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**Phonological Awareness and L2 Learning by children: A systematic research
synthesis**

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ABSTRACT

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The present study critically reports the results of a systematic research of empirical studies in phonological awareness and L2 learning in children at the age of literacy acquisition. The aim of the present study is to determine (1) how empirical studies assess phonological awareness, (2) the age of the population investigated in these studies, (3) the possible relation between the ages of participants and PA tests and (4) the implications of the studies selected in terms of the role of phonological awareness for L2 learning by children. The method consisted of searching the keywords 'Phonological Awareness', 'L2 Learning', 'English' and 'Children' in the following databases: *American Psychological Association*, *SpringerLink*, *Wiley Online Library*, *Web of Science* and *ScienceDirect*. To be included in the inclusion criteria, the first language of the studies should be a western language, preferably a romance language. Also, the second language (L2) approached in the studies should be English. In order to achieve the objectives of this research synthesis, the articles selected for the study should also have used a phonological awareness test and should have been published between the years of 2006 and 2019. Following these criteria, 20 articles were selected and 19 articles were used for analysis. The analysis of the articles selected showed that there is no clear relation between the use of instruments to assess phonological awareness and the age of the population investigated, except in the case of the PALS test (Phonological Awareness and Literacy Screening), which seems to be used with younger children in kindergarten age. About the implications of PA for L2 learning, most of the studies focused on reading, followed by vocabulary, spelling and cross-language transfer, indicating that PA plays an important role in L2 reading acquisition. The articles also provided results that did not fulfill the objectives of the present study, showing the lack of studies that are focused on the role of PA for L2 acquisition among alphabetic languages.

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RESUMO

Phonological Awareness and L2 Learning by children: A systematic research synthesis

Luiz Fernando de Carvalho

Este estudo reporta criticamente os resultados de uma revisão sistemática de estudos empíricos sobre consciência fonológica e aprendizagem de segunda língua em crianças em idade de alfabetização. O objetivo do estudo consistiu em determinar (1) como os estudos empíricos avaliam consciência fonológica (2) a idade da população testada nos estudos (3) a possível relação entre os testes de consciência fonológica e a idade dos participantes e (4) as implicações dos estudos selecionados no que diz respeito ao papel da consciência fonológica para o aprendizado em L2. Como método, as palavras-chave ‘Consciência fonológica’, ‘Aprendizagem de segunda língua’, ‘Inglês’ e ‘Crianças’ foram buscadas nos seguintes bancos de dados: *American Psychological Association*, *Springerlink*, *Wiley Online Library*, *Web of Science* and *ScienceDirect*. Para serem incluídos nos critérios de avaliação, os estudos deveriam tratar de línguas nativas ocidentais, preferencialmente línguas românicas, assim como línguas alfabéticas e a segunda língua deveria ser a Língua Inglesa. Para atingir os objetivos da pesquisa, os estudos selecionados deveriam, também, ter a aplicação de um teste de consciência fonológica e terem sido publicados entre 2006 e 2019. De acordo com os critérios de inclusão, 20 artigos foram selecionados, mas apenas 19 foram analisados. Não foram encontrados resultados significativos sobre a relação dos testes com as idades dos participantes, exceto nos casos em que o teste PALS (Phonological Awareness and Literacy Screening) foi aplicado. Nesses casos, aparentemente, a idade pré-escolar foi levada em consideração na escolha do teste. Sobre as implicações da consciência fonológica para a aprendizagem de segunda língua, a maioria dos estudos mostrou resultados na área de aprendizagem de leitura, seguida por vocabulário, soletração e transferência linguística. Alguns artigos mostraram resultados que não respondem às perguntas de pesquisa desta análise, o que demonstra que são poucos os estudos que investigam o papel da consciência fonológica para a aprendizagem de segunda língua entre línguas alfabéticas.

Palavras-chave: Consciência Fonológica, Aprendizagem de segunda língua, Alfabetização.

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1. Introduction

The acquisition of decoding skills in alphabetic writing systems is a complex process that depends on different variables. According to Scliar-Cabral (2002), one of the biggest challenges for children who are being alphabetized is to deconstruct the idea that speech is a continuous stream and learn how to segment speech into discrete units, the written words - which are also divided into smaller units. The way in which the structures of sound in spoken language (e.g., phonology) is represented in the brain has a great impact in literacy development (Goswami, 2010). The terms related to alphabetization and literacy mentioned in this study refer to the decoding of the written code.

Phonological processing involves one of the most important predictors for literacy success, phonological awareness. As asserted by Goswami (2010), phonological awareness is the conscious knowledge of the sound constituents of words. Also, the author claims that, before learning to read, young children are first aware of large units (syllables and onset-rimes). When learning to read in alphabetic contexts, children will consequently develop the awareness of smaller units, the phonemes (Goswami, 2010).

The causal relationship between phonological awareness and literacy acquisition is largely discussed in literature. Despite the fact that phonological sensitivity causes the acquisition of literacy skills, previous evidence also supports the idea that reading and spelling knowledge develop phonological awareness (Troia, 2004).

In SLA (Second Language Acquisition), phonological awareness is a crucial factor for L2 skills acquisition. According to Bruck and Genesee (1995), the early acquisition of a second

language develops metalinguistic awareness, which includes phonological awareness. The authors carried out a study that compared the performance of monolingual and bilingual children. The results revealed that bilingual children scored higher levels of phonological awareness when compared to the monolingual group.

The orthographic consistency in alphabetic languages refers to the predictability in the relation between graphemes in written words and phonemes in speech (Caravolas et al, 2013). In SLA, the notion of orthographic consistency is important because of the possible differences in the orthographies of L1 and L2. For example, Caravolas et al (2013) argue that English has an inconsistent orthography, resulting in a delay in literacy acquisition if compared to learners of more consistent languages such as Spanish and Czech.

The present study critically reports the results of a systematic research of empirical studies in phonological awareness and L2 learning in children at the age of literacy acquisition. The aim of the present study was to determine (1) how empirical studies assess phonological awareness, (2) the age of the population investigated in these studies, (3) the possible relation between the ages of participants and PA tests, and (4) the implications of the studies selected in terms of the role of phonological awareness for L2 learning by children. In order to achieve the objectives of the study, twenty articles, published from 2006 to 2019, were selected to be included in the systematic review. However, one article was excluded due to the inclusion criteria, remaining 19 articles. Also, the time range of publication was previously from 2014 to 2019. Nonetheless, it was necessary to extend the time range from 2006 to 2019 because not enough articles were being found, considering the inclusion criteria.

My interest in literacy acquisition and phonological awareness arose when I worked in Projeto ACERTA with professor Mailce Mota in my scientific initiation program. I also taught English for children in literacy age in a public school. In my opinion, phonological awareness is a fundamental topic for foreign language teachers to be aware of, especially when dealing with children who are being alphabetized in their first language.

The present paper is organized as follows. After this introduction, Section 2 presents the theoretical background regarding phonological awareness (section 2.1), phonological awareness and orthographic consistency (section 2.2), phonological awareness and literacy acquisition (section 2.3), phonological awareness and L2 learning (section 2.4) and phonological awareness tests (section 2.5). The method is presented in Section 3, as well as the procedures (section 3.1). Section 4 shows the results of this review, which are divided into two sections: *Age group and PA tests* (section 4.1) and *Implications of the studies on PA for L2 learning* (section 4.2). The results are discussed in Section 5 and the final remarks are presented in Section 6.

2. Theoretical background

2.1 Phonological Awareness

Phonological awareness is the ability to perceive, consciously, that speech can be divided into smaller units of sound (Carnio, Vosgrau & Soares, 2017). It is a metalinguistic skill, that is, the capacity of being aware of language features and functions and of reflecting on structural aspects of language (Kuo et al, 2016).

PA basically consists of three skills: Onset-rime awareness, syllable awareness, and phoneme awareness. According to Goswami and Bryant (2016), phonological awareness skills

follow an order of development in alphabetic languages during the first school years. Before reading instruction (kindergarten), the awareness of syllables is firstly developed, followed by the awareness of onsets and rimes. The last skill to be developed is phoneme awareness, as a consequence of literacy acquisition (after first grade). The large grain-size skills are the phonological units larger than the phoneme (the awareness of syllables, onsets and rimes). These large grain-size skills have been found in pre-reading children (Goswami and Bryant, 2016). However, phoneme awareness, the last skill to be developed, seems to appear only after reading instruction (Goswami and Bryant, 2016).

Still concerning the development of phonological awareness, Goswami (2010, p. 106) adds that “phonological awareness undergoes an apparently universal cross-language developmental sequence from larger to smaller units”. However, Goswami (2010) also explains that although children are aware of larger units before learning to read, the development of phoneme (a small unit) occurs according to the orthographic consistency of languages. The phonemes depend on graphemes to be learned, so orthographic consistency has an important effect on phoneme awareness when letters are learned (Goswami, 2010). The next section (section 2.2) discusses the role of orthographic consistency further.

2.2 Phonological Awareness and orthographic consistency

How orthography and phonology interact is also a relevant aspect for PA development. Children who learn to read in transparent orthographies such as Spanish or Turkish develop higher levels of phonemic awareness than those who learn to read in an opaque orthography such as English, a less consistent language in terms of grapheme–phoneme correspondence (Chen et al, 2010). Melo & Correa (2013) also show that different PA skills might be used to decode

different orthographies. The authors indicate that rime awareness is more relevant for English speakers in reading acquisition. On the other hand, Brazilian Portuguese speakers seem to benefit more from syllable awareness, since this is a salient unit in BP (Melo & Correa, 2013).

Goswami (2010) points out the differences in syllabic structures between English and other European languages such as Spanish, Italian and Greek. According to the author, the syllable structure in the European languages is CV (consonant-vowel), an easier pattern to be learned by children. Also, the correspondence between grapheme and phoneme is more transparent, meaning that the “phonemes are made by the letters used to write the syllable” (Goswami, 2010, p. 107). English, on the other hand, has CVC (consonant-vowel-consonant) as the predominant syllabic pattern, being more complex for children to learn (Goswami, 2010). Additionally, the CVC arrangement does not always correspond to the same CVC spelling pattern, making English less transparent in the grapheme-phoneme correspondence (Goswami, 2010).

2.3 Phonological Awareness and literacy acquisition

Phonological awareness plays an important role in reading acquisition in alphabetic writing systems. Individuals who are not able to detect or manipulate the sounds of words will find more difficulties in reading acquisition (Caravolas and Francis, 2005). Decades of research have corroborated the relationship between PA and reading acquisition, demonstrating that phonological awareness instruction improves decoding skills in alphabetic languages (Anthony and Francis, 2005).

A study conducted by Novaes, Mishima & Santos (2013) concluded that a brief training¹ of phonological awareness had a positive effect in learning to read in Brazilian Portuguese (L1). The results showed positive effects in both groups, and the test CONFIAS (Consciência Fonológica Instrumento de Avaliação Sequencial, developed by Moojen, Lamprecht, Santos, Freitas, Brodacz, Siqueira, Costa e Guarda and published in 2015), a phonological awareness test used with Brazilian Portuguese speakers, showed improvement in syllable and phonemic awareness in the group that received training.

There is a debate in the literature concerning the causal relationship between phonological awareness and Literacy. According to Troia (2004), phonological sensitivity seems to result in the acquisition of literacy skills, but the opposite is also possible. As literacy acquisition is developed, deeper levels of phonological sensitivity are achieved (Troia, 2004). The deepest level is that of phoneme awareness mentioned before, developed as a consequence of the learning of the alphabet.

2.4 Phonological Awareness and L2 Learning

In second language acquisition, PA is also fundamental. Young learners who developed good first language skills will acquire the second language faster (Éva & Réka, 2013), not only due to the orthographic depth mentioned before, but also by reason of age, for example. According to Éva & Réka (2013), older children learn the phonology of the L2 faster because they have more time of L1 experience.

¹ The training consisted of classes once a week at school, with 30 to 40 minutes of duration. The students performed rime, alliteration and syllable awareness activities, among others.

Bilingual children are expected to retain higher levels of phonological awareness due to the constant attention to the phonotactic features of two languages (Verhoeven, 2007). According to Bruck & Genessee (1995), the hypothesis that bilingualism fosters metalinguistic awareness is built on the idea that bilingualism offers contrasting ways of linguistic instruction, and that leads children to compare and analyse language characteristics more effectively than monolingual children. Bruck & Genessee (1995, p.309) also argue that “bilingualism affects the development of specific phonological awareness skills, owing to the phonological structures that are salient in the second language relative to the first language.”

Orthographic consistency is relevant for L2 learning because languages differ in terms of transparency of orthographies. The phonological awareness of children evolves according to the phonological structure of their L1 (Chen et al, 2010). For this reason, the idea of cross-language transfer is also important. Research has shown good reasons to believe that the skills acquired in the L1 can be transferred to the L2 (Durgunoğlu et al,1993). For Chen et al (2010, p. 712), “phonological awareness is a complex metalinguistic construct for children who are second-language learners. It can develop in one of the child’s two languages and then transfer to the other language”.

2.5 PA tests

As reported by Troia (2004), phonological awareness tasks can be based on two different factors: phonological analysis and phonological synthesis. “Analysis tasks require the segmentation of spoken stimuli into smaller units, whereas synthesis tasks require the blending of small units into larger segments” (Troia, 2004, p 275). In other words, analysis tasks follow a descending order of analysis, while the synthesis tasks pursue an ascending order. As a

consequence of PA development, the analysis tasks will be more difficult for children because the capacity to segment evolves later (Troia, 2004).

Troia (2004, p. 276) believes that analysis and synthesis tasks are easier for children when “(1) the number of units to manipulate in the stimulus are few and (2) the stimulus is a relatively high-frequency word”. The author also gives examples of analysis and synthesis tasks (in order of increasing difficulty), such as “matching, oddity detection, same-different judgement, segment isolation, simple production, counting and compound production” (Troia, 2004, p. 276).

Goswami & Bryant (2016) claim that children will face a higher level of difficulty in phoneme awareness tasks before they are able to read, as phonemic awareness is the last PA skill to be developed as a consequence of literacy instruction. The authors also cite the phoneme deletion or elision task developed by Bruce (1984). According to them, the task was applied to children with mental ages between five and nine years, but only those with mental ages of eight or nine had a reasonable achievement. Figure 1 below exemplifies the task.

Figure 1: Deletion and elision tasks by Bruce (1964)

Deletion: end sound	Deletion: first sound	Elision: middle sound
1. Syllable	1. Onset	1. Part of onset
party-part	near-ear	snail-sail
fairy-fair	cold-old	frog-fog
every-ever	nice-ice	
	hill-ill	
2. Part of rime	2. Part of onset	2. Rime
think-thin	spin-pin	hand-had
farm-far	frock-rock	nest-net
tent-ten	stop-top	lost-lot
start-star	plate-late	went-wet
pink-pin		left-let

Note. Adapted from *Phonological skills and learning to read* (p. 11), by Goswami, U., & Bryant, P., 2016, London: Routledge. Copyright 2016 by Usha Goswami and Peter Bryant.

The theoretical background section showed the definition of phonological awareness and its role for literacy acquisition. The relation between phonological awareness and L2 learning was also discussed, along with the role of orthographic consistency in this relation. The last section of theoretical background explained the PA tests and provided examples of the most commonly used tests in empirical studies. In the next section (section 3), the method and procedures of the present study are presented.

3. Method

The present study consists of a systematic review of literature which aims to answer the following research questions: (1) How do empirical studies assess phonological awareness? (2) What is the age of the population investigated in these studies? (3) Is there a relation between the ages of participants and the PA test? (4) What are the implications of the studies concerning the role of phonological awareness for L2 learning by children?

3.1 Procedures

This study consists of a systematic review of research articles that address phonological awareness and L2 learning and that have been published between the years 2006 and 2019. The keywords ‘Phonological Awareness’, ‘L2 learning’, ‘English’ and ‘Children’ were selected to find the material in different platforms. The following databases were selected for the search for articles using the aforementioned keywords: *American Psychological Association*, *Springer Link*, *Wiley Online Library*, *Web of Science* and *ScienceDirect*.

The criteria for inclusion of articles were the following. First, the participants should be children in the first years of school, without reported learning difficulties. Second, the first

language of the participants should be western languages, preferentially romance languages. Asian first languages (L1) could not be included because of the difference in the orthographies and representations of graphemes. Third, the second language (L2) approached in the studies should be English. In order to achieve the objectives of this research synthesis, the articles selected for the study should also have used a phonological awareness test.

After applying the inclusion and exclusion criteria, 20 articles were found. However, one article was not analysed because the first language of the participants was Kannada, a language that is not relevant for this study because it is not an alphabetic language. The pieces were primarily analysed in terms of the ages of participants, L1, L2 and phonological awareness test applied. Based on the abstracts and introductions, the articles were then divided according to their focus areas. Following the main objective of the study, which is to determine what are the main findings concerning the relationship between phonological awareness and L2 learning, the results of the studies were assessed and compared to look for similarities and differences in the implications.

4. Results

4.1 PA tests and Age groups

The results concerning PA tests and age group of participants are organized in Table 1. The number of the article, the authors' names and year of publication are shown in the first column. The ages of participants are shown in the second column. Articles 7, 9, 10 and 17 show the estimated age because they did not provide the exact ages of participants, only their grades in school. The PA test used in the studies and the PA skills tested are presented in the third and

fourth columns, respectively. Articles 2, 11 and 16 show a “created version” of PA tests because the authors created an experimental test according to the specificities of the studies.

Table 1: Number and authors, ages of participants, phonological awareness tests and phonological awareness skills tested.

Nº, author and year	Age of participants	PA test and language of application	PA skills tested
1. Kalia, Lane and Wilborn (2018)	5,5 to 11 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Phonemic awareness
2. Gottardo, Pasquarela, Chen and Ramirez (2015)	5 to 7 years old	Created version (English) And Test of Phonological Processing in Spanish (Francis et al., 2001) (Spanish)	Syllable awareness, Onset-rime awareness, and Phonemic awareness
3. Raynolds, López-Velásquez and Valentín (2016)	4 and 5 years old	Phonological Awareness and Literacy Screening (PALS) (English and Spanish)	Syllable awareness, Onset-rime awareness, and Phonemic awareness
4. Zhao, Dixon, Quiroz and Chen (2015)	4 to 5 years old	Phonological Awareness Test and Habilidad Fonológica (Harvard University and Center for Applied Linguistics, 2002) (English and Spanish)	Syllable awareness, Onset-rime awareness, and Phonemic awareness
5. Sun-Alperin and Wang (2009)	Mean age of 8.54 years	Modified version of the Peabody Picture Vocabulary Test—Third Edition (PPVT-III; Dunn & Dunn, 1997)	Onset-rime awareness

		(English and Spanish)	
6. Raynolds, Uhry and Brunner (2012)	5 years, 4 months and 6 years, 4 months	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Phonemic awareness
7. Chen, Ramirez, Luo, Geva and Ku (2011)	4th and 7th grades (estimated age of 9 and 12 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Phonemic awareness
8. Raynolds and Uhry (2009)	4 years old	Phonological Awareness and Literacy Screening (PALS) (English)	Syllable awareness, Onset-rime awareness, and Phonemic awareness
9. Ramirez, Chen, Geva and Kiefer (2009)	4th and 7th grades (estimated age of 9 and 12 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Phonemic awareness
10. Nakamoto, Lindsey and Manis (2010)	Kindergarten to grade 3 (estimated age of 5 to 8 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Syllable awareness and Phonemic awareness
11. Nicolay and Poncelet (2013)	5 years old	Created version (French)	Phonemic awareness
12. Castro et al. (2017)	4 years old	Phonological Awareness Task (PAT; Miccio & Hammer, 2002) (English and Spanish)	Onset-rime awareness
13. Nakamoto, Lindsey and Manis (2006)	Average age of 5,6 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Syllable awareness, Onset-rime awareness, and Phonemic awareness

14. Harrison et al. (2015)	Average age of 8,5 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Phonemic awareness
15. Swanson, Rosston, Gerber and Solari (2007)	Average age of 8,7 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Phonemic awareness and Syllable awareness
16. Savage et al. (2018)	Average age of 5,4 years old	Created version (English and French)	Phonemic awareness
17. Swanson, Orosco and Lussier (2015)	Grades 1, 2 and 3 (estimated ages of 6, 7 and 8 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Phonemic awareness and Syllable awareness
18. Goodrich, Lonigan and Farver (2017)	Average age of 4,2 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Phonemic awareness and Syllable awareness
19. Landry et al (2019)	Average age of 4,5 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Phonemic awareness

Table 1 shows the ages of participants and PA tests used in the articles selected. In addition, the languages of application of the tests and the PA skills tested are also shown. With the information in Table 1, it was possible to answer three research questions: (1)How do empirical studies assess phonological awareness?, (2)What is the age of the population investigated in these studies? And (3)Is there a relation between the ages of participants and the PA test?

The studies assessed phonological awareness using different tests. However, the Comprehensive Test of Phonological Processing (CTOPP) showed to be the most frequent test between the studies. The studies reported in articles 1, 6, 7, 9, 10, 13, 14, 15, 17, 18 and 19 in Table 1 (11 articles) used the CTOPP as a phonological awareness measure, showing that most of the studies follow a pattern in assessing PA. As pointed out by Raynolds, Uhry and Brunner (2012), “The Comprehensive Test of Phonological Processing (CTOPP) (Wagner, Torgesen, & Rashotte, 1999) is a norm-referenced test with subtests for several age groups”. All of the 11 articles that used the CTOPP applied the test only in English or in English and Spanish, showing that the application of the test can also be flexible concerning the languages of application, because it depended on the specificities of each study.

As seen in Table 1, the ages of the population tested vary from 4 to 12 years old. Although the objective of this review was to include only children in age of literacy acquisition, the studies with older children were considered due to the lack of articles that investigate specific ages. Also, some of these articles were considered because they tested younger children too, as in the cases of longitudinal studies. In addition, the studies with older children helped to conclude that there is no strong relation between the ages of participants and the PA tests. As previously mentioned, the most frequent test (CTOPP) was used in children with different ages, showing the weak association.

The studies that used the Phonological Awareness and Literacy Screening test (PALS) as PA measure, articles 3 and 8 in Table 1, show that this test might be applied in children in kindergarten age, showing a possible relation between the ages of participants and PA test. Additionally, Raynolds and Uhry (2009, p.503) pointed out that this test is also “used with

children in grades pre kindergarten to identify children at risk for reading difficulties or delays”. The two articles that used PALS tested the three PA skills: Phoneme, Onset-rime and Syllable awareness. The next section (section 4.2) will discuss the implications of the studies on PA for L2 Learning, aiming to answer the research question: (4)What are the implications of the studies concerning the role of phonological awareness for L2 learning by children?

4.2 Implications of the studies on PA for L2 Learning

Kalia, Lane and Wilborn’s study (2018), article 1 in Table 1, investigated the role of cognitive control in L2 vocabulary acquisition. Phonological awareness, cognitive control and vocabulary in L1 and L2 were tested in children from kindergarten to fourth grade (5 years and 6 months old to 11 years old), in a Spanish-English bilingual environment. Half of them were English native speakers and the other half were Spanish native speakers. Concerning phonological awareness (PA), the blending and elision tasks were applied in English, based on the Comprehensive Test of Phonological and Print Processing (CTOPP) by Wagner, Torgesen, & Rashotte (1999). The results of the study show that the elision test predicted the scores in L1 and L2 vocabulary . Furthermore, the analyses showed that the relation between L1 and L2 vocabulary was mediated by phonological awareness. According to the authors, the results also emphasized how fundamental sound segmenting skills are for L2 vocabulary acquisition.

Article 2 in Table 1, reports a study conducted by Gottardo, Pasquarela, Chen and Ramirez (2015), examined the relationship between L1 and L2 Phonological Awareness and reading skills in different orthographies, considering the grain-size theory for bilinguals. The children were speakers of three different L1s: Spanish, Portuguese and Chinese. The tests were applied from kindergarten to second grade. Their results show that the orthographies in question

affected the relationship between reading and specific subcomponents of phonological awareness. Also, the PA subcomponents analogous to English reading were related for the three English L2 groups, although the L1 orthographies had differences, supporting, this way, the psycholinguistic grain size theory. Moreover, all the PA subcomponents were important for English reading skills.

Raynolds, López-Velásquez and Valentín (2016), article 3 in Table 1, investigated English and Spanish PA subcomponent skills in kindergarten children (4 and 5 years old). The participants were Spanish native speakers learning English as L2. They were given instruction of phonological awareness for 1 year in English, focusing on two skills: Rhyme awareness (RA) and beginning sound segmentation (BSS). The objective of the study was to compare children's performance in English and Spanish PA tests, more specifically, RA and BSS tests. The results of the study show that the participants had better performance in English BSS. Although they had received instruction of PA only in English, no important difference was found between the English and Spanish BSS tests. Finally, the results also discuss the cross-linguistic transfer of PA skills in Spanish native children learning English as L2

In a longitudinal study, Zhao, Dixon, Quiroz and Chen (2015), article 4 in Table 1, investigated the relation of vocabulary and word reading in Spanish and English in bilingual children who participated in the Head Start programs in the United States. The participants, children with ages of 4 to 5 years old, received word reading tests in English and Spanish at times 1 and 2, with a time frame of 5 months between the two tests. At time 1, they also tested the participants' vocabulary and phonological awareness in English and Spanish. Concerning

phonological awareness, their results show that Spanish PA had an important impact on the relation between vocabulary and word reading in English.

A study carried out by Sun-Alperin and Wang (2009), article 5 in Table 1, aimed to investigate the connection between the phonological and orthographic processing in L1 (Spanish) and word reading and spelling in L2 (English) among children with a mean age of 8.54 years. Using onset-rhyme detection, phoneme deletion and homophone choice tasks as PA measures in Spanish and English, they found that Spanish phonological skills and orthographic processing truly predicted English word reading. They also added that the findings of the study reinforce the hypothesis that phonological processes play a central role in bilingual reading acquisition amid alphabetic languages.

The authors of article 6 in Table 1, Reynolds, Uhry and Brunner (2012), carried out a comparative study about the invented spelling of vowels with children in kindergarten. They compared the invented spelling of native Spanish speakers with English monolingual speakers. As a phonological awareness measure, the authors tested the phonemic awareness skill, using the test from The Comprehensive Test of Phonological Processing (CTOPP), by Wagner, Torgesen, & Rashotte (1999). Their results confirm the hypothesis that phonics instruction in kindergarten plays an important role on the invented spellings of new second language vowel phonemes.

Chen, Ramirez, Luo, Geva and Ku's study (2011), article 7 in Table 1, aimed to assess the impact of metalinguistic and sociocultural factors on vocabulary knowledge amid Chinese and Spanish speakers learning English as L2. The participants were children in grades 4 and 7. Using the Comprehensive Test of Phonological Processing (CTOPP), by Wagner, Torgesen, & Rashotte (1999), they measured the phonemic awareness. The results show that phonological

awareness was associated with vocabulary in the three groups (including the control group). Also, PA was not the only variance in vocabulary. The morphological awareness measure plays a more important role in literacy than PA.

Raynolds and Uhry (2009), article 8 in Table 1, carried out a comparative study concerning the English spelling with children (4 years old) speakers of Spanish as L1 (learning English-only instruction) and with monolingual English speakers. As a PA measure, the authors used the phonological awareness literacy screening (PALS) test. The results show that the bilingual children had more mistakes in spelling of ending consonants, which has a phonetic difference in English and Spanish, than the monolingual group. At the end of kindergarten, no difference in the spelling of non-Spanish phonemes was found in the groups.

Ramirez, Chen, Geva and Kiefer (2009), article 9 in Table 1, studied the effects of morphological awareness in word reading with children speakers of Spanish learning English as a second language. The participants were children in grades 4 and 7, with an estimated age of 9 and 12 years old. To test phonological awareness, the authors tested the phonemic awareness skill from the The Comprehensive Test of Phonological Processing (CTOPP), by Wagner, Torgesen, & Rashotte (1999). Concerning phonological awareness, the results of the study show that PA and Morphological Awareness (MA) were the only predictors of Spanish word reading. However, the MA showed to be a stronger predictor in this case. Additionally, “these results are consistent with studies reporting weak associations between phonological awareness and reading in other regular orthographies” (Ramirez, Chen, Geva and Kiefer, 2009, p. 351)

Nakamoto, Lindsey and Manis (2010), article 10 in Table 1, investigated the evolution of English and Spanish reading and oral language skills in children from kindergarten to third grade

frequenting three different instructional programs. The participants were Spanish speakers learning English as L2. The phonological awareness tests were applied in Spanish and English, adapted from the The Comprehensive Test of Phonological Processing (CTOPP), by Wagner, Torgesen, & Rashotte (1999). The PA skills measured were syllable and phoneme awareness. The results reinforce the idea that phonological and decoding skills from L1 can be transferred to L2 learning.

In a longitudinal study, Nicolay and Poncelet (2013), article 11 in Table 1, aimed to investigate the cognitive abilities involved in L2 vocabulary acquisition in children immersed in an L2 context. The participants were 5 years old French speakers learning English as L2. The PA measure was a vowel phoneme detection test. The analyses of the study show that PA does not have an effect in L2 vocabulary in the context of L2 immersion. This effect was explained by phonological STM and speech perception. Between all the phonological processing abilities tested (phonological STM, phonological awareness, and speech perception), the results indicate that phonological STM is the stronger predictor of vocabulary development for L1 and L2 in this context.

Article 12 of Table 1, by Castro et al. (2017), evaluated the effectiveness of Nuestros Niños School Readiness (NNSR) in Spanish-English dual language learners (DLLs) in kindergarten. The PA measured was adapted from the Phonological Awareness Task (PAT; Miccio & Hammer, 2002). The skills assessed were Rhyme Matching, Onset Matching, and Onset Segmentation and Matching in English and Spanish. The results, concerning children outcomes, show the lack of differences in children's PA abilities. The authors also add that a

possible explanation for this lack was the poor implementation of phonological awareness activities as well as the difficulty for the teachers to apply these activities.

Nakamoto, Lindsey and Manis (2006), article 13 in Table 1, carried out a longitudinal study in order to analyze word decoding and reading comprehension of English language learners. The participants were Spanish speakers learning English as L2. The PA measures were sound matching and Elision tasks, adapted from The Comprehensive Test of Phonological Processing (CTOPP). The results show that PA, RAN (rapid automatized naming) and oral language as predictors of reading success in English. According to the authors, “Phonological awareness, rapid automatic naming (RAN), and oral language measures were used as predictors and correlated with growth rates in a manner consistent with past research” (Nakamoto, Lindsey and Manis ,2006, p. 691).

Harrison et al. (2015), article 14 in Table 1, investigated the cognitive and linguistic features related to spelling and writing in English as a second language (ESL) (native speakers of different languages) and speaker of English as L1. The children who participated were from third grade. To measure PA, The Comprehensive Test of Phonological Processing (CTOPP) was applied. The skill tested was phonemic awareness, through the elision task. PA showed to be a strong predictor of single-word spelling for EL1. Along with rapid naming, PA also lead to text level spelling.

Swanson, Rosston, Gerber and Solari (2007), article 15 in Table 1, studied the influence of oral language and phonological awareness in reading by bilingual children (Spanish and English). The participants were children in third grade, with a mean age of 8,7 years old. PA was measured using The Comprehensive Test of Phonological Processing (CTOPP), with

segmentation and blending tasks. Their “results showed that within language contributions of expressive vocabulary and syntax best predicted literacy when compared to phonological awareness measures” (Swanson, Rosston, Gerber and Solari, 2007, p. 413).

Savage et al. (2018), article 16 in Table 1, performed a study with English-French bilinguals. Their hypothesis is that Rapid automatized naming is a fundamental predictor of reading fluency. The phonological awareness measures were assessed using experimental English and French blending tasks. The results show that rapid automatized naming predicted English word and French word reading fluency in Grade 6 and 3. Concerning phonological awareness, the results did not show explicit results.

Swanson, Orosco and Lussier (2015), article 17 in Table 1, performed a longitudinal study to investigate the role working memory components in English reading and language acquisition with Spanish speakers children learning English. The PA test was adapted from the Comprehensive Test of Phonological Processing (CTOPP), measuring phoneme and syllable awareness. “The results suggested that growth in the phonological storage system does not supersede growth of the executive component of WM as a major contributor to growth in children’s L2 reading and language” (Swanson, Orosco and Lussier, 2015, p. 155). The results do not show direct results that answer the research questions of the present research synthesis.

Goodrich, Lonigan and Farver (2017), article 18 in Table 1, performed a study that aimed to assess how effective the intervention of an experimental curriculum was for the development of English and Spanish early literacy abilities with LM (language minority) children. Phonological awareness test was adapted from the Comprehensive Test of Phonological

Processing (CTOPP), assessing phoneme and syllable awareness. Although a PA test was applied, no significant results that address the objectives of this research synthesis were found.

Landry et al (2019), article 19 in Table 1, assessed the influence of the instructional program Preparing Pequeños, “an integrated small-group instruction program designed to promote increased learning for Spanish speaking DLL in language, literacy, and math” (Landry, Assel, Carlo, Williams, Wu and Montroy, 2019, p.1). The PA test was taken from the Comprehensive Test of Phonological Processing (CTOPP), assessing phonemic awareness. Again, although a PA test has been used, no results were shown that can be applied to the objectives of this research synthesis.

5. Discussion

In addition to Table 1, Table 2 presents the first language (L1) of participants of the studies selected. The articles that present asian languages were selected because they also investigated other languages, such as Spanish and Portuguese.

Table 2: Ages of participants, phonological awareness tests and phonological awareness skills tested.

Nº, author and year	Age of participants	PA test and language of application	L1
1. Kalia, Lane and Wilborn (2018)	5,5 to 11 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	50% native-English speakers and 50% native-Spanish speakers.

2. Gottardo, Pasquarela, Chen and Ramirez (2015)	5 to 7 years old	Created version (English) And Test of Phonological Processing in Spanish (Francis et al., 2001) (Spanish)	Chinese (Cantonese, Mandarin), Spanish, and Portuguese
3. Raynolds, López-Velásquez and Valentín (2016)	4 and 5 years old	Phonological Awareness and Literacy Screening (PALS) (English and Spanish)	Spanish
4. Zhao, Dixon, Quiroz and Chen (2015)	4 to 5 years old	Phonological Awareness Test and Habilidad Fonológica (Harvard University and Center for Applied Linguistics, 2002) (English and Spanish)	Spanish– English bilingual children
5. Sun-Alperin and Wang (2009)	Mean age of 8.54 years	Modified version of the Peabody Picture Vocabulary Test—Third Edition (PPVT-III; Dunn & Dunn, 1997) (English and Spanish)	Spanish
6. Raynolds, Uhry and Brunner (2012)	5 years, 4 months and 6 years, 4 months	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Spanish– English bilingual children
7. Chen, Ramirez, Luo, Geva and Ku (2011)	4th and 7th grades (estimated age of 9 and 12 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Spanish, Chinese and English
8. Raynolds and Uhry (2009)	4 years old	Phonological Awareness and Literacy Screening (PALS) (English)	English and Spanish

9. Ramirez, Chen, Geva and Kiefer (2009)	4th and 7th grades (estimated age of 9 and 12 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Spanish
10. Nakamoto, Lindsey and Manis (2010)	Kindergarten to grade 3 (estimated age of 5 to 8 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	English and Spanish
11. Nicolay and Poncelet (2013)	5 years old	Created version (French)	French
12. Castro et al. (2017)	4 years old	Phonological Awareness Task (PAT; Miccio & Hammer, 2002) (English and Spanish)	Spanish– English bilingual children
13. Nakamoto, Lindsey and Manis (2006)	Average age of 5,6 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	English and Spanish
14. Harrison et al. (2015)	Average age of 8,5 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English)	Punjabi, Korean, Urdu, Malayalam and Spanish
15. Swanson, Rosston, Gerber and Solari (2007)	Average age of 8,7 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Spanish
16. Savage et al. (2018)	Average age of 5,4 years old	Created version (English and French)	French
17. Swanson, Orosco and Lussier (2015)	Grades 1, 2 and 3 (estimated ages of 6, 7 and 8 years old)	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Spanish and Spanish– English bilingual children

18. Goodrich, Lonigan and Farver (2017)	Average age of 4,2 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	Spanish
19. Landry et al (2019)	Average age of 4,5 years old	The Comprehensive Test of Phonological Processing (CTOPP) (English and Spanish)	English and Spanish

The information provided in Table 2 shows that most of the studies were carried out with Spanish speakers, mainly because Spanish is spoken by a wide range of people in the USA (and other countries where the studies were carried out) and, consequently, more children are learning both languages. All of the studies that used the CTOPP were carried out with Spanish speakers or English-Spanish bilinguals. Also, articles 10, 15, 17, 18 and 19 show that the CTOPP can be adapted for applications both in English or in Spanish. Other tests were used with Spanish speakers, such as PALS and Phonological Awareness Test and Habilidad Fonológica. Both of the studies with French speakers (articles 11 and 16) used a created version of test.

Regarding the ages of the population tested, the results showed that the ages provided by the studies vary from 4 to 12 years old. The age range shows the difficulty to find enough articles that focus on a specific age group. Regarding the PA measures used in the articles, the results show a possible pattern of test choice, because the CTOPP was applied in most of the studies. The other PA tests varied, except for the PALS test that was used in two articles.

Also, in the cases of CTOPP use, the languages of application seem to be relevant, because these tests were applied only in English (L2) or in English (L2) and Spanish (L1). The studies with different L1s, as French, used different tests. However, most of the tests were

applied in English (L2). Only one study, article 11 in Table 1, applied the test only in L1 (French).

About the association between PA tests and age of participants, there does not seem to be a strong association between these two factors. In the set of studies reviewed, the test more frequently adopted was the Comprehensive Test of Phonological Processing (CTOPP), by Wagner, Torgesen, & Rashotte (1999), with a total of 11 articles out of 19 (articles 1, 6, 7, 9, 10, 13, 14, 15, 17, 18 and 19 in Table 1). This result indicates that the CTOPP test is the most used in PA studies because of its adaptive features for specific purposes. The test was applied to children from 4 to 12 years old, showing that the ages can vary in the same test.

A possible association concerning the use of PA tests and the age of participants is seen in the use of the Phonological Awareness and Literacy Screening test (PALS), adopted in studies with children in pre-kindergarten ages (4 and 5 years old). Two out of 19 articles used PALS as PA measure and the ages (4 and 5 years old) are consistent with the idea that this test is applied in children with kindergarten ages (articles 3 and 8 in Table 1).

Regarding the implications of the use of PA tests to L2 learning, the results show that PA plays an important role in L2 acquisition in the areas of reading, vocabulary, spelling and cross-language transfer. Phonological awareness also plays a role as a measure of effectiveness in phonics instruction approaches. Related to reading, 6 out of 19 articles discussed the role of PA for reading acquisition in L2. As seen in results, PA is shown to be a strong predictor for reading in L2 in most cases (e.g., Gottardo, Pasquarela, Chen and Ramirez, 2015; Zhao, Dixon, Quiroz and Chen, 2015; Sun-Alperin and Wang, 2009; Ramirez, Chen, Geva and Kiefer, 2009; Nakamoto, Lindsey and Manis, 2006; Swanson, Rosston, Gerber and Solari, 2007, articles 2, 4,

5, 9, 10 and 15 in Table 1). However, in Ramirez, Chen, Geva and Kiefer (2009), Morphological Awareness showed to be a stronger predictor than PA in Spanish word reading. Swanson, Rosston, Gerber and Solari (2007) also claim that PA was not a strong predictor of literacy (reading) when compared to within language contributions of expressive vocabulary and syntax.

Concerning vocabulary acquisition, 4 out of 19 articles discussed the role of PA for vocabulary learning (e.g., Kalia, Lane and Wilborn, 2018; Zhao, Dixon, Quiroz and Chen, 2015; Chen, Ramirez, Luo, Geva and Ku's study, 2011; Nicolay and Poncelet, 2013, articles 1, 4, 7 and 11 in Table 1). Although PA seems to affect vocabulary learning, other variables are shown as stronger predictors for vocabulary development than PA, such as Morphological awareness and phonological STM.

In Spelling, 3 of 19 articles addressed this field of research (e.g., Raynolds, Uhry and Brunner, 2012; Raynolds and Uhry, 2009; Harrison et al., 2015, articles 6, 8 and 14 in Table 1), showing, along with other variables, positive relations between PA and spelling. The role of PA in cross-linguistic transfer appeared in 2 out of 19 articles (e.g., Raynolds, López-Velásquez and Valentín, 2016; Nakamoto, Lindsey and Manis, 2010, articles 3 and 10 in Table 1). The two studies showed that the skills acquired in L1 can be transferred to L2 acquisition.

The role of PA in phonics instruction was seen in 2 out of 19 articles (e.g., Raynolds, Uhry and Brunner 2012; Castro et al., 2017, articles 6 and 12 in Table 1). Raynolds, Uhry and Brunner (2012) results corroborate the idea that phonics instruction in kindergarten affects the invented spellings of new second language vowel phonemes. Castro, Gillanders, Franco, Bryant, Zepeda, Willoughby and Méndez (2017) do not show explicit results concerning the role of PA, but sheds light to the importance of PA tests to measure the effectiveness of phonics instructions.

Some of the articles (e.g., Savage et al., 2018; Swanson, Orosco and Lussier, 2015; Goodrich, Lonigan and Farver, 2017; Landry et al., 2019, articles 16, 17, 18 and 19 in Table 1) do not show significant results that answer to the research questions of this research synthesis, although the PA tests have been used. In other words, these articles address themes that do not include PA as a determinant variable for the results. It shows the lack of studies that investigate the role of phonological awareness for L2 learning in alphabetic languages, because most of the articles in the literature study asian languages such as Chinese, Japanese, Korean and Taiwanese.

Finally, the results indicate that phonological awareness is, indeed, a strong predictor for literacy acquisition and L2 learning. Nevertheless, PA does not predict the outcomes alone, it depends on other variables, as Morphological Awareness, Rapid Automatized Naming, Working Memory, Phonological STM, speech perception etc. In order to reveal more about the role of Phonological Awareness in L2 learning in alphabetic orthographies, it is necessary to have more studies focused on western languages, so the role of PA plays alone can be more clear.

6. Final Remarks

The present research synthesis aimed to determine (1) how empirical studies assess phonological awareness, (2) the age of the population investigated in these studies, (3) the possible relation between the ages of participants and PA tests, and (4) the implications of the studies selected in terms of the role of phonological awareness for L2 learning by children. Following the objectives of the study, the research questions were presented: (1) How do empirical studies assess phonological awareness? (2) What is the age of the population

investigated in these studies?, (3) Is there a relation between the ages of participants and the PA test? and (4) What are the implications of the studies concerning the role of phonological awareness for L2 learning by children?

The results showed that the studies assess PA with different tests, but also indicate that there is a possible pattern in the choice of the CTOPP test, which seems to be an adaptive test concerning the particularities of each study. The ages of participants ranged from 4 to 12 years old, showing weak associations between age and PA test. The strongest association was found in the use of the PALS test, which is used with younger children (4 and 5 years old).

The results concerning the role of phonological awareness for L2 learning showed strong relevance of PA for L2 learning in the areas of reading, vocabulary, spelling, cross-language transfer and phonics instruction approaches. Also, the results show that the measures of L2 learning in empirical studies depend on other variables beyond phonological awareness, such as morphological awareness and working memory capacity. In addition, some studies did not present relevant results concerning the role of PA for L2 English learners, showing how more research is necessary in the literature that investigates the role of PA for L2 learners among alphabetic languages.

The strongest limitation of the study was the difficulty to find enough articles that met the criteria selected for inclusion. Most of the articles in online databases about phonological awareness discussed non-alphabetical languages, such as Chinese and Japanese. Another limitation was the lack of studies, between the 19 articles selected, that show the specific role of phonological awareness for L2 learning. For future research, the limitations can be overcome by

extending the range between the years of publication of the articles, allowing a more detailed analysis of the role of phonological awareness in alphabetic languages.

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