ($p < .001$) and in the control group ($p < .001$). A main effect of the group factor $F(1, 37) = 27.14$, $p < .001$, has also been found, showing differences between the experimental and control groups over time, with the experimental group obtaining the highest scores. In addition, there are significant interaction effects between the evaluation factors × group $F(1, 37) = 31.26$, $p < .001$, which, together with Bonferroni's post hoc test, indicates significant differences in favor of the experimental group in E2, E4 and E6. The magnitude of the differences between the groups from E1 to E6 is high as indicated by the effect size estimator ($d = 0.86$). As for sex, there are no effects on this factor $F(1, 37) = 8.12$, $p = .362$. There is also no interaction effect group × sex $F(1, 37) = 6.39$, $p = .267$. The comparison × group × sex is not significant $F(1, 37) = 5.43$, $p = .542$.

Discussion

The aim of this study was to analyze the effect that intervention in phonological awareness, along with the speed of naming and the development of the different components of oral language has on the initial learning of writing. The results obtained indicate significant differences in the group-evaluation interaction in favor of the group that received the intervention with a marked effect size in each one of the analyzed variables, which shows the positive impact of the program and indicates that the instruction in these skills contributes to significantly improving the learning of the writing system in the first levels of schooling.

During the different evaluations carried out, it is observed that both the students in the control group and the experimental group have improved their expressive capacity at a written level, although in all the measurements measured the group participating in the intervention program reached the highest scores, and what is more relevant, these have been maintained throughout the different periods of evaluation, indicating that through the established curriculum the students have access to the writing system, but this improvement can be greater if we implement programs focused on the development of certain skills as seen in this study. This contribution coincides with the results found in other studies that defend the importance of the stimulation of the abilities that favor the learning of writing in early ages (Ainsworth et al., 2016; Gutiérrez, 2017).

Regarding the study of the different variables of the intervention program, the data collected show that the experimental group has improved significantly with respect to the control group in the development of oral language, which indicates that the implementation of oral interaction dynamics oriented to the stimulation of the different linguistic components (phonological, morphological, syntactic, semantic and pragmatic) is a factor of great relevance both for the improvement of the communicative capacity and for the learning of writing, which coincides with the postulates of other authors (Guarneros & Vega, 2014; Pfenninger & Singleton, 2016) who consider that oral language skills are related to the acquisition of writing, since a greater knowledge of the structure of language facilitates access to learning the written code. This fact has been shown in recent studies (Gutiérrez-Fresneda & Díez, 2017) in which the influence of the management of oral language skills in the learning of written language is verified. As for sex, it is observed that up to the end of the first year of primary education the development of oral language is superior in girls, at which point it equates with their male counterparts.

As far as phonological knowledge is concerned, the results indicate that the experimental group improves to a greater extent than the students who followed the curricular program in the awareness and management of units of spoken language, which shows that the training of the abilities that develop phonological awareness is an aspect that intervenes in the initial phase of the learning of writing and facilitates its acquisition, since it favors early spelling, the recognition of words and their segmentation in linguistic units, which would make possible the realization of the phoneme-grapheme correspondences. These contributions coincide with the data found by other authors on the influence of phonological processes on the acquisition of learning from the writing system (Gutiérrez, 2017; Taylor & Perfetti, 2016), although in studies conducted during shorter time intervals. As for sex, it is observed that girls have a greater control of metaphonological skills until the end of the first year of primary education, when it then becomes equal with boys, a situation that coincides with the data found in previous studies (Gutiérrez & Díez, 2016).

In relation to the rapid designation of stimuli, the students participating in the intervention program also obtain superior results than the rest of the students in this facet being able to evoke diverse elements both linguistic and non-linguistic with more precision and agility. As for the efficiency index, it has been verified that the speed has increased significantly since the first year of intervention and has been maintained during the subsequent courses, which is logical since the fast denomination is an index of access to the lexicon and word writing, especially those of arbitrary spelling require the participation of visual processes to access the orthographic representations of words (Kessler & Treiman, 2003). This would indicate that the denomination speed intervenes in the handling of the orthographic representations of the words, besides facilitating the access and the recovery of names of familiar objects and words that are stored in the memory in the long term. These data support the postulates of previous work that point to the influence of speed on the denomination in the learning of writing (González et al., 2015; Plaza & Cohen, 2004).

With respect to the different processes involved in the learning of writing, the data obtained indicate that the intervention program contributes to the acquisition of alphabetic knowledge, as well as to the adequate writing of syllables, words and pseudo words to a greater extent than through the program curricular, an achievement that is maintained throughout the different measurements. This would be explained, on the one hand, by the automation of phoneme–grapheme conversion rules, these allow any combination of letters to be written in a precise way and thus to form different words, which can be determined by the development of abilities that allow a greater capacity to intentionally manage spoken language units, to quickly and accurately visualize and retrieve the phonological representation of words (Gutiérrez, 2017; Mejía de Eslava & Eslava-Cobos, 2008), and on the other hand, as students become more efficient, they depend less and less on phonological processing when the orthographic pattern is consolidated, which is the one that makes it possible to access the representation of words in a fast and precise way.

From the results of this study we can offer a better understanding of the problems that the student faces when accessing the acquisition of the written code, which can contribute to the improvement of the planning of writing teaching activities during the literacy process in the first school levels. A limitation of this work and that it would be interesting to take into consideration in other studies certain variables that can also influence the initial learning of writing, such as, the exposure to the written language in the family, the practices of writing at home and the motivation that the learners have toward this learning since they can also offer relevant contributions on the process of acquisition of the writing system.

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