



# Effects of web-based training on Spanish pre-service and in-service teacher knowledge and implicit beliefs on learning to read



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## HIGHLIGHTS

- Teaching children how to read demands a high degree of specialization.
- The creation of a Spanish online teacher professional development program has been developed to improve teaching of reading.
- Post-Letra program revealed changes in teachers' beliefs about learning to read.
- Post-Letra program, teachers learned more about the essential components of the reading process.
- The assessment of the training and support website was quite positive by pre-service and in-service teachers.

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## ABSTRACT

The main objective of this study was to analyze the effects of web-based training on Spanish pre-service and in-service teacher knowledge and implicit beliefs on learning to read. A sample of pre-service teachers and in-service teachers from Mexico, Guatemala, Ecuador and Spain participated in the on-line course. Findings suggest that teachers may improve their knowledge of phonemic awareness, systematic phonics instruction, fluency, vocabulary, strategies for comprehension as necessary components of quality reading instruction. Upon completion of the training, effects were also found on the teachers' implicit beliefs. Finally, positive ratings were received by both the pre-service and in-service teachers.

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## 1. Introduction

Results from numerous international assessments have suggested that there are a substantial number of children who are unable to read on grade level. Nowadays, reading literacy levels across countries are assessed by two large scale international surveys, namely PIRLS (Progress in International Reading Literacy Study) and the Organization for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA). The *International Association for the Evaluation of Educational Achievement* (IEA), the most recent PIRLS (*Progress in*

*International Reading Literacy Study*, Martin & Mullis, 2013; Martin, Mullis, & Kennedy, 2007; Mullis, Martin, Foy, & Drucker, 2012; Mullis, Martin, Kennedy, & Foy, 2007), the PISA reports (OECD, 2006, 2009, 2013), and the Third Regional Comparative and Explanatory Study (TERCE) that coordinates the United Nations for Educational, Scientific and Cultural Organization (UNESCO, 2015), which involves a total of fifteen Latin-American countries; all point to the importance of assuring that all children become skilled readers.

The European Union (EU) average score in reading for 15 year-olds and the proportion of struggling readers in this age group remained stable in PISA surveys carried out between 2000 and 2009 (EACEA/Eurydice, 2011). In 2009, approximately one in five 15-year olds in the EU-27 countries had difficulties using reading for learning. In many Spanish-speaking countries, it has also been found that average reading skill levels are lower than those of other

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OECD countries (see, for example, the OECD's PISA report from 2012). In addition, there are also reports on PIRLS-TIMSS focusing extensively on reading performance of 4th graders in Spain (Corral, Zurbano, Blanco, García, & Ramos, 2012). These authors report that language training before entering primary school and the student's reading habits are two of the variables with significant impact on the results. This cumulative effect is particularly relevant in families with low socio-economic status.

Reading is a basic skill for survival and those who have reading difficulties in the early grades continue to struggle in school and in life (Joshi, Binks, Hougen, Dean, et al., 2009). This issue is of critical importance for students with specific learning disabilities because it is estimated that approximately 80% of this population have difficulties in learning to read (Lyon, 1995). Longitudinal studies have found that these reading problems often persist and children who struggle with reading during the early grades of primary school are most likely to continue to have reading difficulties throughout their education (Juel, 1988; Vaughn, Linan-Thompson, Kouzehanami, Bryant, et al., 2003).

Some of the reasons why children fail to learn to read have been described by Vellutino, Scanlon, and Jaccard (2003). These authors mention environmental and instructional factors which may contribute to poor reading outcomes. Environmental factors include poor development of oral language, the number of books available at home, parent attitudes and parental models. As for instructional factors, these include an absence of an appropriate environment for reading and writing in the schools, ineffective instructional methods, and a lack of teacher knowledge regarding language.

Teachers play a key role in helping children to learn to read, particularly for those children who are at-risk for failing to learn to read (Brady & Moats, 1997). In their meta-analysis, Marzano, Pickering, and Pollock (2001) concluded that teacher effectiveness is one of the most important factors when it comes to explaining learner progress, not only in reading, but also in mathematics and other school areas.

Some scientific reports such as the *National Reading Panel (NRP) (2000)* have determined the components necessary in order for children to become solid readers and those needed by teachers in order to more effectively teach reading skills. These reports highlight five essential components that are necessary for reading instruction: (i.e., phonemic awareness, phonics, fluency, vocabulary, and text comprehension strategies) (Lyon & Weiser, 2009). Nevertheless, Goldenberg et al. (2014) suggest caution in applying psycholinguistic and instructional principles across languages without taking into account potentially relevant differences in linguistic and orthographic characteristics, as well as differences in the socio-cultural and socio-linguistic contexts in which learning is taking place.

Despite the transparency of the Spanish language (i.e., the process of translating print to sound is never ambiguous because each letter of the alphabet has a unique pronunciation, except the letters *c*, *g*, and *r* where the pronunciation is different according to the vowel following the consonant), many of the studies with Spanish-speaking children (either monolinguals or Spanish–English bilinguals) have revealed that phonemic awareness (PA) is a strong predictor of word reading in Spanish (Carrillo, 1994; Manrique & Signorini, 1994; Signorini, 1997). PA is the ability to hear and manipulate the individual sounds within words. In addition, the ability to use the grapheme-phoneme correspondences (GPC) to translate printed text into oral language appears to be a key component to improving word reading and reading comprehension in Spanish. Castejón, González-Pumariega, and Cuetos (2015) examined the development of word recognition in Spanish, considering accuracy and speed, from a longitudinal

perspective. Results showed that initial gains in reading accuracy occurred very rapidly. However, the growth of reading speed was found to be more difficult and complex, and automatic word recognition remains low at the end of the sixth grade. Students with reading disabilities (RD) in Spanish tend to have a malfunctioning of sublexical processes (i.e., the mechanism that recognizes the relation between graphemes and phonemes). This malfunctioning is expressed in turn by the student's difficulty reading multi-syllabic words automatically (Suárez & Cuetos, 2008). Vocabulary plays also a critical role in reading comprehension because understanding a text requires knowing the meaning of the words. Kim and Pallante (2012) investigated predictors of word reading and reading comprehension skills using longitudinal data from Spanish-speaking kindergartners and first grade students in Chile. For first graders' reading comprehension, word reading, nonsense word fluency, and vocabulary were positively and uniquely related. In addition, Cena, Baker, Kame'enui, Baker, et al. (2013) provided evidence of the relevance of explicit and systematic vocabulary instruction in Spanish. Reading comprehension problems in children are related to a lack in the development of a good fluency. Álvarez-Cañizo, Suárez-Coalla, and Cuetos (2015) carried out a study to determine which aspects of reading fluency are related to reading comprehension in a sample of Spanish primary school children (third and sixth grade). The results demonstrated that children with less reading comprehension made more inappropriate pauses and also intersentential pauses before comma than good comprehenders and made more mistakes in content words. Nevertheless, sometimes Spanish poor comprehenders are able to decode words fluently but they have a deficit in syntactic and semantic processes. Thus, not all reading comprehension difficulties can be attributed to poor decoding or oral reading fluency but poor comprehension also can derive from processes that are necessary to make sense of sentences within passages.

On the other hand, what does research tell us about teaching reading? Teaching approaches that are appropriate for a language that has an opaque orthographic system are not always appropriate for other languages that are more transparent. For instance, in English language many words have an orthographic pattern that correspond to linguistic units larger than the phoneme, such as in the case of rhyme (e.g., *right*, *sight*, *flight*, etc.). Thus for children who learn how to read in English, an approach based on analogies would be more appropriate. Studies conducted into Spanish, however, have shown that children do not rely on this type of linguistic unit in visual word recognition (Jiménez, Álvarez, Estévez, & Hernández-Valle, 2000). Also, most studies have highlighted the beneficial effects a phonological focus in teaching can have to all students during initial education, given the transparency of Spanish (Alegria, Carrillo, & Sánchez, 2005).

### 1.1. Teacher knowledge

It is important to properly train teachers who are responsible for the prevention and correction of reading disabilities. However, it has been found across different languages that many teachers lack sufficient knowledge regarding language as well as the good teaching practices needed in order to effectively help their students acquire basic reading skills (Bos, Mather, Dickson, Podhajski, & Chard, 2001; Guzmán, Delia, Nuria, & Abreu, 2015; Joshi, Binks, Hougen, Dahlgren et al., 2009; Lewis, Cuadrado, & Cuadros, 2005). This lack of knowledge often goes hand in hand with incorrect teacher beliefs regarding what they need to know and do in order to help their students learn.

Bos et al. (2001) administered the Teacher Knowledge Assessment: Structure of Language to 252 pre-service teachers and 286 in-service teachers. This questionnaire is a 20-item multiple-choice

assessment that examined knowledge of the structure of the English language at both the word and sound levels. Results revealed that 53% of the former and 60% of the latter were incapable of correctly answering half of the questions regarding “language knowledge”. Among teachers who believed that a lack of phonemic awareness contributes to reading difficulties, two thirds of the participants believed that PA was a method of reading instruction to be taught to children when learning the individual letters and their sounds.

Joshi, Binks, Hougen, Dahlgren, et al. (2009c) also administered a survey of language concepts related to literacy acquisition to 78 teacher educators. They developed a survey of language constructs of 68 items which included questions regarding how well university instructors felt prepared to teach typical readers as well as struggling readers the skills of reading. Other items in the test asked for definitions of terms such as *phoneme* (i.e., speech sounds that distinguish words in a language) and *morpheme* (i.e., the smallest linguistic unit with meaning), as well as identification of the number of speech sounds in words such as *box* and *moon* and of the number of morphemes in words such as *observer* and *heaven*. Results revealed that although the teacher educators were familiar with some of the language concepts (e.g., syllable awareness); their performance was poor in regard to morphemes and phonemes. In a second study, 40 teacher educators were interviewed regarding best practices for the teaching of the primary components of reading. The majority did not mention the phonological method as a method to be used in the early instruction of reading, and specifically, for at-risk students (in regard to reading).

Lewis et al. (2005) found that Colombian teachers had not updated their knowledge about definition, causes, and manifestations and teaching methods of reading-writing. Most recently, Guzmán et al. (2015) analyzed preschool and primary school Spanish teacher knowledge of general information, symptoms/diagnoses and interventions on reading and writing. Results of the survey revealed that many teachers lacked sufficient knowledge regarding language as well as the good teaching practices needed in order to effectively help their students acquire basic reading skills, particularly PA and GPC.

According to Lyon (1997), these shortcomings are often due to the fact that many future teachers, during their teacher training, receive little formal instruction regarding the development of reading and its challenges. Furthermore, teacher educators (college faculty members) who are responsible for training these future teachers are often not familiarized with many of the concepts regarding language that are necessary in order to teach reading. In addition, it was also found that the subject matter taught to pre-service teachers in regards to reading instruction did not include the main components recommended by scientific research for effective reading instruction (Moats, 1994; NRP, 2000). In another study, Joshi, Binks, Graham, Ocker-Dean, et al. (2009a) conducted an analysis of the content of textbooks used in university reading education courses. In this study, the authors examined whether or not the textbooks contained information regarding the five components recommended by the NRP. Many of these textbooks did not adequately cover these five components or the appropriate procedures for their instruction.

### 1.2. Teacher beliefs regarding learning to read

In addition to the importance of teacher knowledge of reading development and instruction on their ability to effectively teach reading, teacher beliefs may also create obstacles when it comes to incorporating improvements or good practices into their classroom practices (Brown & Lan, 2015; Cunningham, Zibulsky, Stanovich, & Stanovich, 2009). In the absence of knowledge regarding the

essential components of reading instruction, teachers should base their teaching decisions on their own beliefs, which were most likely formed during their educational experiences. Teacher's implicit beliefs have been defined as “personal educational theories, re-established based on historical and socially based teaching expertise that is transmitted via training and teaching practice” (Marrero, 1993, p. 245).

In an earlier study, Jiménez, Rodríguez, Suárez, O'Shanahan, et al. (2015) conducted a study to determine the structure of theories utilized by teachers in regards to learning to read and identified seven main factors or components: sociocultural, maturation, corrective, repetition, nativist, constructivist and psycholinguistic. The first extracted component corresponded to a social learning perspective, emphasizing the role of family factors and social interaction in learning to read (e.g., “I believe that when families interact with children regarding reading, reading acquisition is favored and improved”). The second factor represented a “maturationist” perspective based on the idea that children need to mature and develop their psychomotor skills before they can begin the formal process of learning to read (e.g., “In my point of view, the ability to learn how to read in children is related to their psychomotor development”). The items making up the third factor focused on the role of correction in learning to read and it was referred to as “corrective theory” (e.g., “I think that in the early years of schooling it is necessary to correct children when they make mistakes while reading”). The fourth factor presented items referring to the role of repetition in learning to read (e.g., “I think that repetition is a very useful method in order for children to learn how to read and to correctly assimilate”). The fifth factor, referred to as “nativist theory”, emphasizes the opposite perspective, as it grants increased importance to the innate predisposition of children to learn how to read. This premise is reflected in those items suggesting that instruction is not as important and placing a greater emphasis on learning as an innate ability (e.g., “I think that there are children who learn to read on their own at an early age”). The sixth factor, referred to as “constructivist theory” emphasizes the active construction of knowledge by the individual (e.g., “I believe that in the early years of schooling, instead of correcting, it is better to allow children to discover their errors by rereading”). This factor attributes a more active role to the learner as it assumes that learning occurs when the individual has become capable of integrating new knowledge with the knowledge that they already possess. Finally, the seventh factor, referred to as “psycho-linguistic theory”, presumes that the learner should have attained linguistic development to the degree of understanding oral language prior to tackling the written language (e.g., “I think that it is premature for a child to learn to speak and read at the same time because at this stage children are still very immature”).

Understanding how teachers think about learning to read may make it easier to modify these beliefs in accordance with scientific research recommendations, thereby leading to improved teaching practices (Jiménez & O'Shanahan, 1992). Therefore, analysis and diagnosis of teachers' beliefs on how children learn to read within a specific socio-cultural context should be included in teacher training programs, as it shall most likely increase teacher effectiveness (Sang, Valcke, van Braak, & Tondeur, 2009).

### 1.3. Online professional development on reading instruction

The use of internet-based distance education is gaining popularity in the preparation of teachers (Singh & Stoloff, 2007). An important issue is to design teacher professional development programs of high quality, and these programs should be able to provide ongoing support for teachers as they attempt to implement new curricula or pedagogies. Therefore, the main requirements for

designing a high quality professional development program should be a preparation of teachers in all essential components of reading instruction, providing information on scientifically based instructional materials and strategies, enhancing teachers' ability to implement early intervention and remediation, and facilitating the use of assessment data to inform instruction (Joshi, Binks, Hougén, Dean, et al., 2009b; Uhry & Goodman, 2009). Some recent studies have focused on using technology to improve the teaching of teachers, who are in programs for children from at risk backgrounds, and these studies have used video and web based video platforms to promote effective professional development in literacy for these teachers. This kind of professional development technology has proven effective for teachers who serve a diverse group of learners (Vernon-Feagans, Kainz, Hedrick, Ginsbert, & Amendum, 2013).

Universities may play an important role in improving the quality and access to opportunities for pre-service and in-service teacher training. The success of large, open distance education and on-line courses for university students suggests that this technology may also be effective and appropriate for the training of in-service teachers (Ludlow, 2002). Pre-service university students and in-service teachers satisfaction and acceptance of their training is considered an important part of the training process since it results in a better implementation and optimum results when they put this training into practice (Wilson, 2012; Witt & Elliot, 1985). Research generally supports the finding that when compared with traditional university classes, web-based instruction has few differences in the quality and satisfaction of learning experience as measured by student feedback and student scores (Maki, Maki, Patterson, & Whittaker, 2000). Further, findings indicate that pre-service teachers are satisfied with their online learning, and they learn in an online class as much as they would in a traditional face-to-face class (Singh & Stoloff, 2007). Barnett, Corkum, and Elik (2012) conducted a recent study into determining the assessment level for a web-based environment and whether it could be effective in changing the knowledge, attitudes and behavior of teachers working with children who had ADHD. Teachers reported being satisfied with the platform and also its usefulness.

To our knowledge, no studies have used on-line training with pre-service and in-service teachers, incorporating the suggestions of scientific research on the basic skills that are involved in learning to read in Spanish. We did however find previous studies that provided similar training, albeit with a specific focus on special educational needs (SEN) for attention deficit disorders and/or hyperactivity disorders (ADHD) (e.g., Barnett et al., 2012), or some online resource for supporting English teachers in using RtI for struggling readers in the general education environment (Lopez, 2010).

In Europe, a recent report about teaching reading has been published by Eurydice, the Education Agency of the European Commission (EACEA/Eurydice, 2011). An interesting focus of the report is on programmes to improve the teaching of reading in EU-member countries. According to OECD Teaching and Learning International Survey (TALIS) data, the most common form of professional development for teachers of reading, writing and literature are short, one-off courses, workshops or conferences. More fruitful long-term and ongoing forms of professional development, such as web-based training, are far less common. Progress in International Reading Literacy Study (Martin et al., 2007) data suggest that an emphasis on how to teach reading effectively to all students during initial education is related to effective practice in reading instruction and stronger participation in professional development. The acquisition of a firm foundation in research and theory during initial teacher education is crucial to the development of excellence in the teaching of reading.

According to these guidelines, the Letra program is a web-based tutorial learning system that uses the Moodle platform to create a virtual educational environment that is based on the scientific evidence (Jiménez, 2015). Scientifically-based materials to be included in the *Letra* program e-tool have been tested in the Canary Islands, implementing Tier-2 early reading skills for at-risk K-2 students. Results indicated that children who received the *Letra* instructional materials had higher scores on the Early Grade Reading Assessment (EGRA) on initial sound identification, listening comprehension, letter sound knowledge and oral reading fluency compared to the control group (Jiménez, Rodríguez, Crespo, González, et al., 2010). After this experience, Crespo, Jiménez, Rodríguez, Luft, and Park (2015) designed a new study to examine the effects of a Tier 2 intervention for K-2 Spanish monolingual speakers at risk for reading difficulties. Specifically, the authors were interested in knowing whether the use of a Tier 2 intervention that follows guidelines similar to the interventions conducted in the United States is also effective in a Spanish monolingual setting, taking the differences in the Spanish and English orthographic systems into account. A hierarchical linear growth modeling was conducted and differences in growth rate were found in vocabulary in kindergarten, phonemic awareness in kindergarten and first grade, and oral reading fluency and retell in second grade.

The creation of Letra web-based tutorial learning system was made possible thanks to the support of the National Plan for Scientific and Technical Research, Development and Innovation (R&D&I) of the Ministry of Economy and Competitiveness, and the project was piloted with pre-service and in-service teachers from the Canary Islands and in-service teachers from various Latin-American countries (e.g., Mexico, Guatemala, and Ecuador). Agreements were reached with the Guatemalan Ministry of Education and the University of the Valley of Guatemala (UVG); the Secretary of Public Education of San Luis Potosí and the Autonomous University of San Luis Potosí in México; as well as the Universidad Casa Grande de Guayaquil in Ecuador.

At this point the following questions may arise: How can we appropriately prepare pre-service and in-service teachers to teach reading effectively to all students in accordance with suggestions from scientific research? Given the importance of teacher knowledge of reading development and instruction on their ability to effectively teach reading, and that teacher beliefs may also create obstacles when it comes to incorporating improvements or good practices into their classroom practices, and that satisfaction and acceptance of received training is considered an important part of the training process, through this research, we address the following questions: To what extent can web-based training (a) modify those beliefs that are not consistent with that required by scientific research recommendations, (b) improve pre-service and in-service teacher their subject matter knowledge about what to teach and how to teach the core components or Big Ideas of beginning reading common to alphabetic languages (i.e., phonemic awareness, phonics, fluency, vocabulary, and comprehension), and (c) generate the same degree of satisfaction and acceptance in pre-service university students and in-service teachers ?

## 2. Method

### 2.1. Participants

The sample consisted of 516 participants of which 270 were Spanish speaking in-service teachers from public and private institutions (26 Male, 244 Female) (Guatemalans, N = 58, Mexicans, N = 86, Ecuadorians, N = 90, Spanish, N = 36) and 246 were Spanish pre-service university students majoring in Education at

the University of La Laguna in the Canary Islands (75 Male, 171 Female). The in-service teachers registered for the Letra tutorial training through a project funded by the National R&D&I Plan of the Ministry of Economics and Competitiveness (reference number PSI2009-11662). The sample of pre-service teachers had registered for the program through a Language Didactics course in which they were enrolled at the University of La Laguna. Some 80.4% of the participants were female and 19.6% were males. Of the in-service teachers, 27.4% specialized in Early Childhood Education, 13.0% in Primary Education, and 59.6% in General Basic Education. And, with respect to the university students, all of them were specializing in Primary Education.

## 2.2. Materials and tools

### 2.2.1. Letra: a web-based tutorial program for reading instruction (Jiménez, 2015)

The “Letra” program is based on scientific evidence, designed to offer teachers a model of how to teach typical readers as well as struggling readers to read in their daily classroom practice. The multi-media design created by the authors represents a virtual library where the user sees a row of books in the upper corner, containing all of the necessary content and resources for teacher training (Visit the website at [www.programaletra.ull.es](http://www.programaletra.ull.es)). When the user visits the first volume of the library (i.e., theoretical foundation) they will have the opportunity to browse different tutorials that will help them to understand what it means for a child to attain a good level of phonological awareness, alphabetical knowledge, fluency, vocabulary and comprehension and how to implement the Response to the Intervention (RtI) framework. In the second volume (i.e., structure), the organization of the material is presented to help teacher provide intervention with their students. It includes five books for the classroom teachers and five notebooks for students which can be downloaded and printed for classroom use. Book I is devoted to the proper instruction of vocal sounds, the identification of the vocal sound at the beginning, middle and end of the word, instruction on how to write upper and lower case vowels and the use of oral and written vocabulary. Books II, III, IV and V contain upper and lower case consonants and interconnected syllables that are structured based on various classification criteria. In addition to the articulatory modes of each of the consonants, the following are also considered: sound-spelling transparency, the difficulty of writing and the syllable structure to achieve a learning sequence that facilitates the child's identification of the phonemes. In the third volume of the library (i.e., implementation) the user may consult the teaching materials and the student's materials in order to work on all of the skills that should be encouraged when teaching a child how to read: a) phonological awareness, through tasks requiring that the child manipulate phonemes. For example, children are asked to listen closely and try to distinguish those words beginning with a given phoneme, or they are asked to lift or lower their thumb, depending on whether or not the word stated by the teacher begins with a given phoneme or not; b) alphabetical knowledge, in order to strengthen the grapheme-phoneme and phoneme-grapheme correspondence, in some activities, the child is asked to write the letters that the teacher says and at the same time, pronounce the letter being written; c) vocabulary, with the understanding that the better the child's oral and written vocabulary, the easier it will be for them to maintain a good level of fluency and comprehension, children are offered different topics about which they are to learn new vocabulary, both in written and oral form; d) comprehension, developed through use of illustrated albums, this type of book allows the child to access comprehension via two elements: illustrations and the mediator's voice, upon reading the text, particularly if they are unable to read them by

themselves. It is necessary to continue working on comprehension along with other illustrated albums, adapted to the ages and characteristics of the children; and e) fluency: this section is developed almost transversely along with all of the components, although there is also specific training on quick reading of multi-syllable words. When visiting the fourth volume of the library (i.e., evaluation) the user learns to use the evaluation materials for both the initial screening of children who are at-risk for presenting difficulties in learning to read, as well as materials to monitor students' learning progress. In the fifth volume (i.e., experiences) video recordings are presented on how to implement good teaching practices when teaching children about phonological awareness, alphabetical knowledge, fluency, vocabulary and comprehension. In the sixth and final volume (i.e., resources) the user will find a bibliography that will help them to learn more about reading instruction based on empirical evidence, focusing on the predictive variables of reading success, a bibliography of educational legislation, as well as some related websites of interest.

### 2.2.2. Teacher's knowledge measures

2.2.2.1. *Phonological awareness.* This task was designed to evaluate in-service and pre-service teacher knowledge of phonological awareness. Both groups were questioned regarding their levels of phonological awareness (i.e., syllabic, intra-syllabic and phonemic), and what levels would be the most relevant for instruction when learning to read in Spanish; how children acquire phonological awareness; how PA should be instructed; what type of activities would be the most appropriate; etc. This task consists of a total of 20 items and for each item four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .74$ ).

2.2.2.2. *Alphabetical knowledge.* This task was designed to evaluate in-service and pre-service teacher knowledge of grapheme-phoneme correspondence (GPC) skills. Both groups were questioned regarding the rules of GPC; the characteristics of Spanish as a transparent language in terms of orthography; of the syllable structure of Spanish; digraphs and graphemes having more than one pronunciation; phonemes having more than one spelling option; how to teach the rules of GPC, etc. This task consists of a total of 20 items and for each item four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .82$ ).

2.2.2.3. *Vocabulary.* This task was designed to evaluate in-service and pre-service teacher knowledge of the value of oral and written vocabulary. Both groups were questioned regarding how children acquire vocabulary; types of vocabulary; the relationship between vocabulary and the comprehension processes; how to teach oral and written vocabulary, etc. This task consists of a total of 20 items and for each item, four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .77$ ).

2.2.2.4. *Fluency.* This task was designed to evaluate in-service and pre-service teacher knowledge of fluency and its components. Both groups were questioned regarding fluency in reading; the relationship between vocabulary and fluency; the relationship between fluency and comprehension; on how to teach fluency, etc. This task consists of a total of 20 items and for each item, four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .76$ ).

2.2.2.5. *Comprehension.* This task was designed to evaluate in-service and pre-service teacher knowledge of oral and written

comprehension. Both groups were questioned regarding types of comprehension; whether children are able to understand oral narrative; strategies used in comprehension; how to teach comprehension, etc. This task consists of a total of 20 items and for each item, four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .70$ ).

**2.2.2.6. Rtl framework.** This task was designed to evaluate in-service and pre-service teacher knowledge of characteristics of the Rtl framework. Both groups were questioned regarding this model; the levels of intervention of the model; early identification of children found to be at-risk based on screening tests; how to implement the intervention; progress monitoring; what to measure, etc. This task consists of a total of 20 items and for each item, four potential response alternatives are presented from which the correct one should be selected (Cronbach's  $\alpha = .79$ ).

A composite score for the first five knowledge tasks (i.e., phonological awareness, alphabetical knowledge, vocabulary, fluency and comprehension) was obtained based on the sum of the task scores. This composite score was used to analyze the relationship between teachers' knowledge and beliefs before and after web-based training. These pre- and posttest measures were developed for this study and we administered same test twice. Reliability has been acceptable for all teacher knowledge tasks ( $\alpha \geq .70$ ). Content validity addresses the match between test questions and the content or subject area they are intended to assess. For content validity, the relevance of the elements that we choose to be included within a measurement procedure was based on the description provided by NRP, the scientific research literature, and the curriculum. The content of each teacher knowledge measure was evaluated by committees made up of experts (i.e., researchers working in the areas of reading and teaching students with reading difficulties) who ensured that each test covered content that matches all relevant subject matter in its academic discipline. Curricular validity was evaluated by groups of curriculum/content experts.

### 2.2.3. Teacher's belief measure: questionnaire on teachers' beliefs regarding learning to read (Jiménez et al., 2015)

This attributional questionnaire was created based on a prior representational study. Using historical research techniques, a series of scientific theories regarding learning to read were reviewed. These theories have persisted over the years and are still currently used were identified (for a review of these, see Tracey & Mandel, 2012): nativist, behaviorism, maturationist, constructivist, social and cognitive theories. It was therefore possible to draw the basis of each theory in order to determine the principal ideas presented by teachers of Early Childhood and Primary Education during "Brainstorming" sessions that include a series of normative questionnaires. Those described theories were assessed using normative samples based on "critical episodes" (see Jiménez, Rodríguez, Suárez, & O'Shanahan, 2014). During these sessions, different teacher contributions on reading were collected for inclusion in the normative questionnaires based on each "critical episode". This episode is a descriptive narrative of a situation occurring during an everyday classroom scenario, with specific characters expressing their points of view, which coincide with those of a particular theory. In this case, both "critical episodes" as well as scientific theories are designed, as identified in the historiographical analyses. Below, indices of typicality and polarity are calculated, allowing for selection of those statements that were the most representative of each of the theories. These indices are calculated in the same manner as previously done in the works conducted by other authors examining these theories (e.g., O'Shanahan, 1996; Marrero, 1988; Rodrigo, Rodríguez, & Marrero, 1993; Triana, 1991;

Triana & Rodrigo, 1985). It is interesting to find similarities with those statements describing certain theories, as well as whether or not the most typical statements from a theory are also representative of other theories. For each statement, a typicality index is calculated by detecting the average of the scores obtained by the same with respect to a particular theory. Thus, each statement was evaluated based on a reference theory, receiving values from 0 to 10, thereby indicating whether they are more or less representative of said theory. Similarly, while the typicality index informs us regarding the similarity of the statements to a certain theory, it is also necessary to determine whether or not the most typical statements of one theory are also representative of other theories (i.e., polarity). Upon analyzing the typicality and polarity indices of the statements, attributional questionnaire was created. As a result of these analyses, the following theories were identified: socio-cultural, maturation, corrective, repetition, nativist, constructivist and psycholinguistic. In order to conduct the attributional questionnaire, teachers had to be registered in the "Letra" tutorial training program for reading instruction. Upon entering the user name and password, access is gained to the tutorial system and the user is invited to fill out the questionnaire prior to the training. Both pre-service and in-service teachers answered an attributional questionnaire consisting of 60 items whose statements corresponded with the basic claims of each of these theories. In this case, there were some 10 items per theory. The statements presented to the teachers were written in self-referential terms. For example, "I believe that the child should construct their own reading learning", "I believe that all students need the support of a social environment that complements the reading learning process", etc. The teachers were able to express their degree of agreement or disagreement on a Likert-like scale ranging from 0 to 10, where 0 meant that the teachers were in complete disagreement with the statement and 10 meant that they were in complete agreement with it. Cronbach's  $\alpha$  was found to be .88. The procedure used to determine content validity for the teacher belief measure can be found in Jiménez et al. (2015).

### 2.2.4. The Letra program general assessment questionnaire

This questionnaire consists of a set of statements that evaluates the user's assessment of the Letra program. The assessment questionnaire is integrated into the tutorial program and has a total of nine sections with ten items that each have a Likert type rating scale of 0–10: 1) theoretical foundation (Volume I) ( $\alpha = .87$ ), 2) intervention program structure (Volume II) ( $\alpha = .92$ ), 3) intervention program implementation (Volume III): general aspects ( $\alpha = .91$ ), 4) intervention program implementation (Volume III): student learning ( $\alpha = .91$ ), 5) student assessment (Volume IV) ( $\alpha = .94$ ), 6) experiences (Volume V) ( $\alpha = .95$ ), 7) resources (Volume VI) ( $\alpha = .92$ ), 8) innovation ( $\alpha = .94$ ), and 9) applicability ( $\alpha = .93$ ).

### 2.3. Procedure

Upon selection of the sample of university education students and in-service teachers from the Canary Islands, and in-service teachers from various Latin-American countries (i.e., Mexico, Guatemala, and Ecuador), sessions were held in order to familiarize the users with the platform use. All of the participants had access to a presentation video and another video demonstrating how to browse the web, in which it was possible to visualize the sequence and steps to be followed. Two types of forums were activated on the platform, one focusing on technical aspects where the users could request assistance when facing difficulties browsing, and another focused on the different tutorials where users could formulate questions or doubts regarding the content received by each of the program modules. Many teachers used the forum about technical

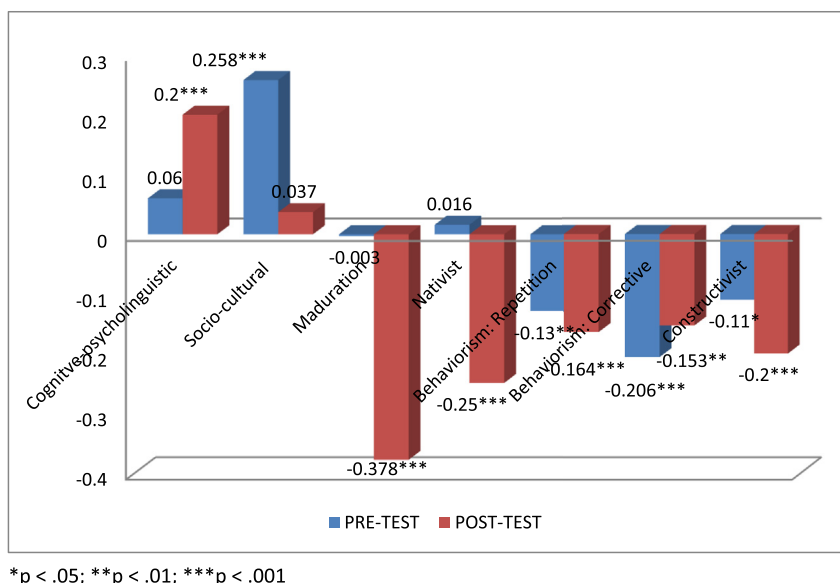


Fig. 1. Intercorrelations for scores on measures of teachers' beliefs and knowledge before and after online course. \*p < .05; \*\*p < .01; \*\*\*p < .001.

Table 1

Pre- and posttest performance of in-service and pre-service teachers on six knowledge tasks.

Group	In-service teachers		Pre-service teachers	
	Pretest	Posttest	Pretest	Posttest
Phonological awareness				
M	3.92	6.05	3.66	7.30
SD	1.33	1.80	1.28	1.32
Alphabetic knowledge				
M	4.46	5.24	4.37	6.68
SD	1.35	1.67	1.59	1.35
Vocabulary				
M	4.20	6.08	4.35	7.84
SD	1.26	1.87	1.50	1.39
Fluency				
M	5.46	7.03	5.16	8.22
SD	1.68	1.76	1.89	1.11
Comprehension				
M	5.01	6.31	4.72	7.72
SD	1.62	1.87	1.69	1.36
Rtl Model				
M	4.12	5.80	4.41	7.27
SD	1.60	1.79	1.37	1.15

Note: Rtl = Response to Intervention Model.

aspects; however, fewer teachers used the discussion forum and other modes of support similar to other studies (Bishop, Giles, & Bryant, 2005). Letra training extended over a five month period. Teachers did not use the web freely but they had to follow the schedule and instructions to each module. The syllabus for online program was organized by weeks. This unit of time is familiar to participants and gives them more flexibility to complete assignments within their own workspace. Nevertheless, when teachers were not able to complete within the basic unit of time, then allowed participants two to three days to complete the activity. Participants were given the opportunity to view an overview document at the end of the previous week in order to schedule their participation. For the first module, users were able to repeat each tutorial up to three times and each of these was accompanied by a pretest and posttest evaluation. Upon conclusion of the review of the tutorials of the first module, it was possible to access the

other tutorials whenever the users wished. The second module was then activated, and this process continued until completion of remainder of the modules. In this second module (i.e., structure), the organization of the material was presented to help teacher provide intervention with their students. Through this module teachers received training about how to teach basic skills that children should automate, showing the effective instructional practices, explicit instruction through modeling, corrective feedback, etc. This module is reinforced later in the fifth module with the presentation of video recordings of teachers working with this model of classroom instruction in phonemic awareness, alphabetic knowledge, fluency, vocabulary, and comprehension. After five months, users were invited to complete the *Questionnaire on teachers' beliefs regarding learning to read* and *General Evaluation Questionnaire for the Letra Program*.

#### 2.4. Data analysis

A correlational analysis on the teacher's knowledge measures and teacher's belief measure data from the 516 participants was employed to determine whether there was a relation between teachers' beliefs and knowledge before and after online course. To compare the pre-service and in-service teachers' data from the knowledge and beliefs measures with regard to time, two separate factorial repeated-measures ANOVAs were used. The sphericity assumption was checked with the Mauchly's sphericity test. In addition, this study also gathered in-service and pre-service teachers' evaluation to the web-based training. For this purpose, we used the multivariate general linear model to understand whether groups were equal evaluating each section of the Letra program.

### 3. Results

In order to determine the relationship existing between teachers' beliefs and knowledge before and after online course, the correlations obtained are shown in Fig. 1. Before web-based training we only found a significant relationship between teachers' knowledge and socio-cultural theory that teachers are attributed. However, once the web-based training ended we found a positive

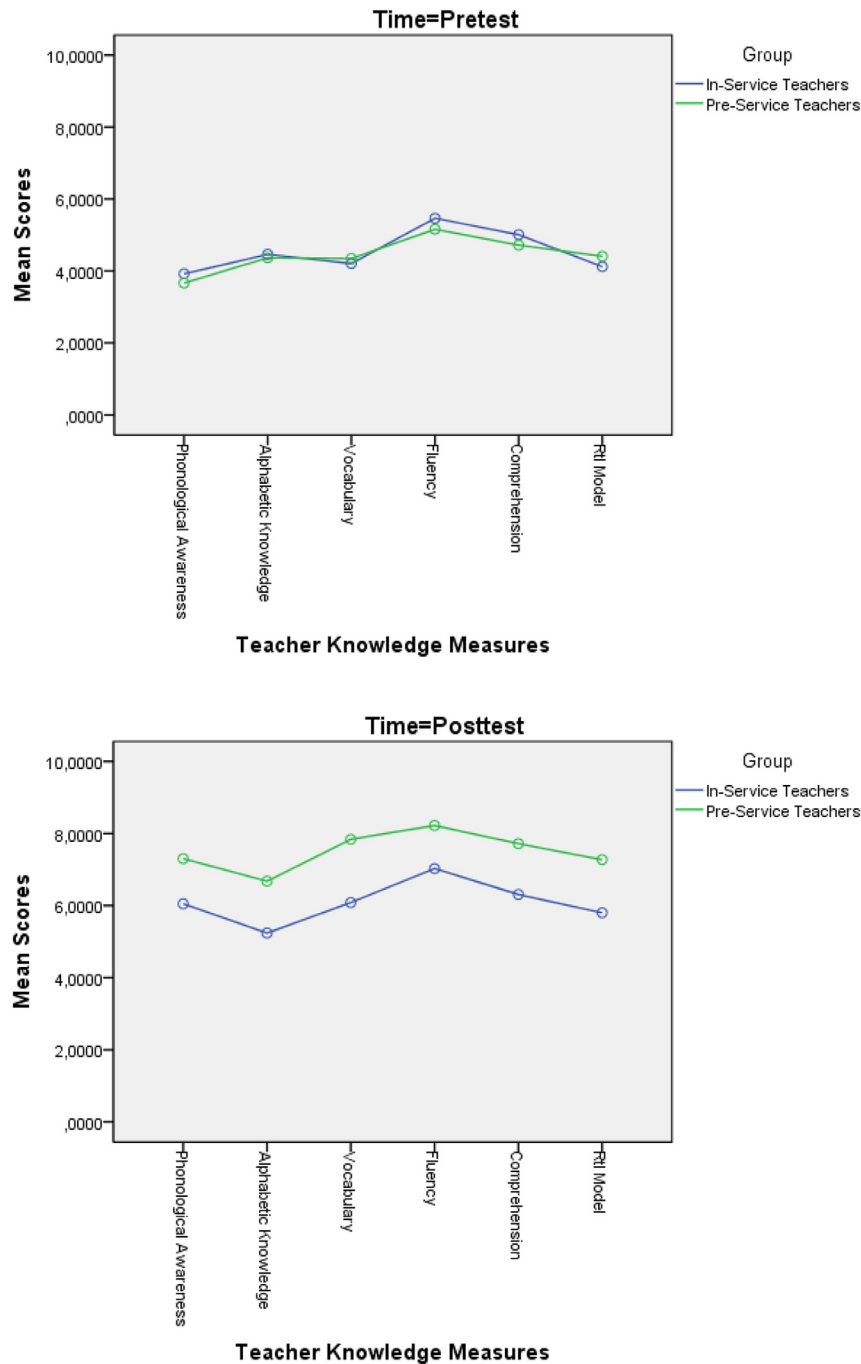


Fig. 2. Pre- and posttest mean scores of pre-service and in-service teachers on six knowledge tasks.

correlation between teachers' knowledge and psycho-linguistic theory attributed, and negative correlations between teachers' knowledge and the rest of the theories of learning to read (i.e., maturationist, nativist, repetition, corrective, and constructivist). That means that the acquisition of new knowledge about the components of reading was associated with a greater attribution of psycho-linguistic theory after web-based training. However, with this new acquisition of knowledge about reading components teacher's attribution was less towards the rest of theories that emphasize to a lesser extent the participation of these reading components.

### 3.1. In-service and pre-service teachers' pre- and posttest performance on the knowledge tasks

Table 1 shows pre- and posttest scores on the six teacher knowledge tasks, before and after web-based course. As Table 1 shows, both in-service and pre-service teacher scores improved on all knowledge tasks.

A factorial repeated-measures ANOVA was conducted for this data, with the six knowledge tasks serving as measures in a within-subjects pre-post factor and pre-service and in-service teachers as a between-subject factor. Mauchly's test indicated that the assumption of sphericity was violated for the main effects of Knowledge



**Table 2**

Pre- and posttest performance of in-service and pre-service teachers on learning to read theories.

Group	In-service teachers		Pre-service teachers	
	Pretest	Posttest	Pretest	Posttest
Socio-cultural				
M	10.94	10.76	10.30	9.83
SD	.96	1.20	.30	1.68
Maturationist				
M	6.75	6.63	3.63	4.98
SD	2.14	2.55	2.42	2.47
Behaviourism: correction				
M	6.65	6.77	7.11	6.71
SD	2.70	2.57	2.00	1.94
Behaviourism: repetition				
M	4.95	5.95	5.44	6.02
SD	2.87	2.60	2.24	1.97
Nativist				
M	6.52	6.05	4.46	5.19
SD	2.53	2.50	2.20	2.27
Constructivist				
M	7.08	6.75	6.37	6.51
SD	1.84	2.10	1.73	2.13
Cognitive-psycholinguistics				
M	7.02	11.39	14.20	13.34
SD	11.73	10.44	10.88	10.28

Task,  $\chi^2(14) = 48.87$ ,  $p < .001$ , and Knowledge Task x Time,  $\chi^2(14) = 31.67$ ,  $p < .01$ . Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .96$  for the main effect of Knowledge Task and  $.97$  for the interaction between Knowledge Task and Time). There was a significant main effect of Knowledge Task,  $F(4.80, 2471.05) = 148.42$ ,  $p < .001$ , partial  $\eta^2 = .22$  but it was subsumed under a significant interaction Knowledge Task x Time,  $F(4.87, 2502.97) = 47.14$ ,  $p < .001$ , partial  $\eta^2 = .08$ . Furthermore, there was a significant interaction of Time x Group, Wilks' Lambda =  $.92$ ,  $F(5, 510) = 7.76$ ,  $p < .001$ , partial  $\eta^2 = .07$ . Planned contrasts revealed no significant differences between pre-service teachers and in-service teachers in the areas tapped by the knowledge tasks at pretest  $F(1, 514) = .92$ ,  $p = .33$ ,  $\eta^2 = .001$ . However, pre-service teachers had higher scores than in-service teachers in the areas tapped by the knowledge tasks at posttest  $F(1, 514) = 190.5$ ,  $p < .001$ ,  $\eta^2 = .27$  (see Fig. 2). Furthermore, the interaction Group x Knowledge Task x Time did not approach significance.

### 3.2. Teachers' implicit beliefs on learning to read

Table 2 shows pre- and posttest scores on the seven theories on learning to read, before and after online course.

A factorial repeated-measures ANOVA on these data, with the seven theories on learning to read as measures of a within-subjects pre-post factor and pre-service and in-service teachers as a between-subject factor. Mauchly's test indicated that the assumption of sphericity was violated for the main effects of Theories,  $\chi^2(20) = 2795.83$ ,  $p < .001$ , and Theories x Time,  $\chi^2(20) = 2731.32$ ,  $p < .01$ . Therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon = .24$  for the main effect of Theories and  $.25$  for the interaction between Theories x Time). There was a significant interaction Group x Theories x Time, Wilks' Lambda =  $.87$ ,  $F(6, 430) = 10.51$ ,  $p < .001$ , partial  $\eta^2 = .12$ . This indicates that the Letra program produced different effects on pre-service and in-service teachers depending on time and theory type. To break down this interaction, planned contrasts were performed comparing pretest-posttest differences

to pre-service and in-service teachers in the cognitive-psycholinguistic theory and the remaining theories in combination,  $F(1, 435) = 22.7$ ,  $p < .001$ ,  $\eta^2 = .04$ . Looking at the interaction graph, these effects reflect that in-service teachers scored significantly higher in the posttest than in the pretest in the cognitive-psycholinguistic theory (see Fig. 3).

Other planned contrasts were carried out to compare pretest-posttest differences between pre-service and in-service teachers in the cognitive-psycholinguistic theory and the remaining theories individually. These contrasts revealed significant differences when comparing the maturationist theory,  $F(1, 435) = 25.60$ ,  $p < .001$ ,  $\eta^2 = .05$ ; behaviorism theory (i.e., correction),  $F(1, 435) = 5.50$ ,  $\eta^2 = .01$ ; behaviorism theory (i.e., repetition),  $F(1, 435) = 9.27$ ,  $p < .01$ ,  $\eta^2 = .02$ ; nativist theory,  $F(1, 435) = 28.4$ ,  $p < .001$ ,  $\eta^2 = .06$ ; and constructivist theory,  $F(1, 435) = 5.30$ ,  $p < .05$ ,  $\eta^2 = .01$ , except the socio-cultural theory,  $F(1, 435) = 43.02$ ,  $p = .40$ ,  $\eta^2 = .001$ .

### 3.3. Pre-service and in-service teachers' rating of the Letra program

Table 3 offers the means and standard deviations of the measures of each section of the Letra program as a function of group.

In order to analyze the effect of the Letra program on the level of evaluation of the pre-service and in-service teachers, a MANOVA was carried out using a general linear model with independent inter-subject variables: group (i.e., pre-service teachers vs. in-service teachers), and with dependent variables consisting of the nine previously described sections of the Letra program. Results demonstrate an effect due to the group variable with Wilks' Lambda =  $.66$ ,  $F(9, 436) = 24.2$ ,  $p < .001$ ,  $\eta^2 = .33$ . In order to determine what sections of the General Letra Program Questionnaire contained significant differences between the groups, univariate contrasts were conducted for each of the evaluated sections, that is, theoretical foundation (Volume I) ( $\alpha = .87$ ),  $F(1, 444) = 137.05$ ,  $p < .001$ , partial  $\eta^2 = .24$ ; intervention program structure (Volume II) ( $\alpha = .92$ ),  $F(1, 444) = 92.3$ ,  $p < .001$ , partial  $\eta^2 = .17$ ; intervention program implementation (Volume III) ( $\alpha = .91$ ), general aspects,  $F(1, 444) = 82.1$ ,  $p < .001$ , partial  $\eta^2 = .16$ ; intervention program implementation (Volume III) ( $\alpha = .91$ ): student learning,  $F(1, 444) = 72.2$ ,  $p < .001$ , partial  $\eta^2 = .14$ ; student assessment (Volume IV) ( $\alpha = .94$ ),  $F(1, 444) = 70.6$ ,  $p < .001$ , partial  $\eta^2 = .14$ ; experiences (Volume V) ( $\alpha = .95$ ),  $F(1, 444) = 68.4$ ,  $p < .001$ , partial  $\eta^2 = .13$ ; resources (Volume VI) ( $\alpha = .92$ ),  $F(1, 444) = 151.9$ ,  $p < .001$ , partial  $\eta^2 = .26$ ; innovation ( $\alpha = .94$ ),  $F(1, 444) = 139.1$ ,  $p < .001$ , partial  $\eta^2 = .24$ ; and applicability ( $\alpha = .93$ ),  $F(1, 444) = 137.8$ ,  $p < .001$ , partial  $\eta^2 = .24$ . This means that there were significant differences found between the groups in the evaluation level, with the largest being the evaluation of the in-service teachers as compared to the pre-service teachers for each of the Letra sections evaluated (see Fig. 4).

## 4. Discussion

In this study we analyzed the effects of the on-line training on both knowledge and beliefs of the pre-service and in-service teachers. On the one hand, both groups showed a low level of knowledge of the main components of reading as identified by the NRP and of the RtI framework, and upon completion of the training, it was found that this knowledge increased for both groups although the pre-service group demonstrated a higher degree of improvement in all of the evaluated components (i.e., phonological awareness, alphabet knowledge, fluency, vocabulary and comprehension and the RtI framework). One possible explanation for these results could be that the pre-service teachers participating in the training were also enrolled in the Language Didactics course and the grade that they received in this class depended on their

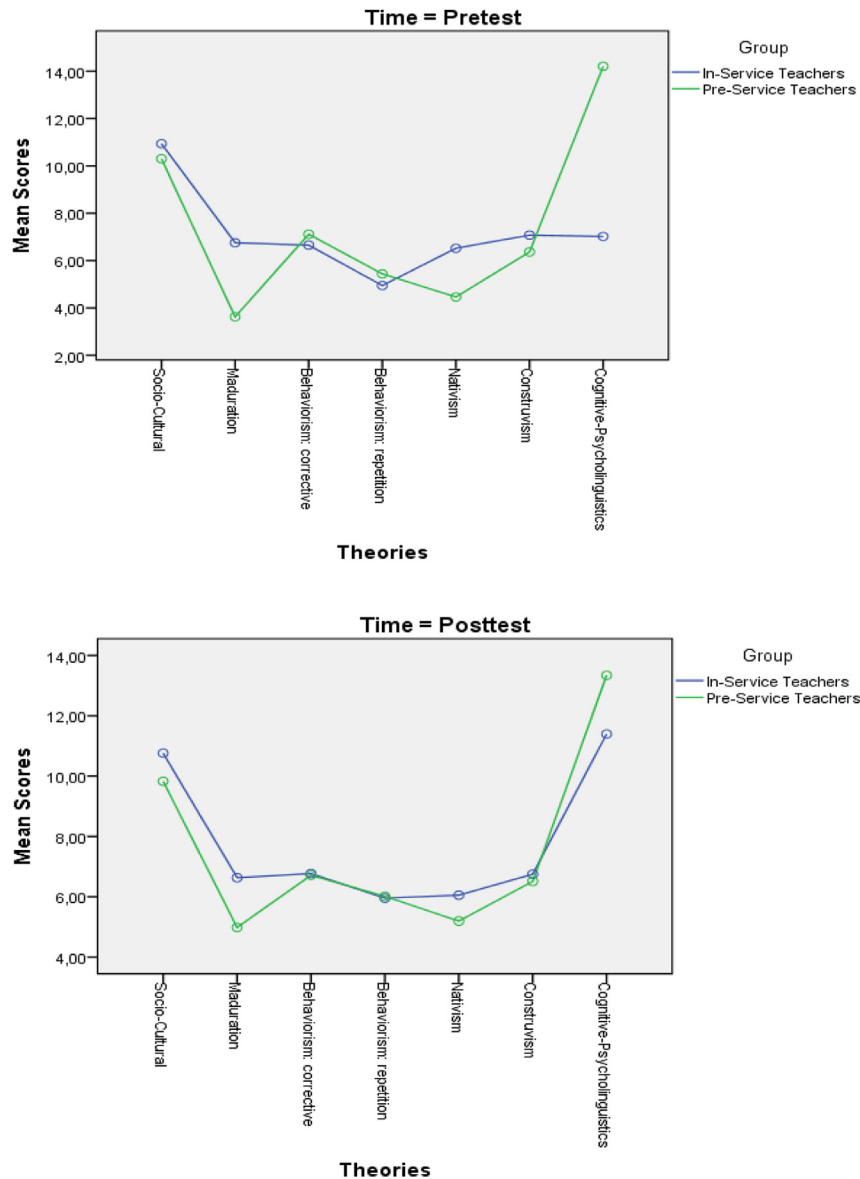


Fig. 3. Pre- and posttest mean scores of pre-service and in-service teachers on seven theories on learning to read.

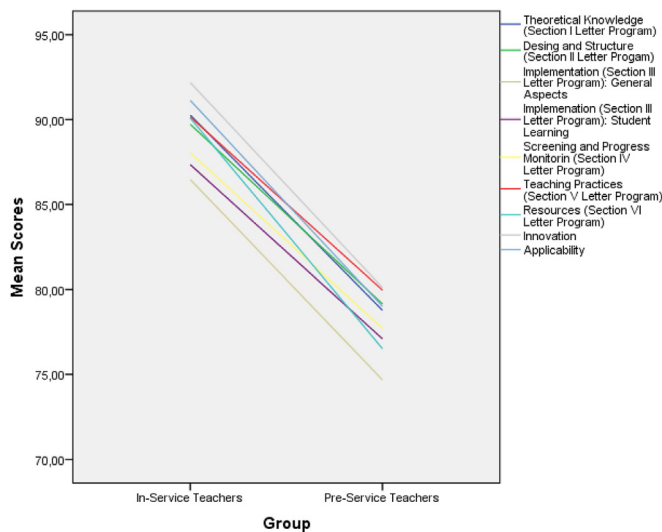
performance in the on-line training, thus increasing their motivation.

Offering this training to university students is justified since there is evidence that the textbooks used in their training often do not include the reading components identified by the NRP, and since they tend to be disconnected from the knowledge and skills needed by teachers in the classroom (Joshi, Binks, Hougen, Dahlgren, et al., 2009c; Spencer, Schuele, Guillot, & Lee, 2008). Therefore, it was recommended that mentors or permanent training programs be implemented via workshops or courses including classroom follow-up in order to promote this training as well as teacher commitment (Moats, 2004). Indeed, previous studies that were designed to include theoretical and practical foundations in teacher training on reading have been found to have positive results when including the components suggested by the NRP. For example, Podhajski, Mather, Nathan, and Sammons (2009) demonstrated that teachers improved their knowledge and that this contributed to improved reading performance in their students.

On the other hand, if the teacher's training based on content suggested by scientific research does not include teacher beliefs, the very guidelines and recommendations published by educational administration legislature will fail to have the desired effect (Moats, 2009). In fact, it may also prove to be an obstacle if the teacher beliefs are in contradiction with the suggestions made by the scientific research. Therefore, in addition to the role played by teacher knowledge on their ability to effectively teach students to read (McCutchen, Green, Abbott, & Sanders, 2009), teacher beliefs should also be taken into consideration since they may affect whether or not this instruction includes best practices (Fang, 1996). One important result of this study is that in-service teachers tend to be more likely to attribute the implicit cognitive-psycholinguistic theory after having received the Letra training. One possible explanation for these results is that the foundation of the Letra program is an emphasis on the relevance of the phonological component of language when children are learning to read. It also suggests that the development of phonological skills, via teaching, stimulation or practice, favors learning to read, since it is assumed

**Table 3**  
Means and standard deviations for each Letra program section as a function of group.

Group	In-service teachers	Pre-service teachers
Theoretical knowledge		
M	90.26	78.77
SD	8.76	11.87
Design and structure		
M	89.72	79.15
SD	11.29	11.94
Implementation: general aspects		
M	86.47	74.67
SD	13.74	13.72
Implementation: student learning		
M	87.35	77.09
SD	12.83	12.61
Screening and progress monitoring		
M	88.05	77.71
SD	13.46	12.41
Teaching practices		
M	90.15	79.96
SD	12.54	13.47
Resources		
M	90.09	76.51
SD	10.40	12.82
Innovation		
M	92.18	80.11
SD	8.61	12.77
Applicability		
M	91.13	79.01
SD	9.41	12.31



**Fig. 4.** Pre-service and in-service teachers' rating of online course.

that students have the linguistic development necessary to understand the oral language so as to subsequently tackle written language.

In this study, we also analyzed the degree of satisfaction and acceptance of the Letra training by pre-service and in-service teachers. The assessment of the on-line training received via the Letra program was quite positive, and it is particularly interesting to note that assessments by in-service teachers were higher than those provided by the pre-service university students. However, a possible explanation for these differences may be due to the increased degree of practical experience of the in-service teachers. That is, the in-service teachers appeared to value the Letra program

more than the pre-service teachers since they potentially were more capable of evaluating the content received based on their experience and classroom practice (Arias, Fallas, & Villers, 2012).

A limitation of this study is that we cannot guarantee that it will have a direct impact on daily practice in the classroom. The objective of a second stage would be that teachers who have demonstrated a greater proficiency implement their knowledge in the classroom. However, despite such limitations, in this study we have sought to capture the changes on teachers' knowledge and beliefs, and teachers are satisfied with their online learning. This previous analysis on the acceptance and evaluation of the training received has been considered to be a relevant part of the training process given that it leads to improved implementation and more optimal results in practice (Singh & Stoloff, 2007). Therefore, we feel that these results, along with the knowledge acquired from the Letra training, may be a first step leading to later incorporation of good teaching practices.

With the introduction of new technologies, a promising alternative has been offered to the area of training when accompanied by a solid theoretical and scientific foundation. Based on this work, we refer to on-line training for both pre-service teachers who are preparing to become future teachers, as well as in-service teachers who are actually working in the classrooms. One of the main advantages offered by the web is that it may be accessed by a large number of teachers and children who may benefit from it, particularly when the training must be conducted in remote geographical regions (i.e., the Canary Islands) or over different continents speaking the same language. Another advantage offered by this alternative technology is that it may contribute to continuous and sustainable teacher training (Collins, Schuster, Ludlow, & Duff, 2002). In addition, it presents new and different options for the permanent training of in-service teachers, offering considerable training flexibility on a personalized basis, while at the same time promoting systematic interactions to guide the implementation of knowledge and practices acquired during the daily job (Ludlow, 2002). The Letra Program has demonstrated potential at large scale, which provides future possibilities for every teacher, no matter where in the world, to receive online education about how to teach reading, based on scientific evidence.

## 5. Conclusions

Teaching children how to read demands a high degree of specialization; however, research shows that teachers often lack basic knowledge of how children learn to read and write or they fail to understand why many of their students have difficulties with these skills. Tutorial systems may potentially offer valuable training to teachers in these areas. These tutorials should be directed at both pre-service teachers who are preparing for future careers in education as well as to in-service teachers in order to better fulfill the needs of the children undergoing difficulties. Therefore, the web-based Letra tutorial system has been designed, taking into consideration the areas that have been highlighted by scientific research in regards to the needs of children in order to become successful readers and teacher needs in order to more effectively teach reading, based on the phonological and orthographical characteristics of the Spanish language. Future research would be to have teachers video tape their reading instructional practice in the classroom during and after the LETRA online course and upload video clips for analysis and evaluation. Nowadays the Letra Program is included in a postgraduate teacher certification program to qualify as reading specialist, offered by the University of La Laguna.

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