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A Review of Evidence-Based Literacy Research with Students who are
Deaf or Hard of Hearing

John L. Luckner, Ed.D.

National Center on Low-Incidence Disabilities

Ann M. Sebald, Ed.D.

National Center on Low-Incidence Disabilities

John Cooney, Ph.D.

University of Northern Colorado

John Young III, Doctoral Candidate

University of Northern Colorado

Sheryl Goodwin Muir, Ed.D.

Colorado Department of Education

Abstract

The ability to read and write for a variety of purposes is essential for succeeding in school and in our contemporary society. Recent legislation requires educators to focus on literacy and to implement reading instruction based upon “Scientifically-Based Research.” The purpose of this investigation was to conduct an exhaustive review of the literature and a meta-analysis of literacy research in the field of deaf education. Results include a summary table of the studies included in the review. In addition, it is noted that there is a paucity of well-designed group studies as well as no systematic replication of studies to establish evidenced-based practices. Consequently, it is suggested that most of the commonly used approaches in the field of deaf education have been established by tradition and anecdotal reports. Recommendations include a proposed model of literacy instruction for students who are deaf or hard of hearing, suggested steps for examining the efficacy of that model, and a request to increase the quantity and improve the quality of research in the field.

Literacy skills are essential for succeeding in our contemporary, technological society. Everyday examples include accessing the Internet or messages via e-mail; reading instructional manuals for the workplace, for computers, for cars; following directions at work, for travel, or for taking medications; and for leisure activities such as reading the newspaper or enjoying a magazine or a book. Literacy is also the key to functioning effectively in school. For most individuals the foundation for reading proficiency begins in infancy, advances with formal reading instruction in school, and continues to increase as the result of quality educational, social and recreational experiences throughout one's lifetime (Chall, 1996). Without well-developed literacy skills, students cannot participate fully in classroom learning. They are at much greater risk for school failure and lifelong problems with employment, social adjustment, and personal autonomy (Moats, 2000). Consequently, individuals who struggle to read and write are much more likely than literate people to drop out of school, go to prison, or to struggle to find and keep meaningful, satisfying work (Cramer & Ellis, 1996).

Literacy skills are also vital at a national level. Countries that are successful in developing strong literacy skills within their citizens are in a better position to meet the economic challenges of operating in a global information-based economy. Simultaneously, citizens with strong literacy skills are better prepared to address the complex educational, social, economic, and political issues that currently exist. Finally, having a population that has strong literacy skills also enables a country to better meet the complex social challenges that it faces. For example, strong literacy skills are linked to better health outcomes for individuals (Berkman, et al., 2004). Simultaneously, a highly literate population will be better able to help determine

how best to allocate scarce resources across competing priorities, such as education, health, transportation, the environment, defense, and social programs.

The importance of literacy was highlighted by the National Reading Panel (NRP), which was convened in 1997 in response to a congressional directive to review the scientific literature and to determine the most effective ways to teach children and youth to read. They issued their report and a summarizing document titled *Put Reading First: The Research Building Blocks for Teaching Children to Read* was developed and disseminated (National Institute for Literacy, 2001). These findings were then incorporated into the *No Child Left Behind Act of 2001* (NCLB) (P.L. 107-110). NCLB emphasizes the development of literacy as well as accountability for student outcomes. School personnel are required to demonstrate that all students are reading at or above grade level by the end of the third grade, and that they continue to make adequate yearly progress in following years.

The NRP and NCLB support reading instruction based upon “Scientifically-Based Research,” which is defined as “rigorous, systematic and objective procedures to obtain valid knowledge, which includes research that is evaluated using experimental or quasi-experimental designs, preferably with random assignment” (Slavin, 2002, p. 15). The problem for administrators, educators, and families who work or live with students who are deaf or hard of hearing is the paucity of “Scientifically-Based Literacy Research” available to establish research-based methods of instruction. Unlike the other areas of special education, often referred to as high-incidence disabilities (e.g., learning disabilities), or general education, the field of deaf education does not have a large body of empirically-based, experimental research to draw upon to establish research-based methods for ensuring that every student with a hearing loss becomes a literate adult. Compounding the challenge of meeting the literacy goals of NCLB is the

ongoing difficulty that students who are deaf or hard of hearing have experienced in developing reading skills. National research for students who are deaf or hard of hearing (e.g., Allen, 1986; CADS, 1991; Traxler, 2000) indicates that the average student with a hearing loss graduates from high school with reading comprehension skills at approximately the fourth grade level. Approximately 20 percent (some 2,000 annually) leave school with a reading level at or below second grade (Dew, 1999).

It is important to note that there are some students who are deaf or hard of hearing who perform on grade level in the area of reading (Erickson, 1987; Geers & Moog, 1989), as well as those who have become successful writers (Cambra, 1994; Schirmer, Bailey, & Fitzgerald, 1999). However, for the majority of students who are deaf or hard of hearing, learning to read and write is tortuously slow and frustrating. Research and observation suggest a variety of reasons why students who are deaf or hard of hearing struggle to become fluent readers and writers. Five often cited problems are:

1. Hearing children learn to map the spoken language they already know to the printed words on a page. For English, like most languages, that mapping is based on sound. Once children understand the underlying principles of the print-sound mapping, once they “crack the code,” they use their knowledge of their spoken language to facilitate the reading process (Goldin-Meadow & Mayberry, 2001). Children who are deaf or hard of hearing do not have easy access to the phonological code. Additionally, natural sign languages such as American Sign Language (ASL) have their own vocabularies, morphologies, and syntaxes, which do not parallel those of spoken or printed English (Marschark & Harris, 1996).

2. Many children who are deaf or hard of hearing begin formal schooling with little fluency in either a spoken or signed language or an awareness of print and literacy concepts (Marschark & Harris, 1996). Reading and writing are considered secondary forms of expression, highly dependent on a primary language system such as speech or sign as a foundation for development. Unlike their hearing peers, who learn to read and write in a language they already know, many students who are deaf or hard of hearing learn to read and write while simultaneously learning their first language.
3. Children who receive stimulating literacy experiences from birth onward have an edge when it comes to vocabulary development, understanding the goals of reading, and developing an awareness of print and literacy concepts (Lyon, 2001). In comparison to their hearing peers, children who are deaf or hard of hearing do not have books read to them as often (Paul, 1998), which has been determined to be an essential component in literacy development (Adams, 1991). Adults often don't read books to children who are deaf or hard of hearing because they don't feel comfortable signing, they have a limited sign vocabulary, the difficulty of finding a comfortable way to seat the child and hold the book to accomplish satisfactory visual contact, or they don't receive positive feedback from the child (Paul, 1998; Stewart & Kluwin, 2001).
4. Vocabulary is critical to reading comprehension. The larger the reader's vocabulary, the easier it is to make sense of the text (Baumann & Kame'enui, 1991). Research suggests that students who are deaf or hard of hearing are delayed in their level of vocabulary knowledge, have smaller lexicons, acquire new words at slower rates, and have a narrower range of contexts that result in word learning (Lederberg & Spencer, 2001). Thus, a vicious circle is created: Impoverished vocabularies limit reading comprehension,

and poor reading strategies and skills limit students' ability to acquire adequate vocabulary knowledge from context (deVilliers & Pomerantz, 1992).

5. To be an effective reader individuals need to be active, self-regulated, and armed with a variety of strategies to help them understand what they are reading (Snow, 2002).

Regrettably, many students who are deaf or hard of hearing continue to struggle with lower-level skills, such as recognition of words, syntactic parsing, and understanding vocabulary. As a result, they do not develop the independent reading strategies such as, self-questioning, activating prior knowledge, summarizing the main idea, constructing representational images, predicting what text will follow, drawing inferences, monitoring for misunderstanding, and rereading difficult sections of text necessary to understand many narrative or expository texts (Andrews & Mason, 1991; Strassman, 1992).

In our current service-and-knowledge-driven economy, in which high levels of literacy and numeracy are required of almost everyone to achieve a good standard of living, there is a demand for rigorous, sustained, scientific research in education (National Research Council, 2002). Simultaneously, as previously noted, NCLB and many federal grant programs call on educators to use "Scientifically-Based Research" to guide their decisions about which teaching approaches to use. "Scientifically-Based Research" includes: experimental control (or comparison) groups, replication of results through multiple studies, an ability to generalize results, rigorous standards especially via peer review, and convergence of results between studies (U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, 2003). When strong Scientifically-Based Research does not exist, it has been suggested that researchers produce syntheses of research summarizing the evidence pertaining to the effectiveness of educational interventions and approaches (Valentine

& Cooper, 2004). One method often used for integrating a body of literature is meta-analysis. For example, the NRP suggested, “First, where possible, there should be meta-analyses of existing experimental or quasi-experimental research in topic areas not addressed by the NRP” (National Institute of Child Health and Human Development, 2000, p. 19).

Meta-analysis is a statistical procedure used to identify trends in the statistical results of a set of existing studies concerning the same research problem (Glass, 1976; Rosenthal, 1978). Through such a procedure, effects, which are hard or impossible to discern in the original studies when sample sizes are too small, can be made visible, as the meta-analysis is equivalent to a single study with the combined size of all original studies.

Meta-analytic reviews go beyond narrative reviews in the sense that they are systematic, explicit, and utilize quantitative methods of analysis (Rosnow & Rosenthal, 1996). Because of these features, meta-analytic reviews are considered to provide more thorough, comprehensive, and precise summative evaluations that entail greater objectivity than narrative reviews. Moreover, meta-analysis is consistent with American Psychological Association guidelines that call for the use of effect sizes, which allow for an evaluation of the practical significance of differences. Consequently, the purpose of this research was to conduct an exhaustive review of the literature and a meta-analysis of literacy research in the field of deaf education.

Method

Study Selection Criteria

We used a three-step literature search strategy to identify pertinent studies. First, computer searches in ERIC, PsychINFO, the William S. Gray database and the Kraus Curriculum database were conducted. The literature search terms used were deaf, deafness, hard of hearing, hearing impaired, literacy, reading, and writing. Specifically, the terms deaf,

deafness, hard of hearing, and hearing impaired were each individually cross-referenced with literacy, reading, and writing. Second, the reference list from every identified study was reviewed. Third, manual searches for articles related to literacy and hearing loss of all issues of the *American Annals of the Deaf*, *Volta Review*, and the *Journal of Deaf Studies and Deaf Education* between 1963 and 2003 were conducted.

Inclusion Criteria

For the purposes of this project literacy was defined as the ability to read and write. We relied heavily on the materials made available by the What Works Clearinghouse (WWC) to guide us. Specifically, we used the Study Design and Implementation Assessment Device (DIAD) (Valentine & Cooper, 2004) as a model for the development of our own study team DIAD (please see Appendix A). One study team member screened each article to identify those that were research studies reporting literacy data for students who are deaf or hard of hearing. Each of the studies included in this analysis had to meet the following selection criteria:

1. The study was published in a peer review journal between 1963 and 2003. Only peer reviewed studies were considered. Unpublished manuscripts (e.g., dissertations) were excluded.
2. Participants in the study were identified as students who are deaf or hard of hearing.
3. The study sample consisted of children and youth between 3 and 21 years of age.
4. Studies had to provide the necessary statistical information for the estimation of effect sizes (e.g., means, standard deviations, group sizes, F values, t values, r values).
5. Studies had to incorporate a control group.

Nine hundred sixty-four articles were reviewed. Five hundred and sixteen were excluded because they were position papers, practitioner articles, literature reviews, curriculum

development descriptions, or program descriptions. Four hundred and twenty-five were excluded because they were studies that lacked a control group, studies of teachers or families, qualitative studies, or studies that included individuals who were either younger than 3 or older than 21. Three team members reviewed each of the remaining studies to ensure that a description of the intervention, a control group, data related to literacy as a dependent variable existed, and that each study sample was statistically independent from other studies. Two studies used the same sample and control group, forcing us to eliminate one of the studies. This process left us with 22 studies to review.

Each study was reviewed and coded according to its outcome domain. In addition, the effect sizes for each dependent variable were calculated. The effect size is a quantitative expression of the magnitude of difference between the scores of the experimental and control groups. Specifically, it is the difference between two means (e.g., treatment minus control) divided by the pooled standard deviation of the two conditions (Thalheimer & Cook, 2002). While statistical tests of significance tell us the probability of the null hypothesis, effect-size measurements tell us the size of the experimental effect and allow us to compare the magnitude of experimental treatments from one experiment to another (Thalheimer & Cook, 2002). Effect sizes have the same meaning across studies, even though studies use different measures and the scores have different score distributions (Glass, 1977). Effect size can be used to review a set of quantitative research studies on a particular problem or it can be used as an aid to interpreting the results of a single study (Wilkinson, 1999).

Generally speaking, the effect size statistic is helpful in judging the practical significance of a research study. An effect size of 1.0 indicates that the treatment group mean was one standard deviation higher than the control group mean. Thus, the average participant in the

experimental group performed at a level that was higher than approximately 84% of all participants in the control group. An effect size of 0 indicates that the treatment and control group means were identical, revealing the training had no effect. An effect size of 0.2 is considered small; an effect size of 0.5 is moderate; and an effect size of 0.8 or above is large (Cohen, 1992).

In calculating effect size estimates for this study the average scores were weighted by sample size according to procedures recommended by Hedges and Olkin (1985). Weighting was conducted because of the general tendency for treatment effects to be inversely related to sample size. The formula used to determine effect sizes is provided in Appendix B.

Results

Table 1 provides a summary of the studies reviewed. Included are the author(s) of the study and date of publication, the weighted effect size, age range, gender, and a research summary. In addition, for the studies with a positive effect size suggestions for how the results of the study may apply to educational practice are provided. Several studies are listed more than once because the researchers used multiple assessments (dependent variables) to examine the effectiveness of the intervention (independent variable). Examination of Table 1 reveals two important factors:

1. No two studies examined the same dimension of literacy (e.g., reading comprehension, vocabulary, word recognition, writing).
2. No replications of previously conducted studies were undertaken.

As such, we were unable to establish distinct categories or apply meta-analytic techniques with any group of studies. Accordingly, our initial syntheses of the research is limited to using the information presented in Table 1 to identify promising elements of a reading program for

students who are deaf or hard of hearing. Results from the studies with large effect sizes suggest the importance of:

- Rehearsal
- Explicit vocabulary instruction and practice with short passages
- High interest literature
- Instruction in the grammatical principles of ASL and how to translate ASL into written English
- Teacher discussion of stories and reading comprehension strategy instruction
- Interaction
- Reading to young students
- Use of captions
- Intensified instruction
- Use of word processing
- Using simple stories and word recognition practice with young readers
- Use of the general education curriculum
- Direct instruction of sight words and teaching morphological rules

Discussion

The purpose of this study was to conduct a meta-analysis of research related to literacy and students who are deaf or hard of hearing. We examined the literature published on this topic over the past 40 years. A variety of limitations need to be noted. First, despite an exhaustive review of the literature, we were able to locate only 22 studies that met our inclusion criteria. Clearly, there is a need for more experimental studies in the area of literacy development of students who are deaf or hard of hearing. Second, while every research study was reviewed by

three individuals to determine if it met the inclusion criteria, it is possible that a relevant study was excluded. Third, many of the studies included in this review provided insufficient information about the characteristics of the participants. Often, only a general age range was provided, gender breakdown was not supplied, information about degree of hearing loss was omitted, and no information about ethnicity was included. Future researchers should gather and report these important details. Fourth, we used a stringent criterion of quality for our initial review of the literature. As previously noted, we used the recommendations of the What Works Clearinghouse (WWC) for selecting empirical studies yielding research-based evidence (Valentine & Cooper, 2003). Consequently, we chose to exclude dissertations, professional presentations, ERIC documents as well as descriptive and qualitative studies. However, we do not endorse a single research method, but rather believe that various research designs are needed to answer different research questions and purposes. We also believe that in some instances when a group design is appropriate, it may be unacceptable to deny services to control group participants. Consequently, for ethical and financial reasons, as well as investigations of issues that have only anecdotal evidence, it is appropriate to use other types of research that produce results that can then be further tested using experimental or quasi-experimental research designs.

As a follow-up to this study, we are in the process of reviewing the other types of literacy research that were not included in this study to examine the topics and themes addressed. We plan to widen our lens using the guidelines for evaluating the quality of evidence suggested for bridging the gap between research and practice for different methodologies (e.g. Brantlinger, Jimenez, Klingner, Pugach, & Richardson, 2005; Chatterji, 2004; Gersten, et al., 2005; Horner et al., 2005; Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005).

Our review of the literature and the attempted meta-analysis indicate that promoting the literacy skills of students who are deaf or hard of hearing is a highly-valued educational outcome. Yet, our review of 40 years of literature suggests that the field of deaf education does not have what the U.S. Department of Education refers to as “strong evidence of effectiveness” or even “possible evidence of effectiveness” about any specific educational intervention for promoting the literacy development of students who are deaf or hard of hearing. Rather, it appears that most of our practices have been determined by practitioners and respected professionals in the field. If we use the framework to classify practices proposed by Odom et al., (2005), which is based on the system developed by the Oxford Centre for Evidence-based Medicine (2001), the majority of the literature in our field would be considered Level 4, the lowest level. The 4 levels of evidence proposed are:

Level 1 – meta-analysis including well-designed randomized control studies.

Level 2 – controlled studies without randomization and quasi-experimental designs.

Level 3 – well designed non-experimental studies (i.e., correlational and case studies).

Level 4 – expert committee report, consensus conference, and experience of respected professionals.

Similar results were reported by Easterbrooks (2005), who recently reviewed the literature in the area of literacy and deaf education and noted:

Research in the area of literacy, although improving in the last 5 or 10 years, is rife with speculation, pseudo-empirically based for the most part, deferential to a belief system, and characterized by many holes in the knowledge base.

Also, the majority of interventions that are currently used with students who are deaf or hard of hearing, (e.g., the language experience approach, bilingual approaches, the writing

process, dialogue journals, trade books versus basal readers, predictable books, teaching sight words, teaching figurative language, or the use of story retelling), have a paucity of well-conducted research to support their use. Comparable findings were also noted by Easterbrooks (2005), who wrote:

We cannot point to many programs, materials, strategies, or interventions and declare there is experimental proof of their effectiveness. In addition, many of the practices that are considered sacred cows in deaf education have little or no evidence to support their efficacy.

Given the lack of empirical studies to support practice in the field of deaf education, it may be beneficial to use the information gained from the studies included in Table 1, in combination with the general education literacy research to develop a model comprehensive literacy program for students who are deaf or hard of hearing. The model, as well as the specific components of the model, could be viewed as working hypotheses that could be researched and revised based on the results of validation studies. As suggested by Levin, O'Donnell and Kratochwill (2003), the initial hypotheses would be Stage 1 of a four-stage approach to examine the efficacy of the model and the components. Stage 2 would involve controlled classroom experiments. Stage 3 would entail the integration of the knowledge generated from Stage 2 into the design of randomized classroom trial studies or single-subject studies (Horner, et al, 2005). Stage 4 would determine the factors that lead to adoption of the model in educational programs and teacher preparation programs for students who are deaf of hard of hearing (Odom, Brantlinger, Gersten, Thompson, & Harris, 2005).

While acknowledging that there are professionals (e.g., Garan, 2002; Krashen, 2005), who question the process as well as the results of the National Reading Panel (NRP) (National

Institute of Child Health and Human Development, 2000), it does provide stimuli for developing a multi-dimensional model of reading instruction for students who are deaf or hard of hearing (Easterbrooks, 2005; Schirmer & McGough, 2005). Simultaneously, the essential elements of a comprehensive reading program reported by the NRP were also identified in *The national agenda: Moving forward on achieving educational equality for deaf and hard of hearing students* as the “core components” of a reading program for students who are deaf or hard of hearing (2005, p. 22).

NRP identified five essential areas for effective reading instruction. Combining the information presented in Table 1 with the recommendations of the NRP suggests that a reading program for students who are deaf or hard of hearing may include the following components:

1. Conversation - the use of speech and/or sign for informal exchange of views, ideas or information.
2. Alphabetic Principle – the use of letters and letter combinations to represent phonemes and/or signs in a system of writing.
3. Vocabulary - the words we must know to communicate effectively.
4. Fluency – the ability to read a text quickly and accurately with ease and expression.
5. Comprehension – the process of constructing meaning from print.
6. Writing – communicating through the use of written symbols.

More in-depth information about each element and the incorporation of the factors noted above and in Table 1 are included in Appendix C.

At the end of the Agricultural Age, the ability to write your name meant that you were literate. Fifty years later, as our society transitioned to the Industrial Age, a sixth-grade education

provided the same status. Today, in our global economy, emerging technologies have caused the criteria for literacy to soar. As explained by Shaywitz, (2003):

In our increasingly technical society it's all about print: instructional manuals for the workplace, for computers, for cars, for putting together children's toys; directions for travel or for work, for taking medications, for making up baby formulas, for safety, for voting, for messages via e-mail, the Internet, pager, and fax. Learning to read opens the door to a better, brighter future (p. 293).

Not long ago, the majority of students who were deaf or hard of hearing were able to graduate from high school and immediately begin earning a paycheck. Most schools for the deaf had vocational education programs that taught skills that matched the available jobs. Examples of these jobs include print shop, shoe repair, carpentry, sewing, barbering, welding, and automotive repair. Unfortunately, jobs in manufacturing are diminishing. As a result, employers are seeking workers who are computer literate, as well as skillful in reading, math, and problem solving (Luckner, 2002). Individuals with poor reading skills are at a disadvantage when competing for jobs and therefore less likely to be employed (Frank, Karst, & Boles, 1989).

The development of literacy skills is regarded as one of the highest priority areas in contemporary education. Yet, it is one of the most complex skills students must master to ensure academic success as well as to function effectively in the workplace and in society. Technology, and the science behind it, permeates all aspects of our lives, from how we work and communicate to what we shop for and how we pay our bills. The complexity of today's world means that individuals need to have some level of proficiency in reading, mathematics and science in order to understand and participate fully in economic and social realms. The crucial factor that promotes or hinders success in today's society is the ability to access, understand, and

use different types of information. Our job as educators is to help students develop the appropriate attitudes, knowledge and skills that will enable them to become proficient readers and writers. Improving the quality of research and bridging the gap between research and practice in the field of deaf education is an essential step that needs to be taken if we hope to improve the educational and career outcomes for individuals who are deaf or hard of hearing. As noted in *The national agenda: Moving forward on achieving educational equality for deaf and hard of hearing students*, “Research is the foundation upon which quality educational practices for deaf and hard of hearing students is based” (2005, p. 37).

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Table 1

Author, Effect Size, Research Summary and Potential Implications of Studies Reviewed

Author and Year	Effect Size	Age	Gender	Research Summary	Implications for Practice
Swanson (1982)	3.311	No Report	4 females 14 males	Use of naming for integration and retrieval of visual information.	Rehearsal
MacGregor and Thomas (1988)	3.152	7.9 – 13.10	45 females and males	Use of a computer mediated text system that included text passages, an electronic dictionary that provided definitions for unfamiliar words, a sentence with the unfamiliar word used in context sentences as well as a game to practice key vocabulary improved vocabulary knowledge.	Explicit vocabulary instruction that includes the definition, a context sentence, and the use of computer games to provide practice with key vocabulary.
Anken and Holmes (1977)	1.979	12.11 – 14.3	10 females and males	Use of “adapted classics” improved word meaning.	High interest literature.
MacGregor and Thomas (1988)	1.969	7.9 – 13.10	45 females and males	Use of a computer mediated text system that included text passages, an electronic dictionary that provided definitions for unfamiliar words and a game to practice key vocabulary improved vocabulary knowledge.	Explicit vocabulary instruction and the use of computer games to provide practice with key vocabulary.
Akamatsu	1.829	High	6 females	Direct instruction of	Complementary

and Armour (1987)		School	and males	grammatical principles of American Sign Language (ASL), and translation to written English improved spontaneous writing skills.	instruction in sign and translation into written English.
Al-Hilawani (2003)	1.767	Third Grade	17 females 13 males	Use of the key word teaching strategy improved comprehension and vocabulary.	Teacher discusses story, teaches students to select key words, discuss events and summarize passages.
Schneiderman (1995)	1.682	11.2 - 14	20 females and males	Use of communication games to teach English-language skills within the context of meaningful social interactions improved writing skills.	Social-interactive approach for promoting language development.
Al-Hilawani (2003)	1.352	Third Grade	17 females 13 males	Use of modified reciprocal teaching approach improved comprehension and vocabulary.	Teacher discusses story, teaches students to summarize, question, clarify and predict.
Anken and Holmes (1977)	1.135	12.11 – 14.3	10 females and males	Use of “adopted classics” improved paragraph meaning.	High interest literature.
Gillespie and Twardosz (1997)	1.094	4 - 10	4 females 5 males	Evening group storybook reading to children at residential program had a positive impact on independent reading and interest in books.	Reading stories to students.
Boyd and Vader (1972)	1.058	Average = 17.2	20 females and males	Watching videos with captions improves comprehension of visual information.	Use of captions.
Calvert	.987	6.1 –	16	Intensified instruction	Intensified and

(1981)		8.11	females and males	that included low student/teacher ratio and competency-based instruction improved ability to recognize correct English syntax.	competency-based instruction.
Akamatsu and Armour (1987)	.966	High School	6 females and males	Direct instruction of grammatical principles of American Sign Language (ASL), and translation to written English improved written English grammar.	Complementary instruction in sign and translation into written English.
Craig, Craig and Latham (1964)	.923	Second Grade	20 females and males	Use of the natural language approach, composed of phrases, narrative language, and controlled presentation and reinforcement of new vocabulary improved written language better than analytical grammar approaches (e.g., Fitzgerald Key).	Analytical grammar systems of instruction are less effective than interaction in meaningful situations.
Walker, Munro, and Richards (1998)	.890	9 - 18	15 females and 15 males	Inferential strategy training (e.g., cause and effect relationships, predicting outcomes) improved reading comprehension.	Explicit inferential strategy instruction.
MacGregor and Thomas (1988)	.861	7.9 – 13.10	45 females and males	Use of a computer mediated text system that included text passages, an electronic dictionary with the definition for unfamiliar words as well as a vocabulary game at end of lesson improved vocabulary.	Explicit vocabulary instruction and vocabulary practice.
Mander,	.743	Average	3 females	Use of word	Use of word

Wilton, Townsend, and Thomson (1995)		= 7.6	and 4 males	processing program to improve spelling accuracy.	processing program.
Akamatsu and Armour (1987)	.725	High School	6 females and males	The process of having students transcribe 2- to-3 minute videotapes of a person signing a story in English word order, revise their summaries, and respond to questions about the stories increased comprehension.	Provide multiple exposures to content using sign and written English.
Andrews and Mason (1986)	.693	5 - 8	23 females and males	Reading simple storybooks (7 to 8 pages in length) with a picture and 2 or 3 words per page and corresponding manual signs for each word, along with 50 drill cards that had printed words on one side and a corresponding manual sign on the other side improved prereading print knowledge.	Reading to students, discussion of stories, rehearsal reading words and stories.
Dale (1979)	.628	Average = 10.3	5 females and males	Effect of education in general education setting with intensive support from trained teacher of the deaf improved word recognition skills.	Support to general education teacher and supplemental work on conversation skills, reading practice, and daily interaction with family using home-school notebooks.
Calvert	.491	6.1 –	16	Direct instruction of	Direct instruction

(1981)		8.11	females and males	sight words and key words in stories. Instruction in morphologic analysis and use of context clues to figure out word meaning, and intensified reading instruction improved vocabulary.	of sight words, explicit instruction of key words, morphologic instruction, instruction in using context clues, and intensified reading instruction.
Walker, Munro, and Richards (1998)	.453	9 - 18	15 females and 15 males	Explicit reading comprehension strategy training (e.g., locating details, story grammar) improved reading comprehension.	Explicit reading comprehension strategy instruction.
Calvert (1981)	.430	6.1 – 8.11	16 females and males	Direct instruction of referent words and phrases in sentences (e.g., pronouns, adverbs, conjunctions) along with an intensified reading program and direct vocabulary instruction improved ability in sentence and word meaning.	Direct instruction of referent words and phrases in sentences, and intensified reading instruction.
Calvert (1981)	.388	6.1 – 8.11	16 females and males	Intensified reading instruction improved paragraph meaning.	Intensified reading instruction.
Calvert (1981)	.329	6.1 – 8.11	16 females and males	Intensified reading instruction improved reading comprehension	Intensified reading instruction.
Braden et al., (1991)	.294	7.3 – 11.6	48 females and males	Use of computer assisted instruction practice activities improved reading.	Use of computers for reading practice activities.
Schirmer and	.284	10.11 –	10	Use of thematic	Pre-reading

Winter (1993)		16.0	females and 14 males	organizers would have a beneficial effect on comprehension.	activities need to engage students in thinking about the topic and provide direction for applying this knowledge to the actual reading.
Calvert (1981)	.216	6.1 – 8.11	16 females and males	Intensified reading instruction improved knowledge of syntax.	Intensified reading instruction.
Calvert (1981)	.201	6.1 – 8.11	16 females and males	Intensified reading instruction improved spelling.	Intensified reading instruction.
Braden et al., (1989)	.123	Average = 14.5	33 females and males	Use of telecommunication conversations improved language skills.	Use of email, chat rooms, and the Internet.
Birch and Stuckless (1963)	.121	Average = 10.3	23 females and 29 males	Use of programmed language improved understanding of comparative adjectives (e.g., colder than ...).	Systematic syntax instruction.
Birch and Stuckless (1963)	.105	Average = 10.3	23 females and 29 males	Use of programmed language improved understanding of predicate nominatives (e.g., a dog is an animal).	Systematic syntax instruction.
Ensor and Koller (1997)	.101	Average age = 16.9	7 females and 13 males	Repeated reading of the same passage for 15 minutes for 3 days improved word recognition.	Use of repeated reading.
Braden et al., (1989)	.098	Average = 14.5	33 females and males	Use of telecommunication conversations improved reading skills.	Use of email, chat rooms, and the Internet.
Ensor and Koller (1997)	.091	Average age = 16.9	7 females and 13 males	Repeated reading of the same passage for 15 minutes for 3 days improved reading comprehension.	Use of repeated reading.
Mander,	.081	Average	3 females	Use of word	Use of word

Wilton, Townsend and Thomson (1995)		= 7.6	and 4 males	processing program improves clarity of wording in writing.	processing program
Schirmer and Winter (1993)	.052	10.11 – 16.0	10 females and 14 males	Students use textual schema for comprehension processing while reading narrative text.	Use of well-formed stories and novels.
Braden et al., (1989)	.000	Average = 14.5	33 females and males	Use of telecommunication conversations had no differential effect on reading.	
Robbins and Hatcher (1981).	.000	9 to 12 years	18 females and 18 males	Word training had no differential effect on sentence comprehension.	
Wauters et al., (2001).	-.203	Average = 8.4	14 females and males	Word recognition ability improves when using speech-only training as well as when training includes speech paired with sign.	.
Birch and Stuckless (1963)	-.263	Average = 10.3	23 females and 29 males	Use of programmed language did not positively affect students' ability to develop sentences.	
Mander, Wilton, Townsend and Thomson (1995)	-.280	Average = 7.6	3 females and 4 males	Use of word processing program did not positively affect students' grammar skills.	
Calvert (1981)	-.288	6.1 – 8.11	16 females and males	Intensified reading instruction did not positively affect students' ability to imitate grammatically correct sentences.	
Birch and	-.319	Average	23	Use of programmed	

Stuckless (1963)		= 10.3	females and 29 males	language did not positively affect students' ability to use verbs.	
Calvert (1981)	-.326	6.1 – 8.11	16 females and males	Intensified reading instruction did not positively affect students' grammatical language skills.	
Braverman and Hertzog (1980)	-.326	8 - 20	92 females and 95 males	Caption rate (60, 90, 120, words per minute) did not affect reading comprehension.	
Mander, Wilton, Townsend and Thomson (1995)	-.359	Average = 7.6	3 females and 4 males	Use of word processing program did not positively affect students' accuracy using punctuation.	
Calvert (1981)	-.414	6.1 – 8.11	16 females and males	Intensified reading instruction did not positively affect students' ability to use prompted grammatically correct sentences.	
Birch and Stuckless (1963)	-.526	Average = 10.3	23 females and 29 males	Use of programmed language did not positively affect students' ability to use predicate adjectives.	
Mander, Wilton, Townsend and Thomson (1995)	-.574	Average = 7.6	3 females and 4 males	Use of word processing program did not positively affect students' organization writing skills.	

Table 2

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Appendix A

Study Design and Implementation Device

Reviewer: _____

Date: _____

Citation: _____

Composite Question 1. Intervention’s Relevance to the Review: Was the intervention properly defined?

- a. Yes, the intervention was adequately described, and it fully reflected ideas about what the intervention should be. Yes
- b. Maybe Yes, the intervention was adequately described, and it at least largely reflected ideas about what the intervention should be. Maybe Yes
- c. Maybe No, there were important details missing from the description of the intervention and/or possible problems with its implementation. Maybe No
- d. No, the intervention did not reflect ideas about what it should be and/or there were known problems with its implementation. No

Composite Question 2. Outcome Measure’s Relevance to the Review: Was the outcome measure properly defined and aligned to the intervention?

- a. Yes, the report presented evidence that the outcome measure was properly defined and aligned to the intervention. Yes
- b. [There is no “Maybe Yes” answer for this question.]
- c. Maybe no, there was evidence that the measure had face validity and was properly aligned to the intervention. However, evidence suggested the measure might not be reliable. Maybe No
- d. No, it is unclear what the outcome was. No

Composite Question 3a. Clarity of Causal Inference: Fair Comparison (for Randomized Designs): Were the participants (e.g. students, schools) in the group receiving the intervention comparable to the participants in the comparison group?

- | | |
|---|---------------------------------------|
| a. Yes, participants were randomly assigned to conditions and few participants dropped out during the study. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, random assignment was used but there was severe dropping out by participants. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, random assignment was used but there was differential dropping out of participants across conditions. | Maybe No
<input type="checkbox"/> |
| d. No, although random assignment was used, participants dropping out during the study probably led to the groups not being comparable. | No
<input type="checkbox"/> |

Composite Question 3b. Clarity of Causal Inference: Fair Comparison (for Quasi-Experimental Designs): Were the participants (e.g. students, schools) in the group receiving the intervention comparable to the participants in the comparison group?

- | | |
|---|---------------------------------------|
| a. [There is no “Yes” answer for these types of designs.] | |
| b. Maybe Yes, reasonable steps were taken to make the groups comparable. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, although steps were taken to make the groups comparable, the steps may not have been adequate. | Maybe No
<input type="checkbox"/> |
| d. No, it is unlikely that the participants in the groups were comparable. | No
<input type="checkbox"/> |

Composite Question 3c. Clarity of Causal Inference: Fair Comparison (for Regression Discontinuity Designs): Were the participants (e.g. students, schools) in the group receiving the intervention comparable to the participants in the comparison group?

- | | |
|--|---------------------------------------|
| a. Yes, an assignment variable with specified cutoffs was used to place participants into groups and there was no attrition problem. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, an assignment variable with specified cutoffs was used to place participants into groups but severe attrition may have affected study results. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, an assignment variable with specified cutoffs was used to place participants into groups, but differential attrition may have affected study results. | Maybe No
<input type="checkbox"/> |
| d. No, an assignment variable with specified cutoffs was not used to place participants into groups. | No
<input type="checkbox"/> |

Composite Question 3d. Clarity of Causal Inference: Fair Comparison (for Single-Factor Within-Subject Designs where two or more interventions are administered to a single sample of participants): Were the participants assigned to treatments in such a way that the effects of the intervention could be interpreted unambiguously?

- | | |
|--|---------------------------------------|
| a. Yes, participants were randomly assigned to one the possible counterbalanced orders of treatment combinations to control <i>practice effects</i> ; there was no potential for <i>differential carry-over effects</i> ; and few participants dropped out during the study. | Yes
<input type="checkbox"/> |
| b. Maybe yes, practice effects and differential carry-over effects were controlled, but there was severe attrition during the study. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe no, practice effects were controlled, but there was potential for differential carry-over effects. | Maybe No
<input type="checkbox"/> |
| d. No, neither practice effects of differential carry-over effects were controlled. | No
<input type="checkbox"/> |

Composite Question 4. Clarity of Causal Inference: Was the study free of events that happened at the same time as the intervention that confused its effect?

- | | |
|---|---------------------------------------|
| a. Yes, other events that might be alternative explanations to the intervention's effect have been ruled out. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, there were no other identified events that could be alternative explanations, but some alternative explanations remain plausible. | Maybe Yes
<input type="checkbox"/> |
| c. [There is no "Maybe No" answer for this question.] | |
| d. No, other events happening at the same time as the intervention may have caused the effect. | No
<input type="checkbox"/> |

Composite Question 5. Generality of Findings: Inclusive Sampling: Were targeted participants, settings, outcomes, and occasions included in the study?

- | | |
|--|---------------------------------------|
| a. Yes, the targets are represented in the sample. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, most important characteristics of the targets are represented in the sample. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, although some important characteristics of targets are represented in the sample, many important targets are not. | Maybe No
<input type="checkbox"/> |
| d. No, the sampled participants were not part of the target populations. | No
<input type="checkbox"/> |

Composite Question 6. Generality of Findings: Effects Tested Within Sub-Groups: Was the intervention tested for its effectiveness within important subgroups of target participants, settings, outcomes, occasions, and intervention variations?

- | | |
|---|---------------------------------------|
| a. Yes, the intervention was tested for its effectiveness on targeted variations. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, the intervention was tested for its effectiveness within most important subgroups of the participants and settings. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, although the intervention was tested for its effectiveness within some important subgroups of the participants and settings, many were left out. | Maybe No
<input type="checkbox"/> |
| d. No, at best the intervention was only tested for its effectiveness within limited important subgroups of the participants, settings, outcomes, occasions, and intervention variations. | No
<input type="checkbox"/> |

Composite Question 7. Precision of Outcome: Effect Size Estimation: Were the effect sizes accurately estimated?

- | | |
|---|---------------------------------------|
| a. Yes, the effect sizes appear to be accurately estimated. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, there was some evidence of statistical issues that may have caused the effect size to be inaccurately estimated, but the likely impact on inferences was minimal. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, there was evidence that statistical issues may have caused the effect sizes to be inaccurately estimated. | Maybe No
<input type="checkbox"/> |
| d. No, the assumption of statistical independence was not met, and dependence was not accounted for in the effect sizes. | No
<input type="checkbox"/> |

Composite Question 8. Precision of Outcome: Statistical Reporting: Were the statistical tests adequately reported?

- | | |
|---|---------------------------------------|
| a. Yes, the statistical tests were adequately reported. | Yes
<input type="checkbox"/> |
| b. Maybe Yes, sufficient statistical information was reported to allow, at a minimum, imprecise effect sizes to be calculated for most measured outcomes. | Maybe Yes
<input type="checkbox"/> |
| c. Maybe No, effect sizes could not be calculated for most outcome measures. | Maybe No
<input type="checkbox"/> |
| d. No, sample sizes were not reported, OR neither the magnitude nor the direction of the effects could be discerned for most outcome measures. | No
<input type="checkbox"/> |

Appendix B

Formula used to determine effect sizes

$$d = \frac{\bar{x}_{\text{exp}} - \bar{x}_{\text{control}}}{S_{\text{pooled}}}$$

where,

$$S_{\text{pooled}} = \sqrt{\frac{(n_{\text{exp}} - 1)s_{\text{exp}}^2 + (n_{\text{control}} - 1)s_{\text{control}}^2}{(n_{\text{exp}} - 1) + (n_{\text{control}} - 1)}}$$

and where,

\bar{x}_{exp} represents the mean for the experimental group.

\bar{x}_{control} represents the mean for the control group.

S_{pool} represents the pooled standard deviation between the two groups.

The pooled standard deviation is used rather than each group's standard deviation in the calculation because it provides a better estimate of effect size (i.e., an unbiased estimate).

GAIN SCORE (Glass, McGain, & Smith, 1981)

$$d = \left[\frac{\bar{x}_{\text{exp-post}} - \bar{x}_{\text{exp-pre}}}{S_{\text{exp-pooled}}} \right] - \left[\frac{\bar{x}_{\text{con-post}} - \bar{x}_{\text{con-pre}}}{S_{\text{con-pooled}}} \right]$$

where,

$\bar{x}_{\text{exp-post}}$ represents the post mean for the experimental group (i.e., mean score after the intervention occurred).

$\bar{x}_{\text{exp-pre}}$ represents the pre mean for the experimental group (i.e., mean score prior to the intervention occurring).

$\bar{x}_{\text{con-post}}$ represents the post mean for the control group (i.e., mean score after the intervention occurred).

$\bar{x}_{\text{con-pre}}$ represents the pre mean for the control group (i.e., mean score prior to the intervention occurring).

$S_{\text{exp-pool}}$ & $S_{\text{con-pool}}$ represent the pooled standard deviations between the pre and post measures for each group (i.e., Experimental & Control). E.g., $S_{\text{exp-pool}}$ is calculated by pooling the $S_{\text{exp-pre}}$ and the $S_{\text{exp-post}}$.

UNBIASED EFFECT SIZE, d' (i.e. D-prime)

$$d' = d \left(1 - \left[\frac{3}{4N - 9} \right] \right)$$

where,

$$d' \xrightarrow{d} d \text{ for large } N$$

This means that d' approaches d in distribution as the sample size gets larger, which would indicate an unbiased estimation of d . This is done because d is an unknown parameter.

Appendix C

Components of a Model for Literacy Development for Students who are Deaf or Hard of Hearing

Conversation

Communication skills develop as a result of humans' need to form relationships, to express themselves, to learn about the world, and to think (Niemann, Greenstein, & David, 2004). Longitudinal research has established that language acquisition by hearing children is highly related to the quality and quantity of conversational interactions they have with skilled language users (Hart & Risley, 1995; Wells, 1986). As a result, it has been postulated that children who are deaf or hard of hearing may also learn language best through conversational interaction with others (Easterbrooks & Baker, 2002; Johnson, 2000; Kretschmer & Kretschmer, 1989,1990; Miller & Luckner, 1992; Stone, 1988).

While infants are not born conversationalists, they are able to express their wants and/or needs before they say/sign their first words. Infants and toddlers use forms of pre-linguistic communication such as crying, eye contact, wiggles, coos, grunts, pointing, smiles, and laughs to convey their wants and needs. When adults respond to these reflexive cries, movements, and facial expressions, babies learn that these behaviors serve a purpose. These early turn-taking interactions provide a foundation for language development.

As babies continue to develop, their communication skills increase and they learn to use more precise behaviors such as reaching, touching, looking, pushing, pulling, facial expressions, babbling, and jabbering to express to people what they want or do not want. As young children continue to mature their communication skills also progress and they begin to use gestures and/or vocalizations to express feelings, get attention, comment on an object, request an action or object, request permission or information, get assistance, greet people, answer questions, supply

information, or protest. As noted earlier, they learn these communication strategies as a result of interactions and feedback from the significant people in their lives.

Conversations with children include unique features. Generally, adults follow the child's lead or topic, rather than imposing their own. Adults also reduce the complexity of their language so that it is closer to that of the child. In addition, adults often repeat or expand on what the child says rather than correcting the child, thus adults discreetly provide more advanced language models of the child's own message. Adults facilitate conversation by providing opportunities for language to be produced and enabling children to be active participants. Adults accept children's behavior as meaningful communication, interpret it in a manner that is contextually appropriate, and become collaborators with the children in communicating the message more effectively. Adults collaborate by informing children about additional information that is needed, modeling language that can be used to express this information, and providing assistance in formulating the expanded communication. These strategies help children in developing messages with greater complexity, specificity of meaning, accuracy, and clarity of expression. This process of participating in more complex communications enables children to attach meaning and function to the language so that gradually more of the responsibility for the communication is shifted to the child.

Additional strategies adults use to help children make sense of the world as well as to develop communication skills are mediation and scaffolding. When adults mediate they provide structure, help focus attention on relevant information or aspects of an experience, and help children organize and generalize their knowledge. Adults generally mediate through conversation. Scaffolding is a general term used to describe the supportive structure that adults use to assist children in performing slightly beyond where they are able to perform

independently. The supports are decreased or removed as children become more independent and then new supports are provided so the children can perform at a new higher level. Specific examples of scaffolding include prompts, questioning, information restatements, modeling, role-playing, repeated practice, and discussion. Once again, most scaffolding activities occur through conversation. A guiding principle for these interactions is that children should be given recognition and credit for their thoughts, rather than criticized for errors in form. Simultaneously, as children become more linguistically skilled, adults need to learn to become conversational partners, engaging in dialogues, rather than delivering adult controlled monologues.

While developing conversation skills is important for all the reasons listed above, it is also prepares children to learn to read and write (French, 1999). Opportunities for conversations occur naturally throughout the day. And whenever possible, they should be based upon the authentic need to communicate in real-life situations. For example, they can take place within the routines of daily living (Boys Town National Research Hospital, n.d.) as well as within the social context of learning. Adults can arrange several chats each day (Clark, 1984; Kretschmer & Kretschmer, 1986). Topics such as real events and personal interests are wonderful stimuli. Adults should remember to offer information as well as ask questions. Scripts (Whitesell & Klein, 1995), scenarios (Stone, 1988), and role-playing are also positive activities for helping students improve their conversational skills. Additional opportunities for conversations occur when adults and children interact with literature. Not only does the literature provide excellent avenues for shared conversations, but many stories also contain dialogues between characters that can provide incidental models for how conversations occur. In addition, when adults read to children using read aloud or story signing, they have built-in opportunities to discuss the story,

comic, poem, song, newspaper/magazine article, or expository text. Reading and writing conferences also provide avenues for conversation.

Students who do not acquire conversational skills incidentally may need explicit instruction in how to participate in conversations. Components of instruction may include the structure of most conversations (e.g., opening, topic initiation, topic maintenance, topic expansion, topic change and closing) as well as interaction skills (e.g., attention-getting, turn-taking, clarifying, questioning, feedback, repair strategies and signaling transitions).

Alphabetic Principle

The alphabetic principle is the understanding that there are systematic and predictable relationships between written letters, spoken sounds and the letters of the manual alphabet. Learning the alphabet is fundamental to becoming a successful reader and writer. Learning that there are predictable relationships between letters, sounds and hand shapes allows children to apply these relationships to both familiar and unfamiliar words, and to begin to read and write with fluency.

One of the first steps in becoming a successful reader and writer is to learn to recognize the letters of the alphabet. The more accurately and the more quickly children can identify the letters of the alphabet, the better they will read. Equally important is letter name knowledge. Knowing letter names is strongly related to children's ability to remember the forms of written words and their ability to treat words as sequences of letters. Children learn letter names by having alphabet books read to them, singing/signing songs such as the "Alphabet Song," and by reciting/signing rhymes. They learn letter shapes as they play with blocks, plastic letters, and alphabet books. Informal but planned instruction in which children have many opportunities to see, play with, and compare letters leads to efficient letter learning. This instruction should

include activities in which children learn to identify, name, and write both upper case and lower case versions of each letter.

For students who are deaf or hard of hearing who use and benefit from oral instruction, there are a variety of programs that can be used to teach children to break apart and manipulate the sounds of words (phonemic awareness), teaching them that these sounds are represented by letters of the alphabet that can be blended together to form words (phonics), and teaching them to decipher a word by sounding it out (decoding).

Students need to transition from knowing the alphabet to being able to read words. Attention should be directed at learning the most frequently used words. This can be achieved by reading a wide variety of well-written and engaging stories and by providing direct instruction in sight words using high-frequency word lists. Students will require multiple exposures to words and ongoing practice before they can be expected to recognize them instantly. Also, common affixes, prefixes attached at the beginning of the words and suffixes attached at the end of the word should be introduced systematically throughout the primary and intermediate grades.

Fluency

Fluency refers to the ability to read text accurately and quickly. Fluency provides a bridge between word recognition and comprehension. Fluent readers are able to group words rapidly and focus their attention on understanding the text. Less fluent readers focus their attention on individual words. Consequently, they have less attention left for comprehending the text.

Fluency develops progressively over time as a result of many opportunities to practice. However, fluency is not a stage of development at which readers can read all words quickly and easily. Fluency changes, depending on what readers are reading, their familiarity with the words,

and the amount of practice with reading text. Even very skilled readers may read in a slow, labored manner when reading text with many unfamiliar words or if they lack sufficient background knowledge. Consequently, the focus of fluency instruction should change as students develop. An instructional progression may go from words to phrases to narrative text to expository text to poetry/songs to technical materials.

There are several approaches to improving fluency. The first is to model fluent reading. Students need to hear/see fluent reading. Read aloud/story sign to students. Read often and with expression. Choose selections carefully. Expose them to a wide variety of genres including narrative, expository, poetry, newspapers and magazines. Choose texts that will spark students' interests and draw them into the reading experience. Also ask other adults to read aloud/story sign to students. Encourage parents or other family members to read aloud/story sign to their children at home. The more models of fluent reading students hear/see the better.

Having students read and reread text a number of times or until a specific level of fluency is reached is also beneficial. Students should practice reading aloud/story signing text that is reasonably easy for them. That is, texts selected for repeated readings should be short, predictable, and simple. As students attain adequate speed and accuracy with easy texts, the length and difficulty of the materials can be gradually increased. Consequently, the use of leveled books, books categorized according to their difficulty so that they can be matched to students at that level, is important for fluency instruction.

Another option is partner reading. In partner reading, paired students take turns reading aloud/story signing to each other. For partner reading, more fluent readers can be paired with less fluent readers. The stronger reader reads a paragraph or page first, providing a model of fluent reading. Then the less fluent reader reads the same text. The stronger student gives help with

word recognition and provides feedback and encouragement to the less fluent partner. The less fluent partner rereads the passage until he or she can read it independently. Partner reading need not be done with a more and less fluent reader. In another form of partner reading, students who read at the same level are paired to reread a story that they have received instruction on during a teacher-guided part of the lesson. Two readers of equal ability can practice rereading after hearing/seeing the teacher read the passage.

We can also practice as well as assess fluency by asking students to read aloud/story sign and count the number of words they are able to read correctly in exactly one minute. We can compare their performance with their previous performances. While there are published norms for hearing students (e.g., Students should be reading approximately 60 words per minute correctly by the end of first grade, 90-100 words per minute correctly by the end of second grade, and approximately 114 words per minute correctly by the end of third grade.), there are no established norms for students who are deaf or hard of hearing, oral or signed reading. It is beneficial to plot students' progress on a graph so they can monitor their growth.

Vocabulary

We use words to think, to express ideas and feelings, and to learn about the world. Most hearing children acquire a vocabulary of over 10,000 words during the first five years of their lives (Smith, 1987). Then their vocabularies increase at a rate of approximately 3,000 new words each year, or about 8 words per day throughout their twelve years of schooling (Nagy & Anderson, 1984).

Word learning is an incremental process that begins at birth and continues throughout our lives. We learn meanings of words indirectly by engaging in conversations, having books read to us, and by reading on our own (Carnine, Silbert, Kame'enui, & Tarver, 2004).

Simultaneously, our understanding of words goes through a series of steps. The stages suggested by the Partnership for Reading (2001) are:

Unknown – The word is completely unfamiliar, and its meaning is unknown.

Acquainted – The word is somewhat familiar; the student has some idea of its basic meaning.

Established – The word is very familiar; the student can immediately recognize its meaning and use the word correctly.

Because words play such an essential role in learning, improving students' vocabulary knowledge has become an educational priority. Student word knowledge is strongly linked with reading comprehension (Snow, 2002). Though most words are learned indirectly, some vocabulary must be taught directly. Direct vocabulary instruction helps students learn high frequency words that appear most often in texts as well as difficult words that represent complex concepts.

High frequency words, also referred to as sight words, make up about 65 percent of all written material (Harp & Brewer, 2005). Many of these words, such as the, of, and, to, you, that, and this, carry minimal meaning themselves. Yet, they do affect readers' ability to comprehend text. Fry (1980) developed a list of the 300 most common words used in print. Carnine, Silbert, Kame'enui, and Tarver (2004) have a similar list of 400 words. Professionals can use a variety of activities and procedures, such as word banks, word walls and timed sight-reading word lists, to make sure that students are able to instantly recognize sight words.

In addition to directly teaching sight words, professionals will want to directly teach specific word meanings and teach word-learning strategies. At the beginning of a unit of study or before students read, it is beneficial to teach them specific words that are central to the material being learned. If students are acquainted with the vocabulary word or concept being learned,

then providing a synonym or definition, followed by a couple examples and non-examples may be sufficient. If students are learning a new word that represents an unknown concept (e.g., evaporation), then providing a definition, examples, non-examples, discussion, graphic organizers, and daily review for several days would be appropriate (Carnine, Silbert, Kame'enui, & Tarver, 2004).

Teaching word-learning strategies such as using word parts, how to use context cues, and how to use references such as dictionaries, glossaries, and a thesaurus are also important. As noted in the section on alphabetic principle, students need direct instruction in affixes, compound words, root words, and figurative language. Similar direct instruction, which includes an explanation of the purpose of contextual analysis, modeling, guided practice, and independent practice with examples sequenced from easy to difficult will help students become skilled at independently determining word meanings.

Dictionaries, glossaries, and thesauruses, both paper and electronic, are valuable resources, especially for sophisticated language users. However, for young students or students with limited vocabularies the process of looking up words may be tedious and of limited benefit. Therefore, professionals should try to select resources that are at the appropriate level for students and provide students with direct instruction about how to look up the meaning of an unknown word and how to choose an appropriate definition or synonym.

Finally, students benefit from repeated exposure to vocabulary. When students hear, see, write, say, and/or sign words, they learn them better. Students who are read to often, and/or who are engaged in reading a wide variety of texts learn more vocabulary. Consequently, it is important for professionals to know what each student's interests are and to suggest materials of interest and that are at an appropriate level of difficulty for that student. Simultaneously, a

variety of computer software and computer-assisted instructional vocabulary programs can be used to help provide the repeated exposures to words in different contexts that are necessary for successful word learning.

Comprehension

Reading comprehension is “the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (Snow, 2002, p. 11). The central purpose of reading is comprehension. To comprehend text, proficient readers demonstrate specific cognitive, motivational, linguistic, and general knowledge abilities (Snow, 2002). Examples of important cognitive abilities include attention, memory, inference, critical analysis, and visualization. Examples of motivational ability include having a purpose for reading, an interest in the content, and self-efficacy as a reader. Examples of important language skills include vocabulary, discourse, and syntax. Examples of general knowledge include familiarity with the topic being read about, fluent word recognition, and specific comprehension strategies.

Proficient readers read for a purpose and actively monitor their understanding. They notice when something they are reading does not match their background knowledge or if it is unclear they use a variety of strategies to rectify this misunderstanding. They ask themselves questions; they pause to think; they create mental pictures; and they use personal knowledge and experiences to try and understand what the author has written (Owocki, 2003). In contrast, less skilled readers are not as likely to detect lapses in comprehension and, when they do detect them, are less able to repair them. They look at the words of a passage without comprehending their meaning and do not recognize their lack of comprehension. They do not reread the passage or take other steps to understand it.

The goals for comprehension instruction are to provide students the knowledge and skills to reflect on and learn from what they read. Specific actions professional can undertake to help students suggested by Snow (2002) and Owocki (2003) include:

1. Creating a learning environment that fosters an expectation that text will make sense.
2. Providing explicit instruction, modeling and feedback about strategy use.
3. Providing time in school for students to read materials that are interesting and worth talking about.
4. Working with families to encourage students to read at home.
5. Using scaffolding techniques and conversational talk with students to help them become more skilled at using a variety of comprehension strategies.
6. Using a variety of methods to respond to literature (e.g., drawing, writing, talking/signing, drama).
7. Using a variety of assessment procedures to document and evaluate students' reading skills.

Professionals who want to use children's literature will want to use "leveled" books, which have been reviewed and determined how difficult it would be for a reader to read each book. A valuable resource for leveled books is Fountas and Pinnell (1999). In addition to having access to leveled books, it is important to have access to books that cover a wide range of interests and genres.

Because comprehension is the application of our background knowledge to the process of reading, it is important for professionals to help students become aware of what they know about a topic before they read the text. Sample ways to build or activate background knowledge are use of visual aids, in-class experiences, webbing, concept-related books, and picture walks. A picture

walk is conducted by slowly showing students each picture of the story. Students are asked to describe what they see, but neither the adult nor the students read any text (Harp & Brewer, 2005). When conducting picture walks, it is best to stop looking at the pictures before the end of the story in order to not reveal the plot.

Knowledge of text structure is also an important factor in fostering comprehension (Dickson, Simmons, & Kame'enui, n.d.). Students are initially introduced to narratives. Consequently, students should be taught narrative text structure. Narrative text structure or story grammar involves an understanding of the characters, the setting, the problem, attempts to solve the problem, and the resolution. Students who can recognize story grammar patterns in narrative texts are better able to make predications, apply previous experience, organize the text as they read, and retain the important information in the story (Snow, 2002).

As students progress through school they are expected to read expository texts. Expository texts have more complex and varied structures. They include diverse vocabulary, relatively long passages and less familiar content. Expository texts also have different organizational patterns than narrative texts. Several of the most common expository text patterns are: (1) major idea/supporting details, (2) details/conclusion, (3) time order, (4) cause/effect, (5) compare/contrast, and (6) question and answer (Harp & Brewer, 2005). As with narrative texts, it is beneficial to provide explicit instruction in expository text structure as well as to teach students to use strategies such as self-questioning, mapping, webs, and summarizing (National Institute of Child Health and Human Development, 2000; Snow, 2002).

Writing

Reading and writing skills grow in tandem; the sophistication of students' writing skills is most often related to their reading ability. Students learning to write are also learning to read,

while simultaneously increasing their conversational skill development. Growth in each system supports growth in the other systems.

Unfortunately, writing is a complex process. To produce a successful composition a writer must decide what to say about a topic, think about the audience, manage the physical requirements of writing or keyboarding, and then arrange the information in an acceptable format, keeping in mind the rules of spelling, capitalization and punctuation. The demands of this process are often overwhelming for many students who are deaf or hard of hearing.

Fundamental to the development of good writing skills is the establishment of environments that help students understand how the process of written communication works and that encourages students to see themselves as writers. Simultaneously, while it may be true that people learn about writing by writing, simply having students write will not result in improved writing performance. The development of writing skills depends on the opportunity to write as well as the provision of properly designed and sequenced instruction, guidance, and practice in relevant skills and strategies. Consequently, professionals will want to provide instruction as well as foster a high degree of student involvement in the use of the writing process. While variations of the writing process exist, most models include the following five-steps:

1. Prewriting
2. Drafting
3. Revising
4. Editing
5. Publication

These stages encompass everything that goes on from the initial thinking about a topic to the publication of the completed project. The process itself is not necessarily sequential; for example, some writers make revisions as they go along rather than as a separate step in the process. During drafting, some writers may go back to their prewriting notes, or gather more information, or discuss their ideas with a peer in order to develop a piece further. Also, every writing activity does not involve the complete process. Students may not bring every piece to the publication stage. Those pieces not brought through the complete process may be thought of as exploratory writing.

Professionals will also want to provide direct instruction in the characteristics of good writing. The six qualities generally regarded as important for good writing (Spandel, 2001) are:

1. Ideas – clarity, detail, original thinking, and interesting.
2. Organization – internal structure, a captivating lead, logical sequencing, and a sense of resolution.
3. Voice – awareness of audience, involvement in the topic, energy.
4. Word choice – accuracy, phrasing, originality, sensitivity to the reader's understanding.
5. Sentence fluency – logical sentence construction, smooth sentence structure, readability.
6. Conventions – overall correctness, attention to detail.

Additional factors professionals may want to take into consideration when planning writing programs suggested by Graham and Harris, (1988) and the Education Department of Western Australia (1994) include:

Allocate Time for Writing

Writers need regular blocks of time to write. Graves (1985) suggests students write for 30-minutes, four days a week to see any noticeable change in the quality of their writing. For younger students Ewoldt (1985) recommends that 15 minutes a day be set aside for writing.

Expose Students to a Wide Range of Literature

Students' experiences with print will have a strong effect on the writing they produce. Stories, poems, expository texts, newspaper articles, and songs all serve as models for students' writing. They influence what is written and how it is written. Professionals therefore will want to read aloud/story sign to students to allow them to have access to a range of meaningful reading/writing stimuli.

Create an Environment Conducive to Writing Development

Creating a positive writing environment, characterized by support and a focus on the positive aspects of students' writing is essential. First, students should be encouraged to take risks with their ideas as well as with the conventions of writing. Second, the development of a sense of community, where students share their compositions with the class, in small groups or pairs, is beneficial. Third, specific modifications to the environment can be helpful to students and timesaving for professionals. Examples of modifications include:

- Establish a writing center
- Post expectations for the current writing assignment
- Display checklists for revising and editing
- Post a chart of the stages of the writing process
- Create word bank mobiles
- Create a word wall

- Exhibit the finished writing on bulletin boards
- Maintain a library of student-created books

Provide Teacher Modeling

Modeling of the process of writing provides students with demonstrations of the type of thinking that goes on when people write. When students see adults working through the selection of a topic, rewriting parts of a sentence, looking for the right words, checking spelling or revising their writing, they learn that writing is not a one-step process for anyone.

Expose Students to a Broad Range of Writing Tasks

Writing topics are best generated from students' interests, experiences, as well as personal, social and educational needs. Yet there are often students who have a difficult time identifying topics to write about and others who are turned off by writing. Examples of different types of writing that can be fun for students include dialogue journals, free writing, speed writing, message boards, lists, notes, letters, descriptions, posters, songs and greeting cards. As students become more skilled and their attitude about writing improves they should progress to writing directions, research reports, and applications.

Integrate Writing with Other Academic Subjects

Writing is an important avenue for exploring thoughts, recording ideas, and demonstrating knowledge. As such, students can be asked to keep math, science, or social studies journals. They can also create summaries of content topics using the graphic organizers that have been developed for instruction. In addition, they can be asked to develop opinion essays about current events and/or controversial issues.

Provide Selective Feedback

Learning to write is a demanding and complex task. When professionals overemphasize students' writing errors, students may lose their motivation to write. To improve students' perspectives about writing, professionals will want to change their roles from that of graders looking for deficiencies to editors responding to drafts in progress. As such, professionals should focus on only a few errors. Priority should be given to errors that have been taught and practiced and to those that occur frequently and hinder the reader's understanding of the text. Whenever possible, feedback should be specific and include suggestions for making corrections.

Appendix C References

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