INTERNATIONAL ACADEMIC RESEARCH JOURNAL

ISSN :2289-8441

International Academic Research Journal of Social Science

Journal homepage: www.iarjournal.com

Systematic Phonics Intervention and its impact on the Development of Phonics Skills and Speech Perception among Children with Hearing Loss using Spoken Language

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Article Information

Keywords
Phonics, intervention, phonological awareness, speech perception, hearing loss

Abstract

Literacy studies on children with hearing loss suggest possible benefits of systematic phonics instruction focusing on automatic recall of visual patterns and auditory-visual memory of sounds /letters. Few studies have looked at the impact of phonics in developing various speech-language skills among children with hearing loss who use spoken language. It was hypothesized that intensive phonics intervention would lead to better phonics skills among participants and that such phonics training would lead to better speech perception levels. The findings of the study indicated positive results in the development of practical phonics skills based on the THRASS© programme. However, a mixed result was evident for speech perception following the implementation of ten weeks of intervention. Poor long-term retention of the acquired skills at post-intervention suggests a need for a prolonged period of intervention to show any significant change. The heterogeneity of hearing levels among participants and the stringency of methods for speech perception analysis may have also contributed to the differing results across speech perception measures. Data suggests that improvements varied across the whole range of micro skills with overall speech perception and vowel perception skills lagging behind word and consonant perception skills despite improvements in phonics skills.

INTRODUCTION

The acquisition of spoken language for children with hearing loss is affected by auditory deprivation in the early years (Brown & Carey-Sargeant, 2001) which makes language learning a conscious effort among children with hearing loss (Fowler, 1991). On the other hand, literacy skills have been shown to be closely linked to speech perception and speech production skills (Geers, 2003; Goldin-Meadow & Mayberry, 2001; Leitao, Fletcher, & Hogben, 2000; Paatsch, Blamey, & Sarant, 2001) and that advanced sensory devices (Geers, 2004; Geers, 2007) and intensive intervention using phonics could help improve literacy skills among hearing children with reading difficulties (Chall, 1983; Simos, 2001; Oudeans, 2003). Phonics links print to speech by creating an environment for better phonological awareness necessary for literacy acquisition (Leybaert, 2000). However, little research has been done to verify the role of phonics in the speech perception of children with hearing loss.

There is a limited number of published intervention studies which specifically investigate the impact of phonics intervention on children with hearing loss who use spoken language. Most studies in this area describe the broad relationship between phonological awareness, and reading and writing skills. Only a limited number of studies (Schirmer & McGough, 2005; Wang, Trezek, Luckner & Paul, 2008) specifically address the topic of phonics instruction or intervention and its relation to hearing loss. Several meta-analytic studies (Schimmel, Edwards, & Pricket, 1999; Luckner, Sebald, Cooney, Young, & Muir, 2005/2006) have been conducted to examine the range of studies in the areas of literacy and deafness.

Luckner et al. in particular noted that out of the 964 studies in literacy and deafness, only 22 were scientifically-based inclusion studies with none meeting the criteria of phonics intervention in the true sense of the word. It was suggested that the paucity of research in phonics intervention for children with hearing loss could be due to the longstanding perception that children with hearing loss have limited access to English phonology and often are language delayed (Kyle & Harris, 2006). More studies are needed to further explain and demonstrate the potential role of phonics in bridging this gap. Children with hearing loss also tend to consistently lag four to five years behind hearing children in written English language skills (Clendon, Flynn, & Coombes, 2003), a phenomenon which has been documented extensively in the literature for over 90 years (Wang et al., 2008). There have been recent studies which suggest that good grapheme-phoneme knowledge can be developed despite lack of phonological awareness skills during the process of learning to read (Gravenstede, 2009).

The general aim of the study was to measure the effectiveness of a phonics intervention programme for children with hearing loss who use spoken language. Specifically, the study seeks to examine the impact of phonics intervention on the development of phonics skills and speech perception. In relation to these specific aims, two operational hypotheses were generated. Firstly, it was hypothesised that there would be an increase in overall phonic skills, word recognition, grapheme identification (vowels and consonants) and phonographic skills scores between Time 2 (pre-intervention) and Time 3 (post-intervention). Secondly, it was hypothesised that there would be an increase in speech perception (SPC) scores (i.e. word perception, vowel perception and consonant perception scores) between Time 2 and Time 3, while no increase in scores were expected between Time 1 and Time 2, and Time 3 and Time 4.

METHOD

Participants

Participants were 18 children (9 male, 9 female) with severe to profound hearing loss from three schools in Victoria, Australia (7 with cochlear implants, 8 with hearing aids, and 3 with both a cochlear implant and a hearing aid). The mean age of participants was 9 years. The mean age at first diagnosis of deafness was 13 months and for cochlear implant or hearing aid fitting was 25 months. English is the first language for all children. Participants were referred by their Teachers-of-the-Deaf (TODs) for observed difficulties in literacy, written and/or spoken language. All participants were attending mainstream education with individual support provided in their school's oral deaf facility. The school reports show that all children had normal oral physiology and cognitive development but experienced some language delay in their early years.

Intervention and Assessments

The study employed materials and techniques from THRASS© (Teaching Handwriting Reading & Spelling Skills) (Davies & Ritchie, 2003), a structured, systematic, and multi-sensory programme involving visual, auditory and kinaesthetic modalities. The three core skills of literacy taught were writing, reading, and spelling. THRASS also incorporates articulatory correction and emphasises exemplary teacher modelling when demonstrating segmentation, blending, and analysis of THRASS keywords to develop better understanding of correct letter-sound relationships. All 44 phonemes and 120 common graphemes were taught to students to develop automatic recall and enhance auditory-visual memory. The materials used during the course of intervention includes the THRASS picture chart, grapheme chart, IPA chart, boardgame, cut-out picture cards, worksheets, Rap & Tap video, Raps & Sequences CD, THRASS Phoneme Machine and THRASS-IT software. The tool strongly incorporates visual, auditory, articulatory and kinaesthetic elements which promote better phonological awareness among children with hearing loss. Speech perception (SPC) performance was measured using the CNC (Consonant-Nucleus-Consonant) word lists (Hearworks, 2000). THRASS phonics was implemented intensively during a 10-week intervention period. Volunteer TODs taught the THRASS method in 30 lessons (30 minutes x 3 sessions weekly) and attended fortnightly meetings for the coordination of instructional methods and resource handling. Data was collected at four points separated by 10-week intervals i.e. before the programme (Time 1-T1), following the first period of no-intervention (Time 2-T2), immediately after a 10-week intervention (Time 3-T3), and after the second period of no-intervention (Time 4- T4) to gauge retention levels. Phonics skills were measured using THRASS word recognition, grapheme and phonographic tests. SPC skills were analysed using four different lists from the CNC word lists (CNC, Hearworks, 2000) tests.

RESULTS AND DISCUSSION

Phonics skills

THRASS tests were administered to assess phonics skills at T2 and T3. It was hypothesised that there would be improvements in phonics skills across all test components. Results showed significant increases in the students' ability to develop phonics skills based on paired-samples t-test analysis of the test components. Specifically at T3 (post-intervention), all 18 children had improved their overall phonics skills with gains made in all areas of phonographic awareness skills assessed. A t-test for dependent samples showed statistically significant difference for overall phonics performance (t = -6.465, df = 17, p = .000 [1-tailed]), word recognition skills (t = -3.770, df = 17, p =.002 [1-tailed]) and overall grapheme identification (t = 3.715, df = 17, p = .002 [1-tailed]). The consonant grapheme scores did not show statistically significant difference (t = -2.854, df = 17, p = .011 [1-tailed]) as compared to vowel grapheme scores (t = -4.185, df = 17, p = .001 [1-tailed]). A similar test was conducted for phonographic awareness with overall phonographic awareness (t = -8.817, df = 17, p = .000 [1-tailed]), spelling (t = -5.340, df = 17, p = .000 [1-tailed]), and phonemic awareness (t = -8.562, df = 17, p = .000 [1-tailed]) all showing statistically significant difference in scores.

The THRASS phonics test results suggest that the participants responded well to the intervention and improved their ability to segment phonemes, distinguish various grapheme patterns, and differentiate between a vowel and consonant phoneme within just 10 weeks of systematic phonics instruction. The results also suggest that children with hearing loss using spoken language could engage in bottom-up processing of sounds in words, providing support for the points by Geers (2003), Geers (2004), and Geers (2007) that advanced sensory devices such as cochlear implants and digital hearing aids makes it possible for hearing-impaired children to be better equipped at bottom-up processing of speech sounds, reading-related skills and spoken language. Similarly, positive outcomes like reading and spelling improvement could be expected as a result of improved phonics skills (Paul, 2009). The students' improvement in word recognition and spelling performance scores in particular was consistent with findings from Chall (1983) who reported that systematic phonics overwhelmingly produced better word recognition and spelling and that the establishment of sound-letter mapping is necessary for decoding and encoding print (Hempenstall, 2002; Oudeans, 2003). It was also evident in this study that more accurate phonological representations and phoneme-grapheme correspondences were generated as a result of intensive exposure to various spelling patterns and storing of those patterns in visual memory, based on the results of students' phonographic awareness test across all of its test components (spelling and phonemic awareness). It was also interesting to note that during test sessions, the students were observed to be silently segmenting phonemes prior to providing their responses. It appeared that the visual component of the THRASS chart may have facilitated the children in making connections between graphemes and phonemes, as well as their perception and production. Results for phonics skills also suggest that intensive phonics intervention using a systematic programme such as THRASS is a potentially viable tool that may have wider benefits for children with hearing loss who face difficulties in many areas of speech, reading, and language.

Speech perception (SPC)

It was also hypothesised that there would be improvements in SPC between T2 and T3 (intervention period) and no improvements between T1 and T2, and T3 and T4 (no-intervention period). We administered CNC word list 103 for T1, list 108 for T2, list 104 for T3 and list 110 for T4 to measure SPC performance. Each CNC word list contains 50 consonant-vowel-consonant monosyllabic words which were phonetically balanced. Scores for word, vowel and consonant perception were drawn from T1 to T4. Results of the Repeated Measures Analysis of Variance (RM ANOVA) showed no significant time effect for overall SPC scores (F (1.925, 32.728) = 2.315, p = .116 [2-tailed]), and vowel perception scores (F (3, 51) = 1.009, p = .397 [2-tailed]). However, significant time effects were found for word perception scores (F (3, 51) = 5.533, p = .002 [2-tailed]) and consonant perception scores (F (3, 51) = 4.828, p = .005 [2-tailed]).

Significant evidence was found relating to students' potential in developing word and consonant phoneme perception during the intervention period as indicated by a large effect size for the two variables. However, the overall phoneme perception scores were not significantly different suggesting that this might be due to the lack of significant change in the vowel perception scores. Another factor could be that the participants of this study were heterogenous in their hearing loss level, ranging from mild to profound. The average hearing loss determines the degree of hearing loss that is present and this affects speech perception in different ways (see Northern & Downs, 2002; Ruscello, 2008). In relation to phonics intervention, the statistically significant increase in the scores for word perception may indicate the extent to which children were able to process all phonemes within a word without visual cues as observed in their performance using a series of auditory alone tests (CNC word lists). The performance may also be attributed to the students' improved ability to perceive consonant phonemes which appear at the beginning and end of words in the CNC word lists, making the test stimuli more acoustically salient for the listener Boothroyd, 1995; Boothroyd, 1997; Boothroyd & Eran, 1994). As for non-significant increase of vowel perception scores, the students were generally already performing at a close-to-ceiling level and therefore had less room to show any significant improvement as a group. In addition, vowels are more subject to variability in their production among individuals with or without hearing loss and therefore more vulnerable when subjected to narrow phonemic transcription than consonants. As the CNC word lists are typically analysed using broad or general phonetic transcription, the variability in the scores for vowel perception in this study may have been affected by a more stringent scoring system. It is also important to note that for speech perception to be improved significantly, a longer duration of intervention may be required for children with hearing loss.

Pairwise comparisons for students' performance between T2 to T3 in relation to phonics intervention, and between T1 and T2, T2 and T3, and T3 and T4 for speech perception scores are summarised as group differences in Table 1.

TABLE 1
SUMMARY OF SIGNIFICANT GROUP DIFFERENCES FOR PHONICS SKILLS AND SPEECH PERCEPTION

Test Components	**T1-T2 (No-Intervention)**	**T2-T3 (Intervention)**	**T3-T4 (No-Intervention)**
Phonics Skills (THRASS)			
Overall Phonics Skills	NA	SI	NA
Word recognition	NA	SI	NA
Overall Grapheme	NA	SI	NA
Grapheme (Consonant)	NA	NS	NA
Grapheme (Vowel)	NA	NS	NA
Overall Phonographic Awareness	NA	SI	NA
Phonographic Awareness (Spelling)	NA	SI	NA
Phonographic Awareness (Phonemic awareness)	NA	SI	NA
Speech Perception (CNC)			
Overall Speech Perception	NS	NS	NS
Word	NS	SI	NS
Vowel	NS	NS	NS
Consonant	SD	SI	NS
Note: Significant increase (SI), Significant decrease (SD), Not significant (NS), NA (Not applicable)			

CONCLUSION

The study provides valuable evidence-based data to the body of knowledge, demonstrating that positive effects from intensive phonics intervention can be achieved by children with hearing loss in particular. The study suggests that intensive phonics skills can be developed successfully among children with hearing loss with a potential for multiple benefits. However, the intervention should be prolonged and tailored towards the needs of individual children to promote further improvement in SPC. A deeper analysis involving close phonemic examination of the actual spoken and written data of participants could possibly illustrate specific changes in phoneme perception and production over the period of study which is usually overlooked in conventional tests focussing on group performance. This could provide a better insight into the individual performance results of the study and explain reasons for mixed findings. This was a complex study requiring managing logistics between various sites for study, coordinating teacher training for implementation of intervention lessons within the experimental time frame, and a tight schedule for the administering of a series of tests on participants during school hours. Given more time and resources, the study should be able to incorporate a wider range of tests to explain the impact of phonics on other areas of speech, reading, and language. Finally, a closer investigation into why certain skills are more retained than others should contribute towards further improvement of phonics intervention design in the future.

ACKNOWLEDGMENT

The authors wish to thank the parents and children from Rosanna Golf Links Primary, Mountview Primary & St. Albans East Primary for their participation. This research would not be possible without the dedication and enthusiasm of the teachers who successfully implemented THRASS for the project and to their facility coordinators for their support and coordination during data collection within their respective schools. Special thanks also to THRASS Australia for the training & support from which the intervention was based upon. This study was partially supported by Melbourne Research & Innovation Institute (MERI) of the University of Melbourne for the funding of THRASS professional development and intervention materials.

REFERENCES

Brown, P. M., & Carey-Sargeant, C. (2001). Assessing early spoken language interaction between a hearing mother and an infant with profound hearing loss. *Deafness and Education International, 3*(2).

Boothroyd, A. (1995). Speech perception tests and hearing-impaired children. In G. Plant & K.E. Spens (Eds.), *Profound deafness and speech communication* (pp. 345-372). London: Whurr Publishers Ltd.

Boothroyd, A. (1997). Auditory capacity of hearing-impaired children using hearing aids and cochlear implants: Issues of efficacy and assessment. *Scandinavian Audiology,* 26 [Supplement], 17.25.

Boothroyd, A., & Eran, O. (1994). Auditory speech perception capacity of child implant users expressed as equivalent hearing loss. *The Volta Review,* 95(5), 151-169.

Chall, J.S. (1983). *Learning to read: The great debate* (Second ed.). New York: McGraw-Hill.

Clendon, S., Flynn, M., & Coombes, T. (2003). Facilitating speech and language development in children with cochlear implants using computer technology. *Cochlear Implants International, 4*(3), 119-136.

Davies, A., & Ritchie, D. (2003). Teaching THRASS. Osborne Park: THRASS (Australia) Pty. Ltd.

Dodd, B., Holm, A., Oerlemans, M., & McCormick, M. (1996). Queensland University Inventory of Literacy (QUIL) [Test Kit]: Department of Speech Pathology & Audiology, the University of Queensland.

Fowler, A. E. (1991). How early phonological development might set the stage for phoneme awareness. In S. S. Brady & D. P. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman*. Hillsdale, New Jersey: LEA.

Geers, A. E. (2003). Predictors of reading skill development in children with early cochlear implantation. *Ear & Hearing, 24,* 59S-68S.

Geers, A. E. (2004). Speech, language, and reading skills after early cochlear implantation. *Ear and Hearing,* (24(1), 59S-68S., 30 October - 2 November

Geers, A. E. (2004). Cochlear implants and oral education: Spoken language outcomes expected at the end preschool years. *Paper presented at the 6th Asia Pacific Symposium on Cochlear Implants and Related Sciences, 30 October - 2 November 2007, Sydney Convention and Exhibition Centre, Sydney, Australia.*

Goldin-Meadow, S., & Mayberry, R. I. (2001). How do profoundly deaf children learn to read? *Learning Disabilities Research & Practice, 16*(4), 222-229.

Gravenstede, L. (2009) Phonological awareness and decoding skills in deaf adolescents. Deafness and Education International, 11 (4), 171-190.

Harris, M., & Beech, J. R. (1998). Implicit phonological awareness and early reading development in prelingually deaf children. *Journal of Deaf Studies and Deaf Education, 3*(3), 205-215.

Hempenstall, K.J. (2002). Phonological processing and phonics. *Australian Journal of Learning Disabilities,* 7(1), 4-28.

Hearworks. (2000). CNC Word Lists 101-110 [Audio CD-ROM]. Melbourne: CRC for Cochlear Implant and Hearing Aid Innovation, Bionic Ear Institute, the University of Melbourne, Melbourne, Victoria, Australia.

Kyle, F.E., & Harris, M (2006). Concurrent correlates and predictors of reading and spelling achievement in deaf and hearing school children. Journal of Deaf Studies and Deaf Education, 11(3), 273-288.

Leitao, S., Fletcher, J., & Hogben, J. (2000). Speech impairment and literacy difficulties: Underlying links. *The Australian Education and Developmental Psychologist, 17*(1), 63-75.

Leybaert, J. (2000). Phonology acquired through the eyes and spelling in deaf children. *Journal of Experimental Child Psychology, 75*, 291-318.

Luckner, J.L., Sebald, A.N., Cooney, J., Young, J., & Muir, S. (2005/2006). An examination of the evidence-based literacy research in deaf education. *American Annals of the Deaf,* 150(5), 443-456.

Luetke-Stahlman, B., & Nielsen, D. C. (2003). The Contribution of Phonological Awareness and Receptive and Expressive English to the Reading Ability of Deaf Students with Varying Degrees of Exposure to Accurate English. *Journal of Deaf Studies and Deaf Education, 8*(4).

Northern, J.L., & Downs, M.P. (2002). *Hearing in Children* (Fifth ed.), Philadelphia: Lippincott Williams & Wilkins.

Oudeans, M. K. (2003). Integration of letter-sound correspondences and phonological awareness skills of blending and segmenting: A pilot study examining the effects of instructional sequence on word reading for kindergarten children with low phonological awareness. *Learning Disability Quarterly, 26*(4), 258-279.

Paatsch, L., Blamey, P. J., & Sarant, J. Z. (2001). Effects of articulation training on the production of trained and untrained phonemes in conversations and formal tests. *Journal of Deaf Studies and Deaf Education, 6*(1), 32-42.

Paul, P.V. (2009). *Language and deafness* (Fourth ed.). Sudbury, Massachusetts: Jones and Bartlett Publishers, LLC.

Ruscello, D. M. (2008). *Treating articulation and phonological disorders in children.* St. Louis, Missouri: Mosby, Inc.

Schimmel, C.S., Edwards, S.G., & Prickett, H.T. (1999). Reading?.. Pah! (I got it). *American Annals of the Deaf,* 144(4), 298-308.

Schirmer, B.R., & McGough, S.M. (2005). Teaching reading to children who are deaf: Do the conclusions of the National Reading Panel apply? Review of Educational Research, 75(1), 83-117.

Simos. (2001). Dyslexia-specific brain activation profile becomes normal following succesful remedial training. *NEUROLOGY* (58), 1203-1213.

Wang, Y., Trezek, B.J., Luckner, J.L., & Paul, P.V. (2008). The role of phonology and phonologically related skills in reading instruction for students who are deaf or hard of hearing. *American Annals of the Deaf,* 153(4), 396-407.