Teaching Children with Hearing Loss in Reading Recovery

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ABSTRACT

This study quantitatively analyzed the structure of Reading Recovery lessons for children with hearing loss by examining and comparing the supportive interactions of three Reading Recovery teachers of 12 children with hearing loss and three Reading Recovery teachers of 12 hearing children. All of the children were in the second year of primary school and were having difficulties with literacy learning.

Codes were developed to represent the teacher interactions, categories of teaching focus, and teaching events that occur during Reading Recovery lessons. For each child, videotaped lessons from the third, middle and final weeks of Reading Recovery were coded, and the resulting data (types and numbers of teacher interactions, number of instances, and time spent on four categories of teaching focus and numbers of each type of teaching event) were analyzed and compared.

Reading Recovery was shown to be a successful literacy intervention for the children with hearing loss in this study. Although the teachers of the children with hearing loss used teaching procedures similar to those used with the hearing children, they also used different communication behaviors and additional supportive techniques. Like the teachers of the hearing children, the teachers of the children with hearing loss successfully taught the children how to use strategic activities necessary for message construction. The teachers of the deaf also supported the children through brief instructional detours focusing on world knowledge and language throughout the time spent reading and writing. The nature of these teaching interactions has implications not only for Reading Recovery, but also for the literacy teaching of all children with hearing loss in the early years of schooling.

INTRODUCTION

Background to the Study

There are a number of intervention programs that have assisted hearing children with reading difficulties worldwide. Some of these offer one-to-one assistance and others are group interventions. Reading Recovery is a one-to-one intervention designed to accelerate literacy learning of children identified as *at risk* in the second year of primary school (first grade).

The first author, who at the time was a Reading Recovery tutor (teacher leader), was approached in 1995 by the principal (superintendent) of a school for profoundly deaf children. The principal was concerned about the number of children who had lack of success with literacy learning. Consequently, in 1996, the first author trained the first teacher of the deaf as a Reading Recovery teacher in Victoria, Australia. Seven teachers of the deaf subsequently trained with other tutors, with ongoing input including school visits from the first author. Three of those teachers, including one who was trained by the first author, participated in this research project.

Although these teachers were using the lesson structure of Reading Recovery, it appeared that they had modified some of the Reading Recovery teaching procedures in response to particular needs arising from the children's deafness. In an attempt to identify any differences, a study was undertaken to investigate three questions related to Reading Recovery and the literacy progress of a group of children with hearing loss:

1. Can the literacy achievement of children with hearing loss and who are experiencing literacy-learning difficulties be improved by implementing Reading Recovery?

2. How will teachers of the children with hearing loss use Reading Recovery teaching procedures?

3. Is the application of the literacy processing theory used as Reading Recovery in hearing contexts the same or different in contexts for children with hearing loss?

The exploration of the first question has been reported elsewhere (Charlesworth, Charlesworth, Raban, & Rickards, 2006). This paper focuses on the last two questions.

Children with Hearing Loss Learning to Read and Write

Learning to read has been found to be a difficult process for many young children with hearing loss, and there have been many research reports over the past 80 years showing that a large percentage of children with hearing loss typically read at significantly lower levels than their hearing peers (McAnally,

Rose, & Quigley, 1999). In fact, the average reading level for a deaf American high school graduate has been reported as being at a third- or fourth-grade level (Paul, 1998; 2001). Furthermore, actual engagement in reading has been shown to be problematic (Ewoldt, 1986; Limbrick, McNaughton, & Clay, 1992; McAnally et al., 1999).

Various interactive models have been proposed which all see reading as a constructive cognitive process with the reader as an active participant in the act of reading. All recognize that readers bring to the task of reading their prior knowledge and that readers develop and apply a large repertoire of processing strategies (McAnally et al., 1999). Many children with hearing loss face particular challenges when learning to read and write since their prior knowledge has been limited by their hearing loss.

It has been shown that children with hearing loss are generally learning how to read and write a language that they may not have yet mastered orally—or in any other mode of communication. Paul and Quigley (1990) argued that most children with hearing loss have not developed an internal representation of English and cannot express their thoughts in English as a primary mode. Indeed, learning to read and write for children with hearing loss can be seen as tantamount to learning the language itself (Mayer, 1998). Consequently children with hearing loss may not have a store of background experiences that are linked to language, owing to a lack of communication between the child, the family, and other people. Without this link they have difficulty connecting their experiences to printed words (Mayer & Wells, 1996; McAnally et al., 1999; Paul & Quigley, 1994; Watson, 1999). They may have a limited language base for reading and have not yet developed the ability to link information from language to their schemas or to use inferring skills and figurative-language abilities to the same extent as hearing children (Paul, 2002; Paul & Quigley, 1990, 1994; Zaitseva, Pursglove, & Gregory, 2000). For this reason, contexts that facilitate language acquisition of young children with hearing loss as they learn to read and write are important (Larney, 2001; Nittrouer & Thuente Burton, 2003).

The vocabularies of deaf students and the rate of acquisition of new words have been found to be far below those of their normally hearing peers (Anderson & Freebody, 1985; LaSasso & Davey, 1987; Paul, 1984; Paul & O'Rourke, 1988). In relation to their use of context cues, many hearing-impaired students are caught in a vicious circle: Their impoverished vocabularies limit their reading comprehension, and poor reading strategies and skills limit their ability to acquire adequate vocabulary knowledge from context (deVilliers & Pomerantz, 1992). Marschark (1993) proposed that the extra cognitive demands placed on children with hearing loss at the word recognition level contribute to difficulties they may have in using context cues which otherwise would aid in syntactic processing.

Writing has been found to assist hearing children with learning to read, but for many children with hearing loss, learning to write is difficult. Mayer and Wells (1996) pointed out that it is highly unlikely that most children with hearing loss can express themselves adequately in writing and that some form of intermediary such as sign language, that links internal verbal thinking and writing in English, needs to be used. For young children who are learning to read and write, the interaction most often occurs in an instructional setting. Singer pointed out that the teacher is a necessary component of his interactive reading instructional model and can exert control over the success or failure of beginning readers who vary in age and developmental attainments (Yopp & Singer, 1994). The role of the teacher in one-to-one Reading Recovery lessons is to select the recommended procedures that he requires for a particular child with a particular problem at a particular moment in time in order to facilitate success.

Clay's Theory of Learning to Read

Hittleman (1988) described the act of reading as a complex transaction/interaction of four sets of variables, resulting in understanding and learning: the reader, the text, the environment and purpose for reading, and the reading process. These interact with—and influence—one another. Reading Recovery teachers take into account all of these variables; however, they focus mainly on the reading process (Clay, 1993b). Clay's theory of learning to read is based on the idea that children construct cognitive systems to understand the world and language. Clay described these cognitive systems as *self-extending systems* that generate further learning through the use of multiple sources of information. Clay (1992) hypothesized

> …that out of early reading and writing experiences the young learner creates a network of competencies which power subsequent independent literacy learning. It is a theory of generic learning, that is, learning which generates further learning. The learner constructs the generic competencies as he works on many kinds of information coming from the printed page in reading or going to the printed page in writing. (p. 1)

Teacher Support in Reading Recovery

Reading Recovery is designed to provide the social interaction that supports each child's ability to work both with familiar text and at a level where he is 'partly right,' not having full control, but—with the support of the teacher—being able to identify a problem and solve it. Such learning states were referred to by Vygotsky (1978) as the *zone of proximal development*. Indeed, what may seem like casual conversational exchanges between teacher and pupil are based on deliberate teaching decisions for a particular child. These are based on the

teacher's records of each child's response repertoire, obtained from the daily individual teaching lessons; that is, on the observable aspects of the child's reading and writing action system (Wood, Bruner, & Ross, 1976). Conversational exchanges continue throughout the series of Reading Recovery lessons as the reading task becomes more complex (Pinnell, Lyons, DeFord, Bryk, & Seltzer, 1994).

Sources of Information Used in Reading Recovery

During Reading Recovery lessons teachers pay particular attention to four sources of information that young children must learn to search for and use to check the message they are constructing (Clay, 1992; 1993b). These sources are meaning (whether what was read makes sense), structure (from the grammar of the language), visual information (whether what was read 'looks right') and phonological information (what is heard, based on the letter information). When reading, it is therefore necessary to have knowledge of the language being read, knowledge of the world the language expresses, and knowledge of the system used for writing that language. Each child learns how to process information from these sources, leading to the development of effective reading strategies for reading text.

These include the child's ability to
- monitor his or her own reading and writing;
- search for cues in word sequences, in meaning, in letter sequences;
- discover new things independently;
- cross-check one source of cues with another;
- repeat—as if to confirm—his or her reading or writing so far;
- self-correct, taking the initiative for making cues match or getting words right; and
- solve new words by these means.

As the child reaches out into more complex texts and writes longer and more involved stories, these operations will be used with increasing speed and fluency on
- longer stretches of meaning,
- less familiar language, and
- less predictable texts. (Clay, 1993b)

This interactive set of strategies that young readers develop enables them to detect when an error has occurred and to search for ways to correct the error. Furthermore, this system of strategies, which over time becomes self-extending, ensures that the more readers read, the more skilled they become and the less they need teacher assistance (Boocock, McNaughton, & Parr, 1998).

The Structure of Reading Recovery

A child's Reading Recovery intervention requires a series of daily lessons, in addition to the classroom literacy program, for approximately 12 to 20 weeks. Reading Recovery teachers are experienced classroom teachers, trained to use Reading Recovery teaching procedures during 1 year of professional development (DET, 2003). The daily lesson framework includes the reading of familiar, previously read texts, the analysis of the child's reading of a new text that was introduced and read the previous day, the composition and writing of a short story of one or two sentences, and the reading of a new and challenging text with teacher support (Clay, 1993b, 2001). The series of daily lessons is discontinued when a child is able to read texts at the same book level as the average for the children in her class. Hearing children who do not reach this point after 20 weeks are generally referred for more long-term assistance.

Reading Recovery for Children with Hearing Loss

The nature of the activities and supportive interactions in Reading Recovery lessons suggest that the intervention might address some of the difficulties experienced with literacy learning by some children with hearing loss. Indeed, Clay (2005) suggested the wider use of Reading Recovery procedures with other groups of individuals including children with hearing loss. However, Reading Recovery has only been reported as being used in a limited number of cases (McAnally et al., 1999). Needham's (1997) research in a mainstream Australian school in Canberra compared the progress of two children with mild hearing loss to Reading Recovery with hearing children in Reading Recovery. Both groups of children achieved similar results. Nielsen and Luetke-Stahlman (2002) reported the case study of an intervention with a child who is deaf in which similar procedures to those of Reading Recovery were used to success-fully prevent reading failure. Since 1995, there has been an effort in America to use the theoretical foundation and lesson framework of Reading Recovery to design one-to-one literacy intervention for children with hearing loss. There has been no formal program established, but teachers of the deaf in different states are using adaptations of Reading Recovery (Fullerton, Brill, & Carter, 2003).

METHOD

Methodology

A mixed-methods approach, applying qualitative and quantitative methods in the form of field and interpretive research, was used in this investigation. The field-research component of the study involved the collection and analysis of the literacy achievement results of 12 hearing children and 12 children with

hearing loss, and the identification and classification of the interactions of their Reading Recovery teachers. The interpretive aspect of the research involved both analysis and interpretation of the children's literacy achievement and the conceptualization of the supportive interactions of the teachers as coded variables. These variables were collected, analyzed and interpreted to reveal important features of the teacher interactions that supported the children's literacy progress.

Children

All the children in the study were in first grade, were experiencing difficulties with reading, and had been identified as at risk by their classroom teacher. The number of children with hearing loss and available to participate in this research was limited by several factors: (a) the number of children identified as being at risk with their literacy learning in first grade, (b) teacher availability, and (c) parental consent for participation in the investigation. The criterion for selection of the children with hearing loss for the study was that they attended either a school for children who are deaf or a mainstream school with a unit for children who are deaf. The children may or may not have been using their residual hearing; however, they all required intervention for the development of their language and communication skills. One child had severe dyspraxia and required sign language for expressive and receptive language. All but one of the children read orally to some extent, although some also signed words or phrases as they read aloud. The other child only signed.

Eight children were full-time students in a special school for profoundly deaf children. The other four children were full-time students in general education classrooms where they received the same classroom program as their hearing peers with the support of interpreters and teacher aides. They also had weekly lessons in the Deafness Unit at the school, where they received instruction specific to their needs from teachers of the deaf. The 12 hearing children attended school full time in general education classrooms in three different primary schools. All of the children in the study were withdrawn from their classrooms to receive one-to-one instruction from their Reading Recovery teacher.

At the beginning of Reading Recovery there was no significant difference in mean age or in the spread of ages between the groups of children; means were 6.8 years (range 6.4 to 8.8 years) for the hearing children and 7.1 years (range 5.9 to 9.2 years) for the children with hearing loss.

Teachers

Six Reading Recovery teachers took part in the study. The teachers of the children with hearing loss had received a year of Reading Recovery training

with teachers of hearing children prior to the year of the study. All teachers also attended eight ongoing professional development sessions in Reading Recovery with their tutors throughout the year of the study. In addition, the teachers of the children with hearing loss received monthly visits from their tutors. The three teachers of the hearing children had between 1 and 6 years experience teaching Reading Recovery, and the three teachers of the children with hearing loss had between 1 and 3 years experience teaching the intervention. Two of the teachers used sign language and/or speech according to the needs of the children, and one teacher of one child used speech and encouraged lipreading.

Measurement of Literacy Progress

The literacy progress of the children was measured by the administration of *An Observation Survey of Literacy Achievement* (Clay, 1993a, 2002). For convenience, the full title has been abbreviated to Observation Survey. The Observation Survey, which was developed particularly for children at the emergent stage of literacy learning, is wide-ranging and designed to monitor changes in a complex set of reading behaviors. It is not a standardized test; rather, it is a measurement of achievement that is administered in a standard way and is designed primarily for diagnosis and criterion-referenced assessment (Smith & Elley, 1999). As there is no Observation Survey designed for children with hearing loss their teachers were trained to administer the existing survey using the same instructions as the teachers of the hearing group but using voice, sign language, or fingerspelling (or a combination) depending on the communication needs of the child.

The tasks making up the Observation Survey are described in Table 1. Teachers can use the Observation Survey results to supplement other observations made about a particular child in a standard or repeatable way to compare the child's performance over time.

The Observation Survey tasks provide information about the precise response repertoire of the child in different areas of literacy performance (Clay, 1993a; 2002). They enable teachers to observe, record, and make a summary of successful and unsuccessful responses when children are reading and writing; the summary informs a teacher about a child's current way of reading and writing language. Reading Recovery teachers use this summary as a baseline for instruction; that is, to design instruction and to inform teaching decisions focused on what the child needs to learn next.

Data Collection

The six Reading Recovery teachers videotaped each child's series of Reading Recovery lessons in their school setting. For each of the children, the first lesson

Table 1. *An Observation Survey of Early Literacy Achievement*

Task	Description of task
Book Level (established using running records of text reading)	The teacher selects and briefly introduces a book. The teacher then records and analyzes the responses for each word as the child reads the text (running record). The accuracy score is used to establish a reading book level. All texts used by both groups were selected by the teachers from the Reading Recovery Booklist (DSE Victoria, 1995).
Burt Word Reading Test	The teacher asks the child to read from a card of 110 words (graded in difficulty) until 10 successive words are read incorrectly, or until there is no attempt to read any more words.
Writing Vocabulary	The child writes down as many words as he can in a maximum of 10 minutes or until the writing vocabulary is exhausted.
Letter Identification	The child is asked to identify the uppercase and lowercase letters of the alphabet and the letters *a* and *g* as they sometimes appear in books.
Concepts About Print	The child is asked to identify or indicate various features of printed language; for example, directionality of print, punctuation, and capital letters.
'Ready to Read' Word Test	The child is asked to read from one of three lists of 15 commonly used words compiled from a sample of children's reading books. (A different list is used for each Observation Survey administration.)
Hearing and Recording Sounds in Words	The child listens to the sounds in words in sequence and writes letters to represent those sounds; (not used in this study because some teachers used sign language and/or fingerspelling).

in the third, middle and final weeks of the series of lessons were selected from the recordings for analysis. The third week was chosen to represent the start of the lessons because prior to that time, the Reading Recovery teachers were working only within each child's body of knowledge (Roaming Around the Known) (Clay, 1993b). The lessons at the three time-points provided data over the entire series of Reading Recovery lessons.

Development of Codes

To investigate the similarities and differences in the lessons of the two groups of teachers, three different aspects of the Reading Recovery lessons were coded. These were the forms of interaction used by the teacher with the child, the main categories of teaching focus, and the specific teaching events used by the teacher. These three aspects were occurring simultaneously throughout the lessons; however, the temporal relationship between them has not been addressed in this study.

Over a period of 2 years prior to the data collection and analysis, the types of teaching interactions about reading and writing of text, letters, and words occurring in Reading Recovery lessons were observed and recorded by the first author during tutor school visits to teachers of both hearing children and children with hearing loss. The resulting list of specific teaching events, which reflected Reading Recovery teaching procedures, was cross checked against Clay's *Guidebook* (Clay, 1993b). These teaching events were then grouped into a set of coded events.

The first author, in collaboration with three Reading Recovery tutor colleagues, refined this set of coded events by individually coding and then comparing the results for a series of sample lessons that were not used for the research. The refined codes were checked and further refined in consultation with a Reading Recovery tutor trainer; this process was undertaken to confirm the design of the lesson codes, and was carried out separately from the reliability check (undertaken later to check the accuracy of the coding process). This refinement procedure was important to ensure that all codes were mutually exclusive and that they accurately represented the teaching procedures used in Reading Recovery lessons (see Tables 4, 5, and 6).

Teacher Interaction Codes

Three forms of interaction used by the teachers when they were teaching the children were identified and coded. Spoken and/or signed communication by the teacher to the child was coded as either an instruction or a question. Actions with the hand other than sign language were coded as hand action. Some examples of these are shown in Table 2.

Moreover, when the teachers were interacting with the children in these ways, they were classified as active. When the teachers were passively observing a child, they were classified as inactive.

Table 2. Forms of Interaction Used by Teachers

Interaction	Examples
Instruction	providing instruction (or telling the child) about how to use illustrations in a book when reading, or giving the child an instruction such as "Read this book"
Question	asking a child what letters he can see in a word, or asking a child if what has been read makes sense
Hand action	pointing to letters in a word or indicating the directionality of print

Teaching Focus Codes

Prior to this study the first author had noticed that Reading Recovery teachers of the children with hearing loss appeared to be spending more time interacting with the children about world knowledge (discussing what the books were about and the meanings of some of the vocabulary) than the teachers of hearing children. They also appeared to be spending more time having interactions about language (how things are spoken in English). To provide evidence for these observations, the whole Reading Recovery lesson was coded into four discrete, mutually exclusive categories of teaching focus. The time devoted to a given teaching focus category was continuous and only concluded when the teacher changed to one of the other three focus categories. The four categories and characteristics of each are shown in Table 3.

Table 3. Categories and Characteristics of Teaching Focus

Category	Characteristics
Reading	the reading of continuous text or reading words in isolation
Writing	the writing of continuous text or writing words in isolation
World knowledge	interacting about the topic that reading, writing, or spoken language is about
Language	interacting about the way a topic is expressed in English

Teaching Event Codes

Ten specific teaching events representing the teaching procedures used by Reading Recovery teachers were characterized and coded. These events (related to text, words and letters) occurred throughout the lessons as the teachers were focusing on reading, writing, language, or world knowledge.

Table 4. Typical Characteristics of Coded Teaching Events Relating to Text

Event and characteristics	Examples from teaching
Directional movement and locating words • attending to directionality of print and return sweep • locating cues in print • reading word by word • locating known and unknown words • attending to spatial awareness	The teacher may be pointing to the directionality of the print in a book or modeling word-by-word reading.
Sources of information • using meaning cues (semantic) • using structure cues (syntax) • reading for meaning • using the visual information in the print • checking that some of the letters in an error match with the letters in the text • using written language found in books	The interaction might be concerned with attending to meaning cues by looking at an illustration or using letter information in the print.
Message construction • checking and monitoring • cross-checking one source of cues with another • searching for and using multiple cues • repeating as if to confirm • self-correcting • discovering new things independently • having a conversation about a topic before writing • composing a story before writing in English word order • writing a story in English word order	The teacher might instruct the child to read a sentence again to confirm that it makes sense, or might encourage the child to correct his errors when reading.
Phrasing in fluent reading • relating the use of oral language to reading text	The teacher might say, "Read it and make it sound like talking."

Four of the teaching events relate to text, three relate to words, and three relate to letters. The events and their typical characteristics, and examples from teaching, are shown in Table 4 on page 32, Table 5 on page 33, and Table 6 on page 34.

Table 5. Typical Characteristics of Coded Teaching Events Relating to Words

Event and characteristics	Examples from teaching
Word construction in reading and writing • using sign to form a visual representation of a word • using fingerspelling to make a visual representation of the letter placement in a word • reading and writing some words in every detail • using word parts • using word analogies when reading	The interaction might be related to using word parts when reading; for example, the word *seeing* has two parts that look like *see* and *ing*.
Word construction in writing by sound analysis • signing or speaking individual words in a sentence • slow articulation of a word • using sound boxes to assist hearing and recording sounds in words • using visual boxes, signing, and finger-spelling to assist seeing and recording the letters in words[1]	The teacher might assist a child to hear the sequence of sounds in a word he is writing by using boxes drawn by the teacher on the practice page in the child's writing book.
Word construction in writing by analogy • using a known word to work out an unknown word • using part of a known word to work out an unknown word; for example, see/sees	The teacher might interact with the child about how to use a known word such as *run* to work out how to write other words such as *fun* and *sun*.

[1] In this study, most subjects used a sign language system; however, the use of sign language over an oral system is not being advocated.

Table 6. Typical Characteristics of Coded Teaching Events Relating to Letters

Event and characteristics	Examples from teaching
Letter formation in writing • constructing letters when writing	The teacher might model how to construct a letter when writing, then ask the child to write the letter on the practice page a number of times.
Letter identification • matching fingerspelling to a letter • working on letter characteristics • increasing the child's letter knowledge • working on letter confusions	The teacher might use magnetic letters to allow a child to manipulate and classify the letter *b* in order to learn its characteristics.
Letter sounds • using letter/sound relationships • using lipreading to assist accessing letter sounds visually	The teacher might ask, "What sound goes with that letter?"

Data Analysis

A total of 72 unedited recorded lessons were digitized (in mpeg format) and transferred to CD-ROM for analysis. The lessons were coded by the first author using The Observer, software specifically designed to support behavioral researchers (Noldus, 1998). The Observer allows second-by-second continuous recording of codes. It also allows a lesson to be paused and particular parts replayed for correction and checking purposes. The researcher could, for example, capture an event in which the teacher intended to focus the child's attention upon world knowledge, record that the teacher asked a question, and finally code the fact that the question was referring to a source of information.

In each lesson, all teacher interactions, categories of teaching focus, and types of teaching events were identified and coded. If teachers were interacting with the children about matters additional to the defined codes, these events were recorded in the first author's lesson log by writing the time of occurrence and details of the corresponding event. The identification of any special teaching procedures that supported literacy learning for the children with hearing loss was made during the lesson coding.

In order to confirm that the coding process was reliable and independent of observer bias, six Reading Recovery lessons with the children with hearing loss

and six with the hearing children were coded by a second Reading Recovery tutor trainer (reliability checker). Across the 12 lessons, there were 111 instances of the four teaching focus categories identified with 96% matched instances, 3,531 instances of teacher interaction with 94% matched instances, and 3,440 teaching events with 90% matched instances. If the total numbers of instances observed by the first author and the reliability checker are compared, rather than just those matched, the agreement on numbers rises to greater than 99% for the forms of teacher interaction and 98% for the teaching events. On this basis it was considered that the remaining data would be reliable.

At the end of coding a lesson, a file of the codes from beginning to end of the lesson, with the time in seconds was generated. The Observer was also used to generate event versus time plots for the lessons. The list of lesson codes and corresponding times was pasted into an Excel spreadsheet that was then used to count both the *number of occurrences* for each coded variable and the *total time* spent on each of the four categories of teaching focus. The variable totals were then entered into a data summary spreadsheet.

Analysis of these data (the number of occurrences for each coded variable and the total time spent on each of the four categories of teaching focus in each lesson) was carried out by the second author using the software package SPSS. During the analysis, SPSS identified data that it labeled as outliers or extreme points. It was decided that these data would be included in the analysis because they represented naturally occurring events during the lessons and were within the range that might be expected to occur during Reading Recovery lessons. Data were analyzed using split-plot analysis of variance (SPANOVA) followed by post-hoc independent samples or paired samples t-tests as appropriate. For those data that were not normally distributed, a nonparametric Friedman Test, Mann-Whitney U Test, or Wilcoxon Signed Ranks Test was used where appropriate. A value of $p \leq 0.05$ was considered statistically significant. All data are presented as mean (SD).

RESULTS

Analysis of the Reading Recovery lessons enabled the identification of similarities and differences in the teaching procedures used by the teachers of the hearing children and the children with hearing loss in this study. The first question investigated in this study was 'Can the literacy achievement of children with hearing loss who are experiencing literacy-learning difficulties be improved by implementing Reading Recovery? This was investigated by collecting and analyzing the Observation Survey results of the children in the study. As mentioned in the introduction, these results have been reported in an earlier publication (Charlesworth et al., 2006). They are reproduced here to convey the children's literacy achievements.

Literacy Progress

Table 7 shows the mean scores on the six Observation Survey tasks at four time points during the year. Across the time of the Reading Recovery lessons, there was a significant increase for both groups in the scores of all Observation Survey tasks, except for Letter Identification. The only significant difference between the scores of the two groups at the successful completion of lessons was in Book Level, with the children with hearing loss having a mean score three levels lower than the hearing group.

Table 7. Mean Scores (SD) on Observation Survey Tasks

		Start of year	Beginning of lessons	Completion of lessons	End of year
Book Level[a]	Deaf	2.3 (2.0)	3.6 (2.8)	14.8 (2.7)[c]	16.2 (3.2)
	Hearing	2.5 (2.2)	3.2 (2.2)	17.8 (1.1)[b]	19.7 (2.4)
Burt Word	Deaf	7.9 (5.5)	11.7 (6.3)	24.0 (4.5)[b]	26.2 (4.7)
Test	Hearing	7.5 (6.6)	9.7 (7.1)	24.7 (5.3)[b]	29.9 (9.1)[e]
Writing	Deaf	10.8 (4.8)	20.5 (9.9)[d]	48.1 (14.3)[b]	45.4 (16.2)
Vocabulary	Hearing	16.4 (12.4)	19.8 (13.3)	47.6 (10.3)[b]	48.6 (10.1)
Letter	Deaf	50.1 (4.0)	50.9 (3.0)	53.2 (1.1)	53.7 (0.4)
Identification	Hearing	46.4 (8.2)	46.8 (8.2)	52.4 (1.4)	53.5 (1.0)
Concepts	Deaf	12.8 (3.9)	16.0 (3.3)	20.7 (2.6)[b]	20.7 (3.2)
About Print	Hearing	13.7 (3.3)	15.2 (3.3)	20.3 (1.9)[c]	20.8 (2.8)
'Ready to	Deaf	5.7 (3.5)	8.1 (3.6)	13.2 (2.0)[b]	14.0 (2.0)
Read' Word Test	Hearing	3.7 (2.5)	5.0 (4.1)	13.5 (1.8)[b]	14.2 (1.8)

Deaf: n=12, Hearing: n=12

[a] The difference between the groups is significant at the p≤0.005 level (2-tailed) at completion of lessons and end of year.
[b] The change in score from beginning of lessons to completion of lessons is significant at the p≤0.001 level (2-tailed).
[c] The change in score from beginning of lessons to completion of lessons is significant at the p≤0.005 level (2-tailed).
[d] The change in score from start of year to beginning of lessons is significant at the p≤0.005 level (2-tailed).
[e] The change in score from start of year to beginning of lessons is significant at the p≤0.005 level (2-tailed).

The Observation Survey results of the hearing children in the study were compared with the State of Victoria Observation Survey results for 2002 (N=7,608). There were no significant differences between the two groups, confirming that the study sample, although limited to 24 children, is a representative group of the state cohort.

Teacher Interactions

The second question in the study was 'How will teachers of the children with hearing loss use Reading Recovery teaching procedures?' This was investigated by collecting data relating to the number of weeks the children were participating in Reading Recovery lessons, the duration of the daily lessons and the total number of lessons; all of these have been previously reported (Charlesworth et al., 2006). The forms of teacher interaction that occurred during the lessons for both groups of children are reported here.

Teaching interactions were tabulated for lessons at three different points in time. Table 8 shows the mean percentage of lesson time in which the teachers were active and the mean numbers of teacher interactions in each of the lessons. The teachers of the children with hearing loss were active in all three lessons for the same percentage of lesson time as the teachers of the hearing children. In each of the three lessons, the teachers of the children with hearing loss also used similar numbers of each form of interaction as the teachers of the hearing children (Means: 143 instructions, 64 questions, and 74 hand actions).

Table 8. Mean Percentages of Lesson Time Teacher is Active (SD) and Mean Numbers of Teacher Interactions (SD)

Week		Time active	Form of Teacher Interaction		
			Instruction	Question	Hand action
Third	Deaf	61.3 (12.0)	135.7 (35.7)	79.2 (27.2)	79.3 (17.2)
	Hearing	65.6 (11.3)	141.6 (38.3)	74.7 (19.2)	69.2 (31.8)
Middle	Deaf	63.2 (10.2)	148.4 (44.5)	81.8 (28.5)	81.4 (35.0)
	Hearing	60.8 (8.3)	133.4 (32.9)	69.6 (19.6)	64.5 (18.5)
Final	Deaf	63.5 (8.9)	146.5 (45.0)	76.3 (22.3)	76.2 (25.4)
	Hearing	58.6 (7.2)	146.7 (37.8)	74.8 (20.1)	76.8 (26.2)

Teaching Focus

The second and third questions in the study were investigated by collecting and analyzing data relating to the categories of teaching focus used by the teachers (Table 9).

The teachers of both groups of children spent a similar percentage of lesson time on reading in the third-week lessons, while teachers of the children with hearing loss spent a smaller percentage of time in the middle- and final-week lessons, although the difference was only significant in the final week. One explanation for this finding is that teachers of the children with hearing loss focused more on world knowledge and language to support the reading.

Table 9. Mean Percentages of Lesson Time (SD) Spent on Teaching Focus Categories

Week		Reading[a]	Writing	World Knowledge[b]	Language[c]
Third	Deaf	71.4 (8.3)	18.3 (5.9)	2.4 (1.9)	7.9 (3.6)
	Hearing	71.7 (7.8)	23.0 (6.0)	0.4 (1.2)	4.9 (3.0)
Middle	Deaf	67.4 (7.4)	21.2 (4.6)	5.3 (6.3)	6.2 (3.4)
	Hearing	72.4 (8.9)	20.5 (5.0)	0.2 (0.7)	6.9 (7.6)
Final	Deaf	66.6 (10.4)	19.9 (6.1)	6.0 (6.9)	7.4 (3.6)
	Hearing	75.0 (7.3)	20.1 (6.0)	0 (0)	4.7 (2.7)

[a] The difference between the groups is significant at the $p \leq 0.05$ level (2-tailed) in the final-week lessons.

[b] The difference between the groups is significant at the $p \leq 0.001$ level (2-tailed) in the third-week lessons and at the $p \leq 0.05$ level (2-tailed) in the middle- and final-week lessons.

[c] The difference between the groups is significant at the $p \leq 0.05$ level (2-tailed) in the third-week and final-week lessons.

Teachers of both groups of children devoted a similar percentage of lesson time to writing at all three time-points. This is surprising, given the acknowledged difficulties many children with hearing loss have with writing. However, it should be noted that the writing task in Reading Recovery is a co-construction task carried out with teacher support.

In each of the three lessons, the teachers of the children with hearing loss devoted a significantly greater percentage of lesson time to world knowledge than did the teachers of the hearing children. Indeed, in the 36 coded lessons for the hearing children, there were only two occasions in which their teachers

focused on world knowledge compared with a total of 119 occasions in the 36 lessons for the teachers of the children with hearing loss. These interactions were relatively brief, ranging from 13 to 74 seconds with a mean of 31 seconds. This focus on world knowledge is clearly a major difference in teaching between the two groups of teachers.

There was also a significant difference between the teachers of the deaf and hearing children in the percentage of lesson time spent focusing on language in the third- and final-week lessons. The teachers of the children with hearing loss spent around 50% more time on language than did the teachers of the hearing children in these lessons. As was the case with world knowledge, the interactions focusing on language were also relatively brief, ranging from 29 to 147 seconds with a mean of 56 seconds for the teachers of the children with hearing loss. This contrasts with the interactions of the teachers of the hearing children that varied from 34 to 164 seconds, with a mean of 97 seconds. In summary, in the third- and final-week lessons the teachers of the children with hearing loss were spending a greater percentage of lesson time focusing on language through shorter interactions than the teachers of the hearing children.

The percentage of lesson time that was devoted to each category of teaching focus does not give a sense of how often the teachers changed between the four categories during a lesson. The teachers of the children with hearing loss made significantly more changes of focus to reading, world knowledge, and language in the lessons at all three time-points, and to writing in the middle- and final-week lessons (Table 10).

Table 10. Mean Number (SD) of Occurrences of Teaching Focus

| Week		Reading[a]	Writing[b]	World Knowledge[a]	Language[c]
Third	Deaf	6.3 (2.1)	1.3 (0.8)	2.7 (2.0)	3.7 (1.9)
	Hearing	2.4 (0.5)	1.0 (0)	0.1 (0.3)	1.3 (0.5)
Middle	Deaf	5.9 (2.6)	1.8 (0.8)	3.0 (1.9)	2.3 (1.2)
	Hearing	2.3 (0.7)	1.0 (0)	0.1 (0.3)	1.3 (0.6)
Final	Deaf	7.2 (2.8)	2.0 (1.3)	4.2 (3.1)	3.4 (1.7)
	Hearing	2.2 (0.4)	1.0 (0)	0 (0)	1.2 (0.4)

[a] The difference between the groups is significant at the $p \leq 0.001$ level (2-tailed) in all three lessons.
[b] The difference between the groups is significant at the $p \leq 0.05$ level (2-tailed) in the middle- and final-week lessons.
[c] The difference between the groups is significant at the $p \leq 0.05$ level (2-tailed) in all three lessons.

The greater number of changes of teaching focus for the teachers of the children with hearing loss can be clearly seen in Figure 1. This shows two typical event-time plots taken from the middle-week lessons. Time spent on each category of teaching focus is revealed in blocks with breaks shown above the lesson timeline. The plot for the teacher of the child with hearing loss shows how world knowledge and language interactions were used to support the child's reading and writing throughout the lesson.

Figure 1. Typical Event-Time Plots From Middle-Week Lessons
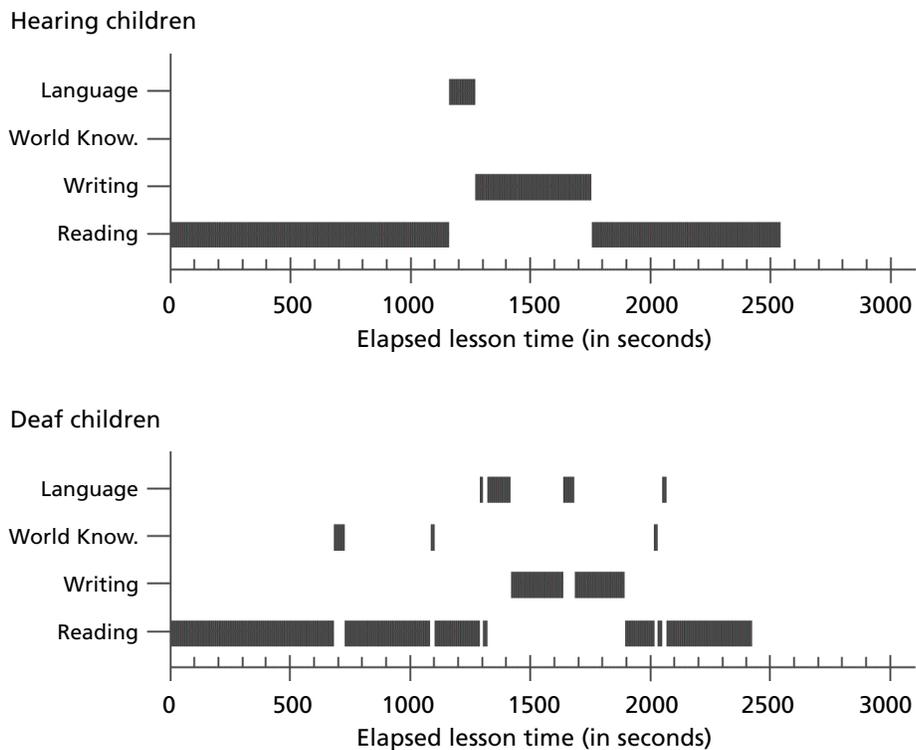
Teaching Events

The third question — Is the application of the literacy processing theory used as Reading Recovery in hearing contexts the same or different in contexts for children with hearing loss? — was further investigated by analyzing the number of occurrences of the specific teaching events (Table 11). These teaching events

Table 11. Mean Number (SD) of Coded Teaching Events

Event	Third week		Middle week		Final week	
	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing
Text						
Directional movement and locating words[a]	22.5 (16.4)	13.0 (13.8)	27.2 (15.5)	12.2 (8.9)	17.2 (10.6)	14.3 (12.5)
Sources of information[b]	110.7 (35.7)	97.2 (37.3)	133.7 (50.7)	88.1 (23.6)	120.7 (49.0)	88.2 (19.3)
Message construction	59.4 (13.2)	64.7 (25.9)	46.7 (17.1)	59.6 (24.3)	62.0 (17.2)	66.4 (20.7)
Phrasing in fluent reading[c]	2.7 (4.5)	6.7 (6.7)	1.1 (1.8)	5.2 (4.8)	1.0 (2.6)	4.1 (5.5)
Words						
Word construction in reading and writing[d]	58.8 (21.2)	57.9 (25.0)	62.0 (25.4)	57.2 (24.6)	58.2 (18.9)	78.7 (34.0)
Word construction in writing by sound analysis	8.3 (8.9)	8.5 (8.6)	11.5 (10.9)	10.2 (7.2)	10.7 (11.2)	8.2 (5.6)
Word construction in writing by analogy	4.2 (4.9)	4.2 (3.0)	3.4 (2.7)	5.1 (4.5)	3.2 (3.6)	5.7 (5.4)
Letters						
Letter formation in writing	3.2 (4.9)	9.2 (10.0)	3.0 (3.1)	5.8 (4.3)	2.2 (2.4)	4.7 (5.1)
Letter identification	12.3 (5.7)	10.8 (5.3)	11.2 (6.9)	9.7 (4.9)	8.2 (4.0)	7.7 (5.7)
Letter sounds	3.0 (6.5)	2.1 (6.1)	3.3 (6.0)	3.2 (8.8)	2.2 (3.3)	2.6 (3.4)

[a] For the deaf group there were significantly more events than for the hearing group at the $p \leq 0.01$ level (2-tailed) in the middle-week lessons.
[b] For the deaf group there were significantly more events than for the hearing group at the $p \leq 0.05$ level (2-tailed) in the middle- and final-week lessons.
[c] For the hearing group there were significantly more events at the $p \leq 0.05$ level (2-tailed) in all three lessons.
[d] For the hearing group there were significantly more events at the $p \leq 0.01$ level (2-tailed) in the final-week lesson than in the third- and middle-week lessons.

were coded as either oral or signed, depending on how the teacher communicated with the child; however, only the total number of events (oral plus signed) are reported here. For both groups, the majority of teaching events in each lesson were related to sources of information, message construction, and word construction in reading and writing.

There were no significant differences either within or between the groups in the number of instances of five of the six teaching events relating to letters and words. For the sixth, word construction in reading and writing, there were significantly more events for the teachers of the hearing children in the final-week lessons than in the third or middle weeks. Examination of the data shows this difference was due to one of the teachers interacting intensively with four of the children in the final-week lesson.

Significant differences were also observed in the number of instances of three of the four teaching events relating to text. First, in all three lessons the number of events about directional movement and locating words was greater for the teachers of the children with hearing loss, however, this difference was only significant in the middle-week lesson. Second, the teachers of the children with hearing loss used more events about sources of information in all three lessons; this difference being significant in the middle- and final-week lessons. Third, in each of the three lessons the teachers of the hearing children had significantly more teaching events about phrasing in fluent reading than did the teachers of the children with hearing loss.

During the coding of the lessons a number of other teaching events were observed and recorded for the teachers of both groups of children; these included asking the child to use a big voice when reading, asking the child to sit still when reading, correcting the child's misbehavior, and the teacher reading a book to a child; however, none of these other events occurred frequently enough to warrant analysis. In addition, several special teaching procedures were identified as specifically supporting the progress of the children with hearing loss; these and the role of sign language in the lessons will be addressed elsewhere.

DISCUSSION

Teacher Interactions

Prior to the study, it was observed that the teachers of the children with hearing loss appeared to be actively teaching for a greater percentage of the lesson and having more teaching interactions than the teachers of the hearing children, with the increased support helping the children access the information they needed to learn to read. This is not born out by this study which found no significant differences between the groups in the time spent actively teaching or in the numbers of teacher questions, instructions, and hand actions.

Categories of Teaching Focus

As would be expected, the greatest proportion of the Reading Recovery lessons for both groups of children was devoted to reading, with a lesser time spent focusing on writing, language, and world knowledge. The percentage of time spent reading for both deaf and hearing children was similar in the third-week lesson. By the middle- and final-week lessons, however, the teachers of the children with hearing loss spent a smaller percentage of lesson time on reading and more time focusing on world knowledge through brief instructional detours; demonstrating that, in contrast to the hearing children, the children with hearing loss required continuing support related to world knowledge in order to process the increasing complexity of texts. This is consistent with reports that many children with hearing loss experience difficulty accessing information in general (Mayer, 2002; Mayer & Akamatsu, 1999).

World knowledge focus involves interacting about the topic that text or spoken English is about. In order to gauge a child's knowledge of the topic before reading a book, for example, the teacher might ask what the child thinks would happen in the story and then encourage the child to refer to the pictures to assist with this. As the child browses the pictures, the teacher might discuss the story with the child, contributing important information that the child appears not to have. The teachers of the hearing children rarely used such interactions.

It would be reasonable to assume that the language knowledge of the children with hearing loss in the study was in the earlier stages of development (Mayer & Akamatsu, 1999; McAnally et al., 1999; Paul & Quigley, 1994). Consequently, the role of the teachers involved not only teaching them how to read, but also working towards increasing their language knowledge. They had significantly more instances of language focus at all three time-points and spent significantly more time than the teachers of the hearing children focusing on language in the third- and final-week lessons.

In each Reading Recovery lesson, children compose and write a short story of one or two sentences supported by the teacher. The child's written story is rewritten by the teacher onto a cardboard strip and cut into language units considered within the child's ability to reassemble (Clay, 1993b). It is clear that the reconstruction task provides valuable opportunities for the children with hearing loss to manipulate words and phrases in English word order to construct a meaningful message. This observation is consistent with the observations of Reading Recovery teachers of children with hearing loss in North America, who used adaptations of the Reading Recovery teaching procedure of assembling cut-up stories (Fullerton et al., 2003).

Both groups of children were writing for a similar percentage of time in each Reading Recovery lesson. As was the case when reading, the teachers of the children with hearing loss changed focus from writing to either world

knowledge or language or reading, and back to writing, in order to co-construct the children's increasingly complex story writing. This contrasts with the teachers of the hearing children who, in each of the three lessons, had only one continuous writing focus.

While focusing on writing, the teachers of the children with hearing loss were also teaching oral language, as well as supporting the writing of it, by making explicit the link between the world knowledge related to the topic (what the story is about), the expression of the child's story in oral English (how the story is said), and the written form of the language (how the story is represented in writing). Prior to writing tasks, teachers of the children with hearing loss had conversations with the children about a topic using the communication modality preferred by each child. The teacher assisted the child to compose one or two sentences in English word order orally and/or by using sign language. The child was then encouraged to practice three or four times by speaking or signing what was to be written. This appeared to provide a link from the visual-spatial language of the children with hearing loss to the way the story was expressed in speech. As the children wrote, the teachers of the children with hearing loss spent time explaining how words, sentences, or phrases were used.

Teaching Events

The coded teaching events represent the teaching procedures used in Reading Recovery lessons. Differences in the numbers of the events used by the two groups of teachers reflect the way that the teachers of the children with hearing loss changed the emphasis of their teaching to take into account the specific needs of the children.

There were no significant differences observed in the number of instances of five of the six teaching events relating to letters or words. The difference in word construction in reading and writing in the final-week lessons was due to intensive teaching by one teacher of the hearing children, which was not typical of the other teachers in the study. Furthermore, for the children with hearing loss, the results on the Observation Survey tasks relating to words and letters show no significant differences from those of the hearing group throughout the year (Table 7). These data suggest that aspects of literacy relating to letters and words might not be any more difficult for children with hearing loss than for hearing children.

There were, however, significant differences in the number of instances of three of the four coded teaching events related to text between the two groups of teachers. It seems reasonable to suggest that these differences are related to factors associated with the children's deafness.

Directional movement and locating words

Directional movement and locating words events relate to directionality of print, location of words, and spatial layout of print. When coding the lessons, the first author observed that some children with hearing loss found coordinating sign language and oral reading difficult, and others found difficulty tracking the text with their eyes while signing; on occasions the children lost track of the order of the words in the text. The teachers in this current study were swift to point to a word if a child appeared to have lost his place in the text, and the child could then quickly resume reading independently.

In the middle-week lessons, the teachers of the children with hearing loss used significantly more events about directional movement and locating words than the teachers of the hearing children. A possible reason for this observation is that the books the children were reading at this point were more complex than those earlier in the lesson series and the coordination of the processing of the printed message with oral reading and/or signing became more challenging. By the final-week lesson they were not assisted with the location of words any more than were the hearing children, suggesting that with intensive reading practice, their ability to coordinate oral reading and signing had improved.

Phrasing in fluent reading

Phrasing in fluent reading events occur when the teacher is relating oral reading to oral language. For instance the teacher might say to the child, "Read it and make it sound like talking." The significantly fewer number of events about phrasing in fluent reading for the children with hearing loss is not unexpected and suggests that the children with hearing loss could not use oral language or speech when reading to the same extent as the hearing children. When the teachers of the children with hearing loss did interact about phrasing in fluent reading they used oral communication to model phrasing by repeatedly reading aloud. They also encouraged lipreading or included a visual approach that involved drawing attention to the punctuation marks to provide a means of arranging the text in phrases and encouraged the child to use these when reading.

Sources of information

During Reading Recovery lessons, children learn how to look for and use sources of information in order to construct a meaningful message (message construction). For example, the teacher might explain the meaning of a word because the child does not know the different ways in which it is used in English; the word *cried*, for instance, could be referring to someone reduced to tears or to someone who *yelled*. Having a short, focused interaction about the world and language knowledge required to make sense of a particular part of

the text provides an important way of linking meanings to words in print. The teacher might clarify the meaning and use of a word and then ask the child to read the whole sentence again to experience that particular use of the word in context and to practice using reading strategies.

Previous studies suggest that children with hearing loss frequently do not have the skills or language ability to use context clues to work out meaning (McAnally et al., 1999). In this study the teachers of the children with hearing loss engaged in significantly more interactions about sources of information in the middle- and final-week lessons than did the teachers of the hearing children, suggesting that as the books become more complex, the children with hearing loss need more support than the hearing children with accessing information in order to process their reading.

Message construction

Message construction is a higher-level cognitive task in which readers of continuous text construct a meaningful message through strategic activities such as self-monitoring, repeating in order to confirm, searching for cues in letters, words or sentences, and self-correction. For example, the teacher might encourage a child to check letter information in a word against an illustration and then to self-correct.

Although not statistically significant, teachers of children with hearing loss in this study provided fewer events about message construction in all three lessons. This suggests that this higher-level task requires no more emphasis for children with hearing loss than for hearing children. It may be that many of the difficulties experienced by children with hearing loss in learning to read are due more to a lack of ability to use some sources of knowledge such as world knowledge and language, and less to particular difficulties with the cognitive strategic tasks of message construction.

Limitations of the Study

There are several limitations of this study to consider. First, there has been little published research on Reading Recovery for children with hearing loss, providing a meager foundation for this investigation. The codes used in the lesson analysis were designed and developed by the first author for this study and were not based on any previous research. Hence, their power to accurately represent teaching interactions in Reading Recovery has not been replicated.

Second, there are no acknowledged criteria for determining an end-point for successful completion of lessons for children with a hearing loss. In this study, the criteria recommended for hearing children were used (Clay, 1993b). In other words, the decision for successful completion was made on a case-by-case basis by the Reading Recovery teacher in consultation with the Reading Recovery tutor and classroom teacher.

A third limitation was the small number of children with hearing loss, in Reading Recovery, and available to participate in the study. A larger group of children with hearing loss and in Reading Recovery would be more representative of the larger population with hearing loss. Fourth, the number of trained Reading Recovery teachers of children with hearing loss is small, limiting the number of teachers who were available to participate in the study. In addition, a measure of oral language for young children with hearing loss, which would have been useful for informing teaching decisions, was not used. Finally, the Hearing and Recording Sounds in Words task of the Observation Survey was not used since the phonemic information related to writing words according to sounds was not available for the children with hearing loss.

CONCLUSIONS AND IMPLICATIONS

Reading Recovery was a successful literacy intervention for the children with hearing loss in this study. Although the teachers of the children with hearing loss used similar teaching procedures to those of the hearing children, they also used different communication behaviors and additional supportive techniques. The use of the mode of communication preferred by the child was an important feature of the Reading Recovery lessons. The authors suggest that the Reading Recovery teacher should personally administer a measure of oral language with the Observation Survey. This measure should be specifically designed for children with hearing loss in the early years of primary school. This would inform the teacher about choice of books; the ability of a child to use the English language when reading, writing, speaking, and listening; and possibly the way in which the child uses their signing modality for communication.

Like the teachers of the hearing children, the teachers of the children with hearing loss successfully taught the children how to use strategic activities necessary for message construction. They also supported the children through brief instructional detours to focus on world knowledge and language throughout the time spent reading and writing. This enabled the children to understand the structure of the written language and the meaning it conveyed. This focus of teaching is seen by the authors to be essential if children with hearing loss are to make the same progress with their literacy learning as their hearing peers. The nature of these teaching interactions has implications not only for Reading Recovery, but also for the literacy teaching of all children with hearing loss in the early years of schooling. Based on the findings of this limited study, further research with larger groups of children with hearing loss is recommended.

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