

Teaching Phonological Awareness Skill to Students with Hearing Impairment: Current Perspectives*

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Abstract

This study deals with the current debate whether teaching phonological awareness skill to the hearing impaired students would be helpful for the reading comprehension. Purpose of this study is to present the theoretical grounds of teaching phonological awareness skill to the hearing impaired students. This study was done by a literature analysis based on a recent cognitive reading mechanism, the dual route cascade model of reading. This research explained why teaching phonological awareness skill to the hearing impaired students would be an effective method to building their reading comprehension.

Key words: phonological awareness, the hearing impaired, dual route cascade model, reading comprehension

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I . Introduction

The hearing impaired have an alarmingly low level of **reading** achievement compared with hearing students and this gap has not been closing (Kyle & Harris, 2006; Traxler, 2000). In the norming studies of the 9th Stanford Achievement Test for Hearing Impaired (SAT-HI), the statistics report states that the reading comprehension skill of 17 and 18 year old hearing impaired students were lower than the 4th year elementary school grade level for hearing students; in addition the 10th SAT-HI result did not show any improvement compared to former reports by the Gallaudet Research Institute. (Gallaudet Research Institute. 2003; Paul, 1998; Traxler, 2000). In addition, the annual reading growth rate for the hearing impaired is about 0.3 grade levels per year (Allen, 1986).

There are many research data showing a relationship between the level of hearing and reading achievement. Hearing status is a substantial factor to explain reading achievement for students with hearing impairment (Kyle & Harris, 2006). Korean statistics are comparable to the American reports. Kim et al, (2002) have reported that 74.6% of the 9th grade students with hearing impairment achieved below the basic academic reading level, compared to 3.1% of the 9th grade students with normal hearing. Kim et al, (2002) reported that 66.7% of hard of hearing students and 78% of deaf students were identified as having failed in basic academic reading skills. Despite their low median performance of reading ability, their achievement shows a varying spectrum. Few students have good achievement scores, but most did poorly on standardized tests.

The cognitive process is enabled by tools of the mind, signs that mediate relations between people. The most important tool of the mind is language due to its communicative functions among people (e.g. Vygotsky, 1986). Cognition makes an important interaction with language, and some cognitive components might have a strong relationship to language, so these might be worked as predictor variables in order to understand written language performance.

A deficit in some cognitive and linguistic processes was reported as a predictor of reading disability. One of the predictor variables was phonological awareness which has strong relationship with the rate of processing. Disabilities related to problems in reading are reported as having a deficit in phonological sensitivity which includes phonological awareness (Schatschneider, Carlson, Francis, Foorman, & Fletcher, 2002; Stanovich & Siegel, 1994; Torgesen, Wegner, Rachotte, Burgess, & Hecht, 1997).

It is generally accepted not only for hearing students but also for hearing impaired students that the reading process is also carried out by means of both a phonological route and an orthographic route (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001). In reading development, acquiring phonological awareness by auditory access is not a mandatory condition but rather one option because the understanding of phonology is a cognitive process and as such it could be taught by the steady efforts of a teacher. There are lots of research studies which present evidence that the hearing impaired students use a phonological awareness skill in the reading process (Perfetti & Sandak, 2000). Geers (2003) stressed that severe to profound hearing impairment early in their development have a better forecast for normal literacy development. The use of a cochlear implant is associated with the phonological coding process for decoding print, longer working memory spans for short-term storage of phonemes, words and sentences and accelerated language development for reading comprehension. Hanson (1989) asserted that the profoundly hearing impaired use a phonological code. The profoundly hearing impaired population show an interrelationship between phonological awareness and reading achievement (Transler, Gombert, & Leybaert, 2001).

Researchers interested in students with hearing impairment are also exploring issues related to accessibility, coding, and the storage of phonological information (e.g., Dyer, MacSweeney, Szczerbinski, Green, & Campbell, 2003; Harris & Moreno, 2004; LaSasso, Crain, & Leybaert, 2003; Musselman, 2003). Currently, while teaching phonological awareness skills with students with

hearing impairment and documenting how to apply those skills in reading and spelling, many teachers of the hearing impaired do not account for accessing phonological information which might have important roles in reading achievement (Trezek & Manngren, 2005). However, Hanson (1989) stated that “phonological units of a language are not sounds, but rather a set of meaningless primitives out of which meaningful units are formed” (see Trezek & Manngren, 2005). Moreover, a student with hearing impairment who is having good reading performance can use phonological information which is the understanding of phoneme-grapheme rules in the alphabetic language, like English and Korean (Hanson, 1989; Hanson & Fowler, 1987).

The current study suggests that the phonological awareness ability or knowledge of phonology is an important variable when comparing the skills of the hearing impaired reader and the average hearing reader (Hanson & Fowler, 1987; Musselman, 2000), and it was possible for students receiving phonology in reading instruction to acquire knowledge of phonic skills and apply this skill to read and accept nonwords from the sentence (Trezek & Manngren, 2005).

Son’s research (2004) resulted that phonological awareness was significantly different between hearing children and hearing impaired children. Phonological awareness score of hearing impaired was significantly different among hearing children, hearing aided children and cochlear implanted children, and there was no difference in syllable structure among the hearing aided children and cochlear implanted children.

Park et al. (2002) researched about phonological awareness abilities of the hearing impaired children. The subjects who participated in the experiment are composed of four hearing impaired children (3 cochlear implanted children and 1 hearing aided child). The subtests consisted of rhyme matching, onset matching I II, word initial segmentation and matching I II. The results show that the phonological awareness of hearing impaired children is different from that of normal children.

These research studies denote that the hearing impaired

student has been tested with a standardized reading assessment tool in reading, but for the accountability issues, tested by the CBM, with proper reliability and validity in a general education class. The purpose of this study is to find the underlying contribution that phonological awareness make to the reading achievement of the students with hearing impairment and low achieving students.

This study tries to review the phonological awareness studies of the hearing impaired students which may affect key roles in reading comprehension among the many related skills.

II. The Cognitive Reading Mechanism

The Dual Route Cascade Model and Implications of the Reading Problem

Reading is a composite cognitive process of decoding symbols for the intention of deriving meaning and constructing meaning. It is the mastery of basic cognitive processes to the point where they are automatic so that attention is freed for the analysis of meaning. Reading is a complex interaction between the text and the reader which is shaped by the readers' prior knowledge, experiences, attitude, and language community which is culturally and socially situated. The reading process requires continuous practices, development, and refinement.

According to the Dual route cascade model (Coltheart, Rastle, Perry, Landon, & Ziegler, 2001), reading recognition processing is accomplished by means of two distinct but interactive procedures that are referred to as the lexical and non-lexical routes. Actually Dual route cascade model consists of three routes, the lexical semantic route, the lexical non-semantic route, and the graphic phoneme conversion route. Each of the routes exhibit two ways in which the units of the different layers interact. Dual route cascade models can be utilized to explain information processing for reading (reviewed from Coltheart, Rastle, Perry, Landon, & Ziegler, 2001).

The overall architecture of the Dual route model is illustrated in Figure 1.

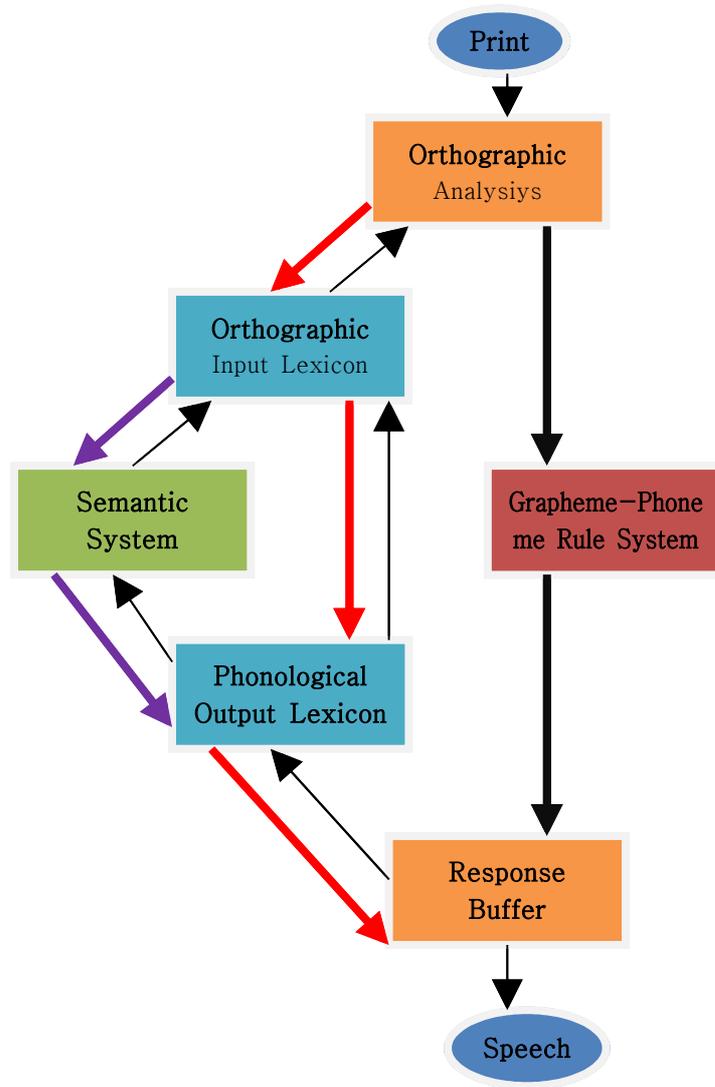


Figure 1. Basic Architecture of the dual-route cascaded model of visual word recognition and reading aloud. From DRC: A Dual Route Cascaded Model of Visual Word Recognition and Reading Aloud by Coltheart, Rastle, Perry, Landon, & Ziegler, 2001, p. 213.

Coltheart, Rastle, Perry, Landon, & Ziegler (2001) explained that reading by the lexical route relies on the activation of word-specific orthographic and phonological memory representations. The lexical route (orthographic lexicon) can process all familiar words, regardless of whether they are regular or irregular in terms of their letter-sound relationships, but it fails with unfamiliar words or non-words because these items do not have lexical representations. Only the lexical route can deliver a correct response to irregular words, whereas the integrity of the non-lexical route is essential for accurate reading/spelling of non-words. Wolf & Bowers (1999) have asserted that the deficit of the RAN subtest represents an orthographical deficit. Because reading disability could not be explained by the phonological problem they assumed that lexical asymmetry would have a problem, and children who have an asymmetry of phonological and orthographic skills can be defined as having reading disabilities (Stanovich & Siegel, 1994).

Molfese (2000) argued that newborns and 6-month olds with a familial risk for dyslexia have reduced sensitivity to speech and non-speech sounds. In addition, Manis & Keating (2005) asserted that children with reading disabilities are impaired from birth in auditory processing or, more specifically, in speech perception, this would affect the development and use of phonological representations on a wide variety of tasks.

McBride-Chang (1996) reported structural equation analyses indicating that speech perception was not directly related to word recognition among third graders. Instead phoneme awareness acted as a mediator for the relationship of speech perception and word reading. Phonological process deficit may have a problem in lexical access.

Poor perception of the phoneme might impede the development of phoneme awareness, which interfered with early word decoding and word reading development. Manis et al. (1997) found that 10-14 year old dyslexic children tested showed low phoneme awareness in word recognition, but about half of the dyslexics were in the normal range for chronological age on

a measure of phoneme awareness.

Auditory perceptual skill has been a key factor of reading ability. Kavale (1981) undertook a meta-analysis concerning the relationship of auditory perceptual skills to reading ability from 106 studies. A total of 723 correlation coefficients were collected and aggregated across five auditory perceptual skills, five reading achievement variables, three grade levels, and three subject characteristics. The findings indicate that auditory perception is an important correlate of reading ability with the proportion of explained variance in reading achievement depending on the combination of auditory and reading variables considered.

Hearing impaired students also have a problem in phonological processing. Since the hearing impaired problem in reading appears to be derived out of phonological sensitivity and phonological processing, it would seem reasonable to infer that hearing impaired students and low achieving readers may have a common problem in phonological awareness.

Many researchers have reported a problem of reading achievement for hearing impaired students, but there are only a few studies that attempt to explain the rationale or reasons behind such a problem. Especially the outcome of reading comprehension may have many different reasons that are complicated by psychological and social issues. Reading should be taught through systematic, organized instruction. Reading is a skill which is built upon through stages and is an ongoing process. If a stage of reading development has not been learned, students will flounder in their reading ability.

Chall(1991) presented five stages of reading development, as follows:

Stage 0 Pre-reading Stage: Unsystematic accumulation of understandings about reading between pre-school and kindergarten.

Stage 1 Initial Reading or Decoding Stage (grades 1-2; Ages 6-7): Student's central task is learning arbitrary

letters and associating them with corresponding parts of spoken words. Learner acquires knowledge about reading. Phonics.

- Stage 2 Confirmation, Fluency, Ungluing from Print, Automaticity Stage (grades 2-3; Ages 7-8): Consolidation of what was learned in Stage 1 which requires reading many easy and familiar books for developmental reading.
- Stage 3 Reading for Learning the New Stage: A First Step (Grades 4-8; ages 9-13); Readers need to bring prior knowledge to their reading. Children acquire facts.
- Stage 4 Multiple Viewpoints Stage: (High School; Ages 14-18): Reader should include instruction in reading/study skills, and reading strategies for success.
- Stage 5 Construction & Reconstruction Stage: (College ; Ages 18 & up)

III. The Phonological Awareness Contribution to the Hearing Impairer's Reading

Phonological awareness is essential for reading development in hearing children, and phonological awareness consecutively develops at syllable, rhyme, and phoneme levels (Sterne, & Goswami, 2002). According to this study phonological contribution of reading comprehension from the results of the experiments. First, the syllable awareness of hearing impaired students can be equivalent to that of chronological age-matched hearing control students. Second, the ability of hearing impaired students to make rhyme judgments can be above chance, but poorer than that of younger reading-matched hearing control students. Third, skillful students with hearing impairment can phonologically recode nonsense words, and store it to the lexical information as a auditory image with part of visual information.

In the study of Dyer, et al. (2003), phonological awareness task performance at levels of chance resulted in hearing impaired

students making scores that were correct 73% of the time in rhyme scores and the phonological awareness task. In addition, in a decoding task, students with hearing impairment had an average 64% of accuracy. Although they performed significantly worse than the hearing reading age control students, hearing impaired students performed significantly better than chance. Phonological awareness and decoding correlates with hearing impaired students' reading skills, and reading delays are negatively related to those skills. The study showed that hearing impaired students can also use phonological structure as a predictor of their writing abilities.

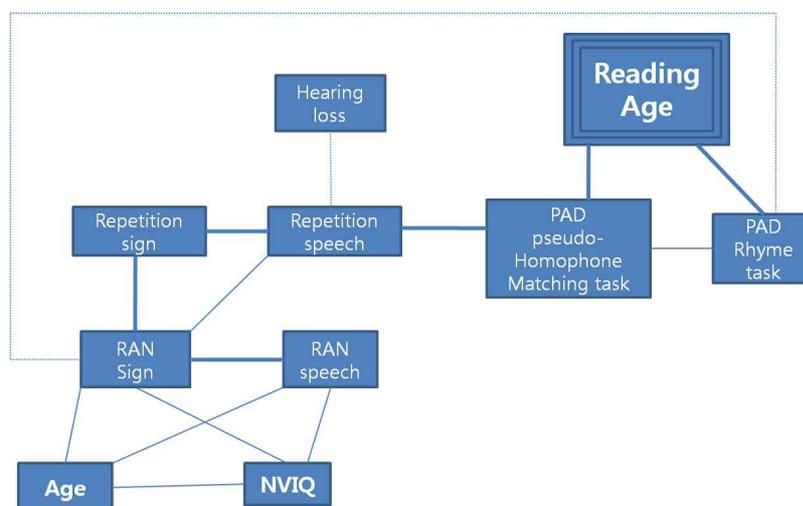


Figure 2. Predictors of Reading Delay in Deaf Adolescents: From The relative Contributions of Rapid Automatized Naming speed and Phonological Awareness and Decoding Dyer, Szczerbinski, MAcSweeney, & Green (2003)

* Positive correlation—solid lines

** Negative correlations—dotted lines

Although ample research papers report that developing phonological awareness may have an impact on reading ability, in the case of hearing impaired students, researchers are divided in their opinions on whether or not hearing impaired students

can use phonological awareness skills. It is a controversial issue, because this question is based on the presumption of whether teaching phonological awareness skills to hearing impaired children will have a positive effect on their reading ability.

Transler, Gombert, & Leybaert (2001) examined 26 hearing impaired students (8 years 11 months to 13 years 6 months). They looked to see whether phonological decoding would be observed among children with severe and profound hearing loss. They used word likeness and syllabication tasks, and divided their study by three conditions: 1) homophone condition, 2) open-closed condition, and 3) nasalization condition. In the ANOVA test result, they inferred that hearing impaired children used phonological decoding processes at a sub-lexical level to read the items and then to solve the experimental tasks. However, poor speech skills did not reveal any clear relationship with phonological awareness skills.

Olsen, Tassel, and Speaks (1997) evaluated relations among scores for phonemes, words in isolation and words in sentences for 876 listeners with sensorineural hearing losses, with ages ranging from 15 to 65 years old. They examined participants with ten-word lists of consonant-vowel-consonant monosyllables. Each list utilized the same 10 vowels and 20 consonants and were separated and recorded. This research found that speech recognition is a single construct; therefore, scores on all speech recognition tests should be predictive of scores on other tests, and phoneme scores are reasonably accurate predictors of recognition for hearing impaired participants. At the same time, these finding implicate that phonological awareness test in phoneme level can be work as a tool for hearing impaired students in general education class. Although the hearing impaired students had a trouble in hearing, testing phonological awareness to the hearing impaired students is a reasonable approach to the evaluate phoneme awareness.

Table 1 presents recent studies on the phonological awareness for the hearing impaired.

Table 1. Population and methods of recent research studies

Research	Participants	Method
Dyer et al. (2002)	72 students with hearing impairment, (above 70dB), 81 hearing control group	Group Reading Test (NFER-GRT) Non-verbal IQ (NVIQ)
Trachenberg (2002).	Students with Reading disabilities & Students with profound hearing impairment, and normal hearing achievement	Reading rate and comprehension: revised textbook of fifth grade On line Digit Span: Verbal short-term memory- created typical digit span. Corsi Block Tapping Tack : Visuo-spatial memory(VS_STM) Written naming and segmentation task. compiled for test Working memory span
Transler, Gombert & Leybaert, (2001).	26 students with hearing impairment, 11m, 15 fm	Homophone condition Open- closed syllable condition Nasalization condition Control tasks: Word-likeness
Allman, (2002).	students with hearing impairment (kinder 5, first grade 5), vs 34 hearing control students	Error analysis. Phonological awareness tests Spelling was qualitatively analyzed for patterns.
Beech & Harris, (1997)..	Signed English 16 oral reading at same level hearing control group 36 children; 6-8 years old.	One lexical decision task in word reading Homophone judgment
Izzo, (2002).	29 residential school students with hearing impairment, 4 - 13 years old	Interview data: + DRA 1. word to word matching task 2. Story-retelling task for reading comprehension

Trachenberg (2002) examined hypotheses about phonological awareness in memory and reading achievement. This research attempted to replicate findings of both verbal and visuospatial

immediate memory deficits in adults with reading disabilities and others who were hearing impaired. Differences were found between reading disability and the hearing impaired participants. This study argued that the hearing impaired have a reading problem not derived from deficits in memory. Also, the research suggested that both processes were dependent on memory, and that phonological awareness may contribute to determining reading achievement.

With regard to orthographic representations and their connections, no reported studies have explored RAN as a possible correlate of reading delay in hearing impaired readers. RAN may relate to reading in deaf readers the question remains as to the question remains as to whether it plays any role in relation to their phonological awareness abilities or is independent of them (Dyer, Szczerbinski, MacSweeney, & Campbell, 2003).

Lichtenstein (1998) investigated hearing impaired college students whose reading achievement levels were higher than those reported for typical prelingual hearing impaired students. He reported that his subjects typically used two or more codes rather than just one exclusively. The most commonly used codes were sign and speech (phonological code); however, good readers have the tendency to use phonological coding. This research presented advantages of phonological coding as a correspondence to the English syntactic structure because phonological coding permitted short-term retention. Unequivocally recognized as a critical dimension for reading success with hearing students, phonological awareness skills are now receiving more attention for students with hearing impairment (Narr, 2006). However, the problem whether teaching phonological awareness skills to the hearing impaired would in fact be effective needs a very conservative approach to be proven.

The functions of recoding processes can be divided into two functions that inner speech coding can serve: a lexical access function and a working memory storage function (Baron, 1973; Baddeley, 1979; Massaro, 1979). That is, semantic information in long-term memory that is associated with individual lexical items

can be accessed through orthographic, visually obtained information. Inner speech coding processes play an important role in the storage of sequential information necessary for the comprehension of more complex linguistic materials (Hardyck & Petrinovich, 1970). Decoding processes are more important for comprehending difficult or unfamiliar materials, and more necessary when word-order information is crucial for comprehension or when concepts must be combined in proper semantic relationships (Baddeley, Eldridge, and Lewis, 1981).

Analyzing error pattern of phonological awareness test might show pre-reading difference between reading disability and the students with hearing impairment. Hearing impaired subjects made errors in similar amounts to the hearing readers, but their error patterns indicate that they might be using phonological information in a different way from the hearing readers (Tractenberg, 2002). This phenomenon shows that using phonological awareness skills in reading is not only a possible skill to use but also a necessary one for their reading performance. If students who have greater understanding of phonology, or of how students with hearing impaired readers apply their knowledge, and sometimes allows hearing impaired readers to surpass the norm of disabled readers (Tractenberg, 2002).

IV. Discussion and Conclusion

A student with hearing impairment may use visual code; dactylic (fingerspelling) code, signs code, and speech-based codes (reviews of Lichtenstein, 1998). For the pre-lingual hearing impaired reader, recent research has suggested that phonological codes of hearing impaired might be possible and effective route to may serve to provide phonological information useful for lexical access. Teaching phonological awareness skills to the hearing impaired needs plenty of effort and time in the early age. The hearing impaired use inner code when they decode nonwords in reading (Leybaert, 1993). Inner speech coding is a

process by which the reader transforms the printed information to some kind of speech-based code, possibly an articulatory code (Baddeley and Hitch, 1974) which is concerted speech or more abstract motor programs for hearing persons including auditory imagery. When normal silent reading has shown that inner speech and inner hearing in verbal memory, the hearing impaired can use inner speech through possible coding strategies (lip-reading, sign, finger-spelling).

It would be not very useful for maintaining information in working memory if the hearing impaired students have no phonological code. However phonological awareness still has a priority in the decoding process of reading mechanism. For the hearing impaired students, a more serious problem is the growing uncertainty in decoded information. Especially unfamiliar words for the hearing impaired students or foreign words might be hard to decode by visual code because the hearing impaired students are highly vulnerable to miss important code of the reading, so without fundamental coding skill of the language.

Relevant factors for reading achievement are varying according to the reading level of hearing impaired students. However, finding principal factors that explain reading achievement of the students with hearing impairment can be used as an evaluation tool for evidence based practice processes. Many research studies have presented supporting evidence of effectiveness of teaching phonological awareness skill for the hearing impaired students. Teaching phonological awareness is still important issue for the hearing impaired students. However we need to review the effectiveness of the teaching phonological awareness skill respect to coding features of hearing impaired students.

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