Bilingual Children's Phonological Awareness: The Effect of Articulation Training

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1. Introduction

Phonological awareness, the ability to reflect on and manipulate the phonemic segments of speech, is seen as emerging over time, in response to the increasingly segmental nature of phonological representations (Fowler, 1991; Thomas, 1997). It refers to the capacity that the individual knows that the spoken word can be segmented into smaller units, and that he can distinguish and synthesize these units. Phonological awareness, a process involved in language perception, has gained research attention in itself and other related aspects since the early work of Bruce in 1964. With the focus on "relations" between perception and production, which views perception and production as potentially equal and fundamentally interactive, the link between phonological awareness and articulation behaviors has been found and addressed in speech pathology (MacKay *et al*., 1987, Magnusson, 1991, Webster & Plante, 1992, Strange & Broen, 1980). Thomas (1997) also presented a conceptual model that ascribed a causal role to articulation in the development of phonological awareness.

Phonological awareness is also considered part of metalinguistic abilities, referring to the ability to perform mental operations on the output of speech- perception mechanism (Tunmer & Rohl, 1991 for a review). Once a child is able to reflect on the components of a language, it is likely that this metalinguistic awareness could be applied to a second language as well (Durgunoglu *et al*, 1993). Cisero and Royer (1995) further indicated that if phonological awareness is not restricted to language experiences, it would suggest it be transferred from a familiar language to an unfamiliar language, which thus implies a kind of "abstract cognitive ability" that facilitates language processing across a variety of languages. Alternatively, if phonological awareness skills are restricted to language experiences, it would suggest that there is a kind of "specific tuning" associated with the ability to detect differences in the sounds of language. It seems that language background can influence the nature and development of phonological awareness, according to the results of multilingual Chinese children in Singapore reported by Rickard Liow and Poon (1998). Cisero and Royer also reported that evidence for cross-language transfer in English and Spanish was found, but finding it depended on looking at the right skill at the right time in a child's developmental history.

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Given the trainability of phonological awareness (Wise *et al*. 1999; Olofsson & Lundberg, 1983; Lundberg *et al*., 1988), and the casual role of articulation in the development of phonological awareness, articulation training is administrated in this study to examine if transfer occurs in bilingual children's phonological awareness skills. If transfer occurs; that is, if phonological awareness could be applied to a second language, will the articulation training effect on phonological awareness, if there is any, transfer to phonological awareness in other language? Alternatively, if phonological awareness is limited to language experiences, training effect may only be reflected in the phonological awareness of the training language.

2. Methodology

a. Bilingual subjects

In the past, bilinguals referred to people who had equal mastery of two languages; however, as suggested by Diebold (1961:111), the concept is now extended to include people who have "any contact with possible models in a second language" (qtd. in Macky). Based on this criterion, many kindergarten children in Taiwan can be considered bilingual, since they contact English with many kinds of models at an early age. Sixty kindergarten children in Taipei City participated in this study. Many of them contact English in school settings, ranging from one hour to four hours per week in kindergartens or English language schools. Some of them are exposed to English at home through a variety of models, such as language learning audiotapes or videos, picture books and flash cards. According to the classes they attend, subjects were divided into two age groups, middle class (younger children) and big class (older children). The mean age of the middle and big class children was 5;3 and 6;3 respectively. Subjects' English experiences were reported by teachers. A pre-test English proficiency test was administrated and the child who didn't know any of the English expressions or vocabulary in the test was excluded.

b. Tests and procedures

To examine articulation training effect on phonological awareness and its transferability, a set of phonological awareness pretest and posttest were administrated to tap children's awareness skills in different languages, before and after articulation training. Each set consisted of different cognitive-demanded levels, including onset/ rhyme detection, onset deletion and onset/ rhyme substitution tasks in Chinese and English. One point would be given for each correct response. The maximum in each task is ten. So, the maximum in Chinese is fifty; as it is in English. Children

would finish five Chinese tests and then proceed to English tests. After finishing phonological awareness pretests, half children, randomly selected as an experimental group, received articulation training. After one week upon the completion of pretests, all the children would receive phonological awareness posttests.

c. Articulation training

English tongue twisters were selected as an interesting means of articulation in this study. Tongue twisters are sentences or phrases intended to be difficult to say clearly, especially when repeated quickly. To say a twister well takes intensive attention to the articulatory movements, which can be considered an articulation training as well. Ten four-word English tongue twisters were used, which lasted about one hour. Half of the subjects were randomly selected as an experimental group, receiving tongue twisters articulation training. Another half formed the controlled group, and didn't receive any training at all.

3. Results

a. English proficiency tests

Table 1 Results of English Proficiency Test

Group	Act-out Test (Max=5)		Vocabulary Test (Max=40)	
	Mean	SD	Mean	SD
Middle-class	0.9	1.4	12.7	7.4
	4.15*	***.81***	***33.6***	***2.41***
Big-class	1.5	1.7	19.1	8.4
	4.69	***.48***	***35.5***	***1.86***
Total	1.2	1.6	15.9	8.5

Note. * Bold and italic numbers represent the results of immersion program children in Taiwan, reported by Li (2001).

English proficiency tests, including an act-out test and a vocabulary test, were illustrated in Table 1, with the comparison of results of immersion program children in Taiwan. These bilingual subjects' English abilities showed that they only have some experiences in contacting this language, and haven't developed full English skills as immersion program children.

b. Phonological awareness pretests & posttests

Table 2 Results of phonological awareness pretests and posttests

		Experimental			Controlled		
		Pretest	Posttest	Paired Samples *t*-test	Pretest	Posttest	Paired Samples *t*-test
Chinese (Max= 50)	Older	26.73	32.53	$t_{(14)}$= -3.42, *p*= .004*	23.87	23.00	$t_{(14)}$= .66, *p*= .520
	Younger	14.93	17.93	$t_{(14)}$= -2.89, *p*= .012*	13.93	14.80	$t_{(14)}$= -.85, *p*= .409
	All	20.83	25.23	$t_{(29)}$= -4.36, *p*= .000*	18.90	18.90	$t_{(29)}$= .00, *p*= 1.00
English (Max= 50)	Older	24.67	28.33	$t_{(14)}$= -2.56, *p*= .023*	20.13	19.20	$t_{(14)}$= .91, *p*= .378
	Younger	15.07	17.87	$t_{(14)}$= -3.18, *p*= .007*	13.20	14.60	$t_{(14)}$= -1.92, *p*= .075
	All	19.87	23.10	$t_{(29)}$= -3.90, *p*= .000*	16.67	16.90	$t_{(29)}$= -.36, *p*= .724

From paired-samples *t*-test, we found that the experimental group showed significant improvement in the posttests, in two age groups in both Chinese and English. Experimental group of children performed significantly better in phonological awareness posttests, not just in English but even in mother tongue, Chinese, after English articulation training. However, in the controlled group, no significant difference was found. ANOVA results indicated that experimental group and controlled group had the same starting points (*p*= .366, *p*= .081) in awareness tests. Bar charts below illustrate these improvements generally (Figure 1) and in two separate age groups (Figure 2 and 3).

All the three bar charts showed significant differences in experimental groups in their phonological awareness mean scores. Chinese posttest (po_ch) and English posttest (po_eng) means are significantly higher, compared with their pretests (pre_ch and pre_eng). In Figure 3, although it seemed that children in controlled group also improved a bit, the statistic result failed to show any significant improvement in the posttests.

Figure 1
Overall Results of All Children (N= 60)

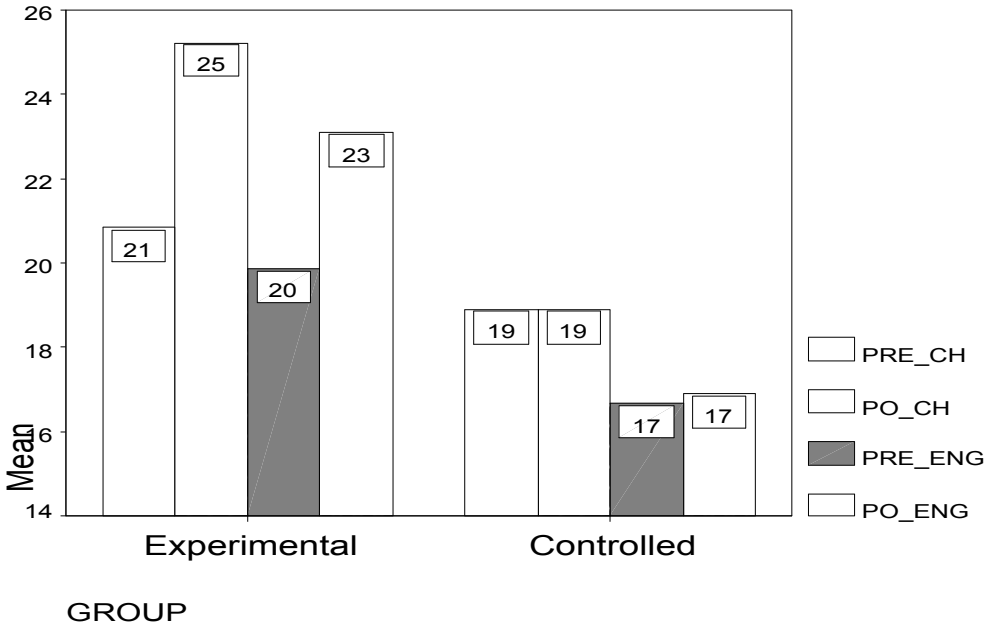


Figure 2
Overall Results of Big-class Children

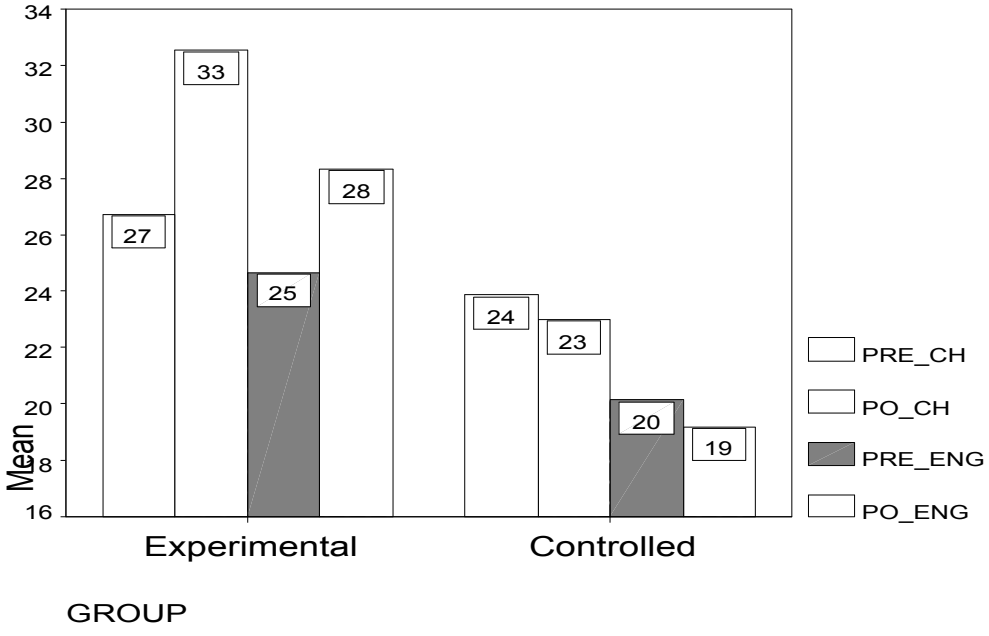
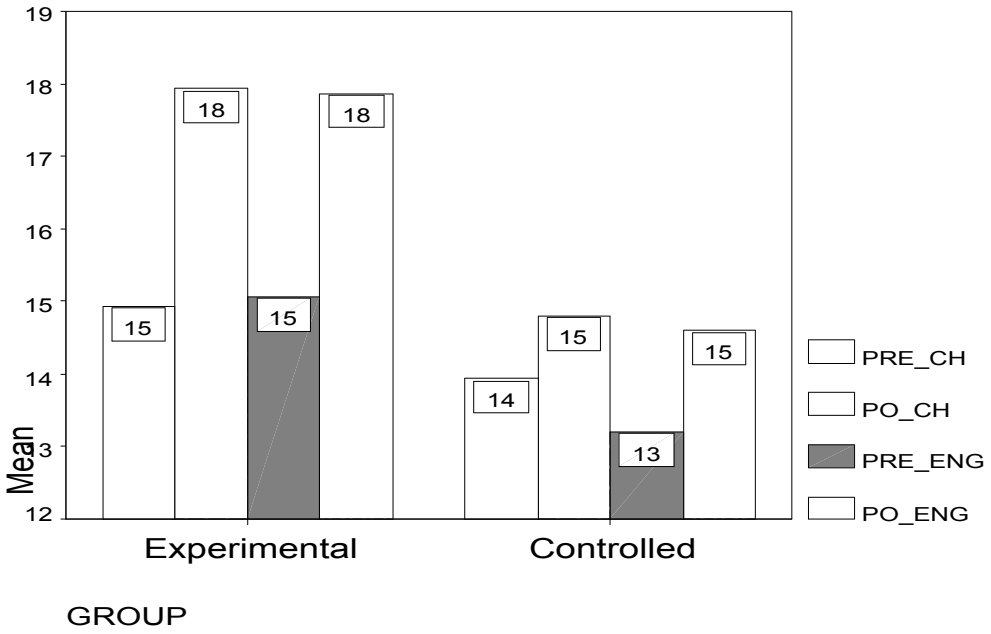


Figure 3
Overall Results of Middle-class Children



c. Training effect on phonological awareness levels

A period of tongue twisters training had its effect on the total scores in phonological awareness posttests. But did the training lift children's awareness abilities up to a higher level? Or did it make the existing abilities more skillful when children dealt with the posttests? We may analyze the changes in their developmental order, and the pass percentages in each level in experimental group, to examine whether and how the effect worked on it. Pass percentage here refers to the percentage of children who passed the threshold (60%) in each test.

Figure 4
Pass Percentage in Experimental Older Children in Chinese Tests

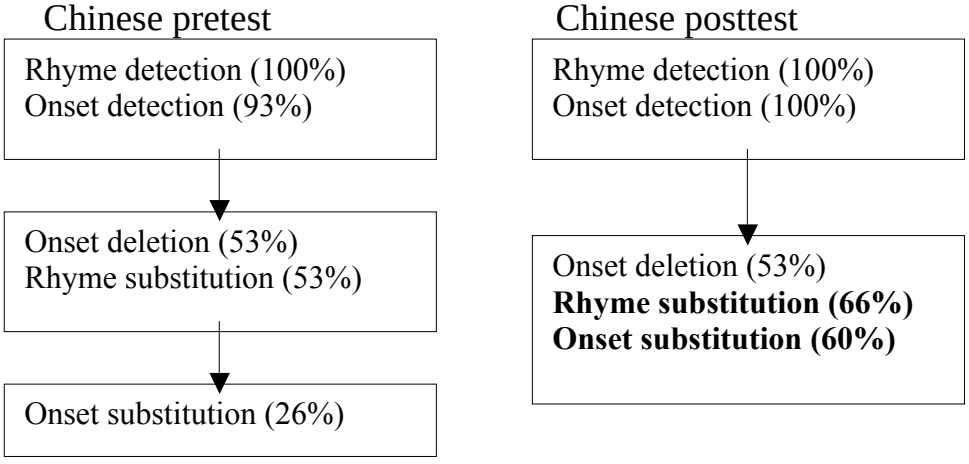
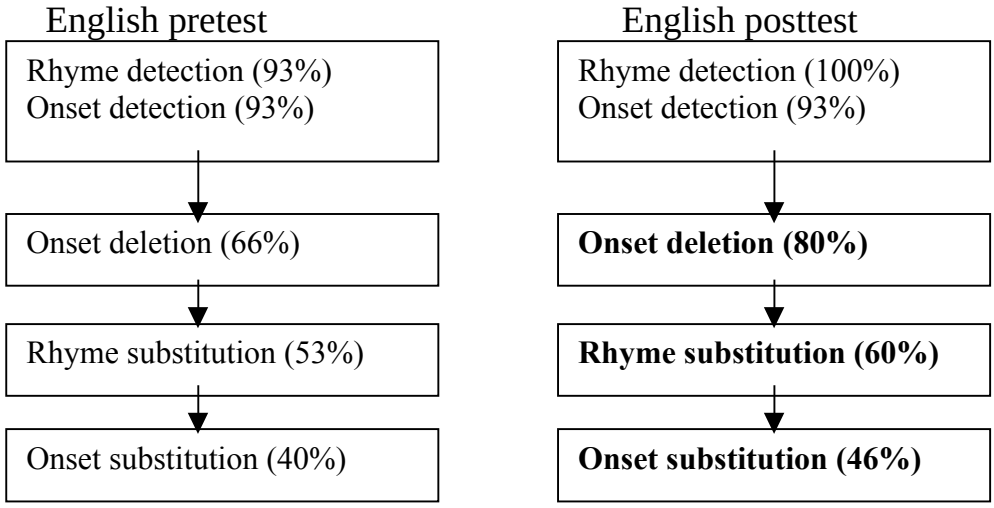


Figure 5
Pass Percentage in Experimental Older Children in English Tests



The figures above illustrated the changes in pass percentages in Chinese and English phonological awareness tests in experimental older children. In Chinese performances, it is found that improvement lied in the last two tests: rhyme substitution and especially onset substitution tests, which increased 34 percent after the articulation training. Thus, in the posttest, onset deletion, rhyme substitution, and onset substitution tests all revealed the same pass percentage. About 60 percent of older trained children passed the three tests. In other words, these three may appear to be of approximately the same difficulty to children.

Children's performance in English showed a slightly different pattern. Improvement was found in last three tests: onset deletion test, rhyme and onset substitution tests. The pass percentage in three tests all increased from 6 to 14 percent.

The following figures present the results in younger children.

Figure 6
Pass Percentage in Experimental Younger Children in Chinese Tests

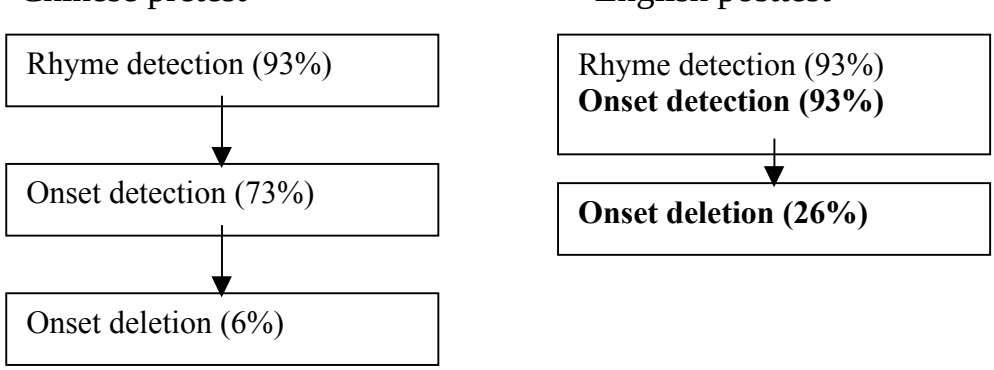
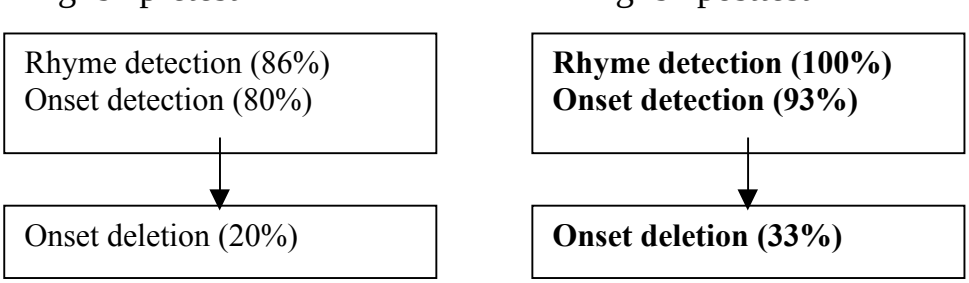


Figure 7
Pass Percentage in Experimental Younger Children in English Tests



We can notice that none of the younger children are able to pass substitution tests. After a period of training, we found that the difference fell on the increased pass percentages in onset detection, and onset deletion tests in both Chinese and English, and rhyme detection only in English. None of them went across to substitution level after the training.

As phonological awareness is a developmental progression ability, we may interpret the results from the differential gain in each task, which had also been used to interpret the results by Cisero and Royer (1995). Older children made larger accuracy gains on deletion and substitution tests than on detection tests. This could be explained as their detection skills were well-developed at the time of testing, and their competence in detection skill enabled them to make gains on the developing deletion and substitution skills. In younger children, their rhyme or onset detection skills had not developed to the ceiling; therefore, after a period of training, the effect fell on the building block of phonological awareness, either on rhyme detection or on onset detection skill. In Chinese, we found that the gain was on onset detection and deletion, since children's rhyme detection in Chinese developed well. On the contrary, in English, there is still some room for the improvement of rhyme detection ability. So, the gain could be found in both detection skills.

4. Discussion

From the results mentioned, it could be summarized that L2 tongue twisters training had a bilateral effect, not only on the perceptual skills in L2, but also in L1. We then further analyzed the pass percentage in each test, which indicated the developmental order in children. How can we interpret the results? We will discuss these from the perspectives of articulation training and phonological awareness, and cross-language transfer of language skills.

a. Articulation training and phonological awareness

Several previous findings from both impaired and normal children (Magnusson, Webster & Plante, Strange & Broen, Thomas & Senechal) indicated articulation played a causal role in the development of phoneme awareness. Some studies tried to enhance phonological awareness by giving awareness training, from articulatory awareness to phoneme awareness (Wise *et al*., Byrne & Fielding-Barnsley). However, little research was done to improve phonological awareness through articulation training. In this study, the results confirm that a short period of tongue twisters training in L2 enhances phonological awareness scores not only in L2, but also in L1. Besides, it seems that training also "pushes" children's awareness level to a higher one, if the basic one(s) are mature enough. Alternatively, training will make the existing awareness abilities more skillful.

The explanation toward improvement or skillfulness in awareness levels within the language could be from the perspective of developmental progression hypothesis, which indicated phonological awareness develops from basic rhyme awareness toward more cognitive-demanded phoneme awareness (Cesiro& Royer, 1995; Yopp, 1988). Based on this, children who are mature in the basic rhyme awareness can move to higher onset awareness. Otherwise, if the building basic abilities are not well-developed, children's awareness won't be lifted to another level. The results in this study then well support this hypothesis. It thus also suggested that the training effect is not a kind of short-term reinforcement; instead, it enhances children's phonological awareness development at the right point, if there is any.

Many previous studies indicated the causal relationship between articulation and phonological awareness from observations in pathology and some longitudinal studies. The results in this study presented an empirical support toward this causal relationship. After training, improvement in both L1 and L2 phonological awareness scores was found. Improvement in L2 is quite predictable, since tongue twisters training were given in L2 texts. However, how come training in L2 also affected the performance in L1? This will be discussed in next session.

b. Cross-language phonological awareness

Do phonological awareness skills acquired in L1 transfer to another language, even if there is little or no experience with that language? Durgunoglu *et al*. (1993) reported cross-language transfer of phonological awareness, in that they found Spanish–English bilingual children's recognition on English word and pseudoword recognition tests was

predicted by the levels of both Spanish phonological awareness and Spanish word recognition. They argued that metalinguistic awareness that processes word recognition needed not be language specific. Later on, Cisero and Royer (1995) proposed that evidence for cross-language transfer could be found, but finding it depended on looking at the right skill at the right time in a student's developmental history.

Two results in this study supported the view of cross-language transfer in phonological awareness. First, children were able to handle phonological awareness tests approximately well in their mother tongue, and in English. After articulation training, phonological awareness improvement was found in both English and Chinese. Evidence of transfer especially came from the latter. This can be explained as a transfer from L2 to L1. Backward transfer, or reverse transfer, Su (2001) indicated, is often found in bilinguals who are exposed to the target language environment at an early age or for a long period of time.

We can also explain the improvement found in both L2 and L1 from the perspective of a general improvement in the abstract underlying capacity. What is general underlying capacity going to do with phonological awareness transfer? Cisero & Royer indicated that if there is transfer of phonological awareness skills from a familiar to an unfamiliar language, it would suggest that there is a kind of "abstract cognitive ability" that develops which can facilitate language processing across a variety of languages. Similarly, Durgunoglu *et al.* indicated that once a child is able to reflect on the components of a language, it is likely that this metalinguistic awareness could be applied to an (alphabetic) second language as well. Such metalinguistic awareness needs not to be language specific, since similar types of processing underlie languages. This also suggests an abstract underlying capacity dealing with such processing.

Based on this, the improvement in both L2 and L1 can be explained. After English articulation training, phonological awareness in English improved, as the causal relationship expected. This awareness, part of metalinguistic awareness, is not language specific, as Cisero and Royer, and Durgunoglu *et al.* indicated, and this further suggests the existence of an abstract underlying capacity. Therefore, this improved ability expected in English was also reflected in Chinese. Since the surface awareness abilities improved, it is very likely that the underlying capacity also increased.

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