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ABSTRACT

Evidence from a nine-month longitudinal study of deaf children's early attempts at learning to read provides the construct for an instructional model that stresses that even though the children may have, at the least, a meager expressive sign language vocabulary, they can be lead successfully through the holophrastic or one-word stage of reading development by matching signs and meaning to print. In addition, the evidence identifies three levels of change in this word-reading development. At the first level, the child knows about printed word symbols, can handle a book properly, and begins to attend to stories and label pictures with manual signs. At the next level, the child can: recognize words on food labels, cereal boxes, and road signs in picture contexts; recognize the alphabet using finger spelling; read and print a first name; and attempt to sequence and recall stories. During the third level, the child rapidly increases a sight-word vocabulary, spelling and printing knowledge, and story reciting and sequencing abilities. Two classroom experiments and parent interviews provide additional evidence to support this instructional model. The findings of these efforts suggest that children's communicative interactions about reading related activities using finger spelling and manual signs with parents, teachers, or peers act as precursors to and possibly shape the reading acquisition process that follows. (HOD)

CENTER FOR THE STUDY OF READING

Technical Report No. 329

HOW DO YOUNG DEAF CHILDREN LEARN TO READ? A PROPOSED MODEL OF DEAF CHILDREN's EMERGENT READING BEHAVIORS

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Abstract

An instructional model based on deaf children's early attempts at learning to read is proposed based on a nine-month longitudinal study. This model holds that reading can be initiated by giving deaf children opportunities to match their internalized manual language to printed words. The recommended procedures stress the use of joint reading-related activities involving parents, teachers and peers. Two classroom experiments and parental interviews provide evidence to support this instructional model. A three-leveled word reading sequence is defined for deaf children based on the subjects' emergent reading behaviors. Finally, practical suggestions are made for teachers and parents interested in promoting reading in young deaf children.

How do Young Deaf Children Learn to Read?

A Proposed Instructional Model

Based on Deaf Children's Emergent Reading Behaviors

How do deaf children learn to read? For two prelingually deaf children with hearing parents, early reading was tied closely to communication about reading activities in the home using Spoken English, fingerspelling and manual signs. According to Schlesinger and Meadow (1972), for instance, a child with an 82dB hearing loss, Marie began to read books at age 4 years 5 months when she transferred her fingerspelling games used with her mother in their communication to reading material. Another deaf child, Mark (93dB loss) was reported by Henderson (1976) to begin to read at age 5 years 8 months when his parents pointed out that printed words have corresponding manual signs. Mark's parents would frequently read and discuss stories from library books to him using Spoken English, finger spelling and manual signs. While these two examples[1] may not be typical, they do illustrate that parent-child interactions during reading activities may be a contributing factor in developing early reading behaviors.

Early language emerges from joint activities during which parent and child engage in a reciprocal turn-taking relationship according to Bruner (1975), Snow (1972), and Moerk (1976). It is possible that early reading emerged for Marie and Mark during

joint reading activities when they responded to their parents reading to them and communicating about reading to them using fingerspelling and manual signs.

When formal reading instruction in school begins, would children as Marie and Mark having had these joint reading activities be more receptive to a reading lesson than, let us say, other deaf children who came to school without prior constructs about the tie between their sign language and print? How would these competencies develop for children who had no parental support for language or reading activities in the home? Questions as these could be explored by asking parents about their perceptions of their children's early reading behaviors and by following deaf children as they begin to learn to read at school over a full year. From longitudinal data, developmental levels of deaf children's emerging reading behaviors could be charted, and from this an instructional model based on deaf children's early attempts at reading could be developed. Thus, a model as such could shed light on the question posed earlier--how do deaf children learn to read?

Reading acquisition models based on child prereading behaviors have been used to explain the reading behaviors of hearing children (Mason, 1980, 1981). This process-oriented approach to reading acquisition examines prereading behaviors before skilled reading takes place and traces children's progress as they acquire knowledge about print in the home and school

environment. This theoretical framework assumes that children need to understand aspects of the function of print (its relationship to meaning and use) before learning about its printed forms, letters, sounds and words. We adapted this perspective to deaf children by testing whether ties from manual language to meaning to print would foster the emergence of reading behaviors of children who are hearing-impaired.

The purpose of this study, then, was to determine whether supplementary instruction that was based on our model would lead to greater gains in early reading than would a well-taught cognitive perceptual, traditional program. To test the effects of the instruction, we used an experimental/control design, measuring group gains in print knowledge and interviewing parents about their perceptions of their child's growth in reading. Both parental interviews and classroom experiments support the model, leading to a conclusion that deaf children are similar to hearing children in being aided at the early stages of learning to read if they are shown how print is meaningful.

Reading Acquisition and Hearing Children

A review of longitudinal reading acquisition studies shows that early print knowledge among preschool children emerges and unfolds in a predictable and systematic fashion (Bissex, 1982; Clay, 1972; Ferriero & Teberosky, 1982; Mason, 1980; Soderbergh, 1977). McCormick and Mason (1981) found that children develop increasingly more refined strategies for recognizing and

understanding print which can be described as three levels of understanding how to read words. Unless instructed otherwise then, an important aspect of early reading is an opportunity to match printed words to familiar speech. It is important because it frees children to develop prereading concepts about how written language corresponds to their spoken language and helps them realize that print has a use or function. An early prereading concept which lays the foundation for later reading competence for hearing children, then, is the realization that print is an extension of what they already know in speech.

How do children go about learning about the function of print? One way, according to parents (Mason, 1980) is through informal print experiences at home. Parents may help their children by reading to them, coaching them on alphabet letters, showing them how to print their name, encouraging them to watch Sesame Street on TV, and pointing out print on recipes or food labels or street signs (refer to Bissex, 1982, for other examples). Hence, when children become aware of print in their home and community environments, begin to print their names, start to handle books and recite stories they then realize that written language is simply an extension of their understanding of oral language. From here, literacy acquisition begins.

Reading Acquisition and Deaf Children

While many prelingually deaf children with severe to profound hearing losses do not have a fully functioning

intelligible speech system that they use to reference meaning, deaf children enrolled in total communication programs use a combination of what speech they do have with signs and finger spelling (Jordan, Gustason & Rosen, 1976). We might assume, therefore, that early steps of literacy could be acquired by deaf children by tying print to their manual signs. Indeed, deaf children have the cognitive ability to learn to read. Work by Furth (1973) and Rittenhouse (1977) shows that deaf children perform as well as hearing children on non-verbal tasks. Equally important for early reading, deaf children have the perceptual skills to differentiate letters. Studies of Russian preschool children (reviewed by Moores, 1978) and American children (Quigley, 1966) suggest that deaf children as young as 3 1/2 can learn a fingerspelled alphabet. Thus, deafness does not necessarily obstruct reading acquisition because of cognitive or perceptual deficits.

If neither cognitive nor perceptual deficits impedes deaf children learning to read, why then do deaf preschoolers and first graders of hearing parents have difficulty learning to read? One likely reason is a limited opportunity to internalize a complete linguistic system. Because reading is a language skill, competency in one's "native tongue" is considered to be critical for reading acquisition (Gibson & Levin, 1975; Goodman, 1976). Yet, the frustrating reality is that most young deaf children at the preschool level are seldom linguistically

competent, that is, they have not yet mastered what Chomsky (1965) calls "the underlying system of rules" in any language whether it be Spoken English, American Sign Language or the various Signed English systems. Thus, while hearing children by the age of six have acquired most syntactic rules and can use or understand several thousand words (Carey, 1977), most young deaf children cannot construct complete sentences and have a sign language vocabulary ranging from several words to about 500 (Champie, 1981; Griswold & Commings, 1974).

While deaf children are able to internalize sign vocabularies as the 45 subjects of this study have indeed accomplished, the modality differences between a visual-gestural language and an auditory-oral language could impede reading development. For example, using a visual-motor code as sign language to map meaning onto a sound-based alphabetic code as written English is problematic for the deaf reader, especially at the sentence and paragraph levels because of their differences in form.

In sum, then, while cognitive and perceptual factors may not block reading acquisition for deaf children, the lack of a fully internalized language system as well as the modality (visual-gestural vs. auditory-oral) and code differences (visual code vs. speech code) may make the acquisition process difficult. While educators have developed lessons and materials for this sign-to-print mapping (Bornstein, 1973; Greenburg, Vernon, DuBois, &

McKnight, 1982), little work has been done tracing deaf children's acquisition of print using these instructional strategies.

An Instructional Elaboration

Because reading acquisition and language competence are inextricably related, we propose that instruction of young deaf children's reading ought firstmost to relate existing linguistic knowledge of sign language constructs to print. We propose further that this instructional goal be carried out using reciprocal teaching. That means that the teacher initiates lessons by modeling the requisite behaviors, leading children gradually to take over all portions of the task (Palincsar, 1984). Through teacher modeling, important reading strategies are shown, tried out and learned. Furthermore, through guided practice, children acquire strategies for reading that they practice at home with their parents on weekends and in the residence halls with dorm parents and friends. In particular, we predict that:

(1) severe and profoundly deaf children given experiences relating their manual language to meaning to print will acquire significantly greater letter, word and story reading abilities than children who do not have this explicit training,

(2) the role of experience with letters, words and stories will affect letter and word knowledge beyond home background variables.

(3) and, the amount of exposure to sign/print mapping routines will significantly affect the number of words learned.

Broadly speaking, the aim of this study was to describe whether deaf children learn about print knowledge over time in a manner suggested by developmental reading acquisition studies. The more narrowly focused aim was to determine whether an experimental treatment used in conjunction with traditional instruction would be more effective than the traditional treatment alone.

Because the experimental treatment had not before been tried with deaf children, we made several conservative decisions. One was to keep the treatment in force for two full semesters (12.5 clock hours of instruction using small group instruction of 30 minutes for each weekly session). A second decision was to develop eight early reading tests and measure experimental and control group subjects' gains on individual tests and overall gains. A third decision was to interview parents and teachers in order to determine the extent to which adults saw changes in the children's reading behavior. Finally, a fourth decision was to keep a weekly diary of the treatment and videotape several sessions at different periods of time so as to document

instructional procedures and children's nonverbal reactions to the lessons.

Method

Subjects. The 45 children who participated in this study were from three state residential schools for the deaf.[2] No schools were large enough to house both experimental and control groups so residential schools with comparable instruction were selected. Twenty-three children were from a school in the southeast part of the U.S. and 17 and 5 were from two schools in the northeast. Each school used a combination of Spoken English, manual signs and fingerspelling in their classes and encouraged the parents to do likewise.[3] The subjects were selected using the following limitations: (a) between the ages of 5 and 8 years old, (b) a sensorineural hearing loss greater than 71dB in the better ear across the speech range, (c) loss of hearing before the age of 2, (d) normal intelligence and no additional handicaps other than deafness, and (e) English-speaking hearing parents. All 23 children who met the above criteria from the southeast school were assigned to the experimental group which received the model-based training while 22 from 2 schools in the northeast were assigned to the control group.

Setting

In the experimental group, traditional instruction included activities such as matching color words to objects, matching geometric shapes, matching similar letters, matching picture

words to sight words, reading and signing chart stories based on language experience and units on other cultures, reading filmstrips and basal texts and printing letters and words. Students in the first grades in this group also were observed working on phonic and word identification skills in workbooks which had been adapted by the teacher using finger spelling and manual signs. Weekly trips to the school library were also scheduled for both kindergarten and first graders.

In control group 1, we observed similar traditional reading instructional techniques as found in the experimental group. However, there were several differences. For example, control group 1's entire curriculum was unit-based; thus the children seemed to be exposed to print by way of the many chart stories we observed hanging in the classroom and the teacher-made booklets we saw on the children's desks. Additionally, several first graders were working on computer-aided instruction to increase their print word vocabularies. Overall in this group, we observed daily story reading activities where the teacher or aide would sign and discuss a library story book to the children.

In control group 2, again, we observed the same type of conventional reading instruction found in control group 1 and the experimental group. This group, however, relied mainly on language experience chart stories for their reading material. One activity observed in control group 2 but not observed in the 2 other groups was matching sentence strips to chart stories.

Another difference with this group compared to the two other groups was less time spent in teacher-led story reading activities.

Test Procedures and Instrument

The 45 children were tested individually in September and again the following May. The test battery took each child about 30 minutes to complete and was administered in September by the experimenter-trainer using Spoken English, signs and fingerspelling with the children responding, with signs, fingerspelling, and unintelligible vocalizations. In May, the experimenter readministered the test to control group children but another trained person tested the experimental children. (The reason for this was that in May the experimenter and children knew one another, which might have given those children a testing advantage.)

The test battery was comprised of a set of prereading tasks adapted from tests used with kindergarten and first grade hearing children (Mason, 1980; McCormick & Mason, 1981). They were: (a) fingerspelling own first name, a letter, and a word; (b) identifying all 26 uppercase plastic letters with the fingerspelled handshape; (c) printing a name, a letter and a word; (d) reading a story; (e) reciting from memory a new word pictured story signed by the experimenter; and (f) recognizing 150 common words where the child was first asked to sign (not fingerspell) the printed word. If wrong, the child saw the word

pictured, thereby determining out of context and in context knowledge of each word. (A copy of the test battery is in Appendix I).

The word recognition task of 150 sight words was too long to be given at one time for 10 of the children. For them, the testing period was divided into two shorter sessions of about 15 minutes each. An extensive list was chosen because a corpus of words was needed for the training program. The source of these words was the list of expressive signs known to deaf preschoolers (Griswold & Commings, 1974) and the pictured words were validated by 30 first grade hearing children. By testing deaf children on 150 of these words, we could determine what signs they knew and which print word equivalents they did not know. (Only 4 children could not sign most of the pictured words, 2 from the experimental group.) Participating teachers corroborated this sign list by noting that most of the children used these signs in their everyday communication but could not read them in printed form.

Parent Questionnaire

To determine to what extent print-oriented activities were occurring in the home environment, parents were interviewed in October and again in May about their perceptions of their child's print knowledge in the home. The 45 participating parents responded to 28 questions about how they used signs and fingerspelling with their child, what their child knew about

letters, words and stories and how they supported their child's reading behaviors in the home. This information was used to determine whether reading behaviors are more likely to emerge outside school when the sign- and meaning-to-print relationships are made explicit. (A copy of the Parent Questionnaire is in Appendix II.)

Training Program Components

Our training program at school directly taught children how to express the meanings of printed words and ideas in stories. It consisted of word recognition and story-time sessions, 30 minutes each week for the 9 month school year, with 4 to 6 children and the experimenter. Within the training program, we designed an interim experiment to measure the differential effects of the training.

There are two critical facets of the treatment: the materials and the instructional approach. The materials consisted of 20 experimenter-made simple storybooks and 50 drill cards. Each storybook was constructed on 5" by 8" cardboard approximately 7 to 8 pages in length (adapted from Mason, 1980). Each page of the sample story was elaborated with a picture, two to three words, and illustrations of the corresponding manual sign(s). Most of the story words were selected from the 150 pretested word list. We knew that, if pictured, they would be in the expressive sign vocabularies of the children, so could be easily read. The story lines were similarly constructed of a

simplified syntactic structure. The 50 drill cards were selected from the 150 word list. On one side of each card was the printed word; on the other side the word was pictured.

To measure the differential effects of the training, the 150 words were ranked in difficulty based on pretest results and put into 3 equivalent groups of 50 words each. Fifty drilled words appeared on drill cards and in the training storybooks and were rigorously taught during the storytime sessions. Fifty exposed only words appeared in the storybooks materials but were not drilled. Fifty untaught words were not presented in the training sessions and did not appear in the materials. A comparison of words learned within each word set allowed us to determine to what extent exposure to printed words would be helped by word drill and story reading.

The instructional approach focused on storybook reading, modifying reciprocal teaching (Palincsar, 1984) in order to tie children's background experience to word and story concepts. Each session began with experimenter modeling: the experimenter signed one of the storybooks to the children. Next, to help children begin to focus on meaning, a discussion took place using 3 to 5 target signed words from the story. For example, children might describe what they knew about the sign and would sign to label a person, a picture or a toy object or an action. Guided reading took place with the target signs read with the printed word equivalent in the context of the story. Supervised practice

(10 minutes) followed with children participating in joint reading-related activities such as holding and reading books to peers, reciting the storyplots with assistance of peers, and play-acting the stories. The session ended with each child given a copy of the book to take home and keep.

Results

Treatment comparison. The experimental group (X = 134.17) outperformed the control group (X = 97.68) on the overall test of prereading print knowledge (Table 1 displays pre- and posttest means of each test). A MANCOVA analysis determined that the two groups were reliably different (Hotellings T^2 value = 86.29, $p < .0001$). A discriminant analysis using a canonical correlations approach was run to aid in the interpretations of these results. The variables with the highest posttest correlations were fingerspelling (r = .5[illegible]), bookreading (r = .543), drilled words (r = .547), and exposed words (r = .513). See Table 2.

Insert Tables 1 and 2 about here.

Another breakdown, using the results of 8 univariate t-tests (adjusted for pretest scores) determined that the two groups were reliably different favoring the experimental on all tests except the printing and the alphabet knowledge test (Table 3). The control group outperformed the experimental group on the printing subtest. No difference occurred on the alphabet subtest. Thus,

the treatment effects extended beyond the deliberate instruction of bookreading and word recognition to fingerspelling and untaught words.

Insert Table 3 about here.

The classroom experiment results demonstrate that the training affected book reading, word reading, and fingerspelling. It had no effect on alphabet identification because of ceiling effects (most of the 45 children could recognize the 26 letters of the alphabet before school began in September). It had an unexpectedly negative effect on printing which could be traced to the fact that some experimental group children misinterpreted the directions for this task.

Since neither random assignment to groups nor subject matching was feasible,[4] we used multiple regression techniques (Pedhazur, 1982) in order to determine the contribution of children's background variables to early reading. First, the background variables age, race, sex, parent occupation and education were entered to predict pretest scores. Age and race made significant contributions, each accounting for about 13% of the variance. Table 4 shows the analysis to predict posttest scores. Race no longer was a factor[5] but age was, accounting now for nearly 25% of the posttest score variance. Older children in

both the control and experimental groups did better on the test than younger children.

Insert Table 4 about here.

All the variables together accounted for a total of 82% of the variation in May test scores. Of the 5 blocks of variables, the only significant background variable was age. As expected, pretest scores accounted for a large portion of the variance. An important point is that we chose the order of entry of the variables in order to show that the treatment accounts for some of the variance after entering background and pretest variables.

Training effects. Differential effects within the training itself indicated in the training vocabulary more drilled words ($\bar{X}$ = 29.39) were learned than exposed only words ($\bar{X}$ = 24.82) and more exposed words were learned than untaught words ($\bar{X}$ = 19.69).[6] Two planned orthogonal comparisons support the differences between drilled and exposed words ($t_{44} = 4.21$, $p < .05$) and between exposed and untaught words ($t_{44} = -6.84$, $p < .05$). Thus, exposure plus word drill had a significant advantage but exposure to words alone also increased print word learning (see Figure 1).

Insert Figure 1 about here.

Parental Interviews

As the September and May testings of the 45 subjects demonstrated that deaf children made gains in letter, word and story reading knowledge in the classroom, the parental interviews likewise showed that the parents perceived knowledge gains by their children (see Andrews, 1983 for a fuller description of parent interviews). Taking first the letter knowledge category, parents of the younger children who did not know the alphabet in September reported a 13% change in their children's ability to fingerspell the manual alphabet over the school year. Additionally, parents noted their child was more often pointing out alphabet letters on cereal boxes, books and clothing labels using fingerspelling (a change of 19% since September). According to parents, capital letters were recognized before lowercase letters. Looking next at the responses about child printing abilities, parents reported that their child was printing more letters and words in May than in September. There was a 23% change in the ability to print more than 20 capital letters, a 33% change in printing more than 20 lowercase letters, and a 23% change in printing more than 20 names and words. Reading word knowledge, also, was acquired during the school year, especially among the first graders, with an 11% change in reading more than 20 words. Finally, regarding story reading knowledge, children were observed signing pictures in books (11% change from September), showing a greater understanding of

stories in sign language (15% change from September) and signing parts of stories back to parents. Thus, within both groups, gains in letter, word and story knowledge were observed by the participating parents.

But did parents of the experimental group notice a larger gain? Parents of the experimental children saw greater changes in letter knowledge and printing items than did parents of the control children. While experimental group parents perceived their children to be less knowledgeable about letters and printing at the beginning of school, by the end of the year, both groups had similar perceptions. More reading word knowledge, too, was thought to be acquired by the experimental group children many of whom started the school year with less word knowledge (48% were thought to know fewer than 10 print words) than the control group (33% were thought to know fewer than 10). Support for reading, according to all parents, was oriented around letters rather than stories in September; however, at the end of the school year during which the experimental children brought the training storybooks home, a 25% increase by that group was observed in support for home story-reading activities.

In summary, then, the parental reports showed that these deaf children increased substantially their letter, word and story reading abilities over the year. Larger changes were thought to be made by the experimental group children who had the sign-to-print training than by control children. Thus, the

home-based descriptive data support our hypothesis that reading can be m.. readily acquired by deaf children when they match sign language and meaning to printed forms.

Test of the Early Reading Model

While the test results and parental reports demonstrated overall changes in print knowledge from September to May, an explanation of how those changes occurred is best depicted from children's progress in their acquisition of print knowledge. To do this, we merged data from the tests, parent interviews and a classroom reading diary, testing our 3-leveled word-reading sequence for deaf children (adapted from Mason, 1980). This gave us a way to specify changes in word reading knowledge deaf children make over a full school year.

Word reading sequence. Based on the kinds and numbers of words parents reported their children to be reading, we placed the 45 children into one of three word reading levels in September and again in May. Level one--prereading--described behaviors observed at the beginning of the year and among the youngest children: labeling pictures with signs, identifying print letters with fingerspelling, attending to stories in sign language. Level two and three--context-dependency and word integration--described more mature abilities: fingerspelling short words, printing names and words, identifying words in environmental contexts, recognizing print words and sequencing and reciting stories. By placing the children in these levels in

September and again in May, we tested whether there was a developmental progression in word reading knowledge (see Andrews, 1983, for case studies).

Level 1: Prereading. Children who knew less than 100 manual signs and could identify about 10 print letters were at this level. These children, because of their limited language knowledge had difficulty labeling pictures with signs and attending to stories in sign language. In September, 6 children were classified as prereaders, but by May all of these children had progressed to the next level.

Level 2: Context-dependency. While the level one children had limited expressive sign language knowledge, the Level 2 children had larger sign vocabularies often combining 2 or 3 signs in an utterance which in turn, supported their print knowledge skills. Level 2 children, for instance, were able to read words in picture contexts such as stop, McDonalds, and Trix. Besides this, they could fingerspell and print their first names, names of family members, identify most letters of the alphabet, print about 15 letters and attend to stories in sign language. Although these children had difficulty sequencing story events, they did attempt to recall content items. In September, 16 of the 45 children were at the context-dependency level, however, by May, fifteen children moved to the next level.

Level 3: Word-meaning integration. Children at Level 3, compared to Levels 1 and 2, had extensive sign vocabularies as

well as more developed conversational skills. Regarding reading behaviors, these children read food labels, road signs, restaurant names and could recognize at least 20 or more print words. In addition to these skills, they could identify and print all 26 letters, recite manually most of the alphabet in sequence, fingerspell and print short words, recite stories from memory, sequence stories and even recognize multiple meanings of words. Children at this level were word analyzers who often broke down word units into letters as indicated by their word recognition errors. Often they would confuse words based on initial letters. For instance, the word yellow would be signed as the word yes. In September 23 children were classified as word-meaning integration readers and by May, this number had increased to 38, almost 85% of our sample.

In comparing each group on word-level changes over the school year, similarities and differences emerge. For example, both groups showed dramatic increases in the ability to identify environmental signs, food labels, restaurant names and TV titles. Also, both groups showed decreased membership in the lower levels--Prereading and Context-dependency--with more children moving into the highest level--word-meaning integration. Yet, the data showed a major difference; that is, the experimental group made larger gains within the Level 3 word-meaning integration over the school year than the control group.

In summary, then, Levels 1, 2, and 3 specified 3 developmental stages deaf children progress through in learning about printed words from easiest to more skilled levels. These levels need to be studied further with other groups of young deaf readers.

General Discussion

Tests, parent interviews and classroom observations provide evidence which supports the proposed model that deaf children initially learn about reading when they begin to connect manual language with meaning to printed forms. Furthermore, the results of our classroom experiments suggest that closely approximating the child's sign language competencies with print knowledge instruction can, in fact, accelerate letter, word and story reading abilities. Given experiences being read to, talking about stories, having labels explained, and recognizing and printing words, deaf children can acquire important concepts about the function and conventions of print.

Yet, even though they may easily acquire knowledge about letters using fingerspelling and words using manual signs, deaf children and hearing children diverge on a fundamental developmental aspect: hearing children are able to develop notions about the graphophonemic structures of words, and thereby develop strategies to "sound-out" new words not previously known. Compared to Mason's (1980) analysis of hearing children's prereading development, the hearing-impaired children's

development was slower, deviated at the letter-to-sound analytic level, never achieving a letter-cluster-to-sound analytic level. Other investigators (Conrad, 1979; Ewoldt, 1978) have found that older deaf readers are able to get meaning from print without using a phonological system. While deaf children in this sample were not observed using intelligible vocalizations or letter-sound information to decode words--strategies initiated by hearing children who use a symbol-sound system--the enhanced growth in letter, word and book reading suggest that deaf children begin reading by bypassing the phonological system and, instead, use a system they can readily understand.

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Having examined the early reading behaviors of deaf children longitudinally over 9 months, we return to our original question--how is reading learned by deaf children? A major problem in accounting for this accomplishment arises from the fact that deafness has a devastating effect on language development, which in turn affects reading development since language and reading are closely intertwined. As a result, a dismal consequence of deafness is that the semantic and syntactic forms of any linguistic system, whether it be English or American Sign Language, are underdeveloped in most deaf children of hearing parents. Full linguistic competence and hence reading competence, then, are seldom attained by the majority of the deaf population.

Our approach to this problem was to construct an instructional model based on the deaf child's existing linguistic knowledge of sign language constructs. This model stresses that even though the child may have at the least, a meager expressive sign language vocabulary, he/she can be lead successfully through the "holophrastic" or one-word stage of reading development by matching signs and meaning to print. Moreover, in tracing deaf children's early reading behaviors from a longitudinal perspective, we were able to identify 3 levels of change in this word-reading development. At the first level, the child knows about printed word symbols, can handle a book properly, begins to attend to stories and label pictures with manual signs. At Level 2, the child can recognize words on food labels, cereal boxes and road signs in picture contexts, recognizes the alphabet using fingerspelling, read and print a first name, and attempt to sequence and recall stories. Level 3 marks a shift in the development of word recognition strategies where the child actively breaks down letters in words usually focusing on the initial letter. At this stage, the child rapidly increases a sight-word vocabulary, spelling and printing knowledge, and reciting stories and sequencing abilities.

Our model additionally focuses on another issue, one that a vast literature supports in accounting for language learning--the communicative setting in which the child acquires language. We contend, based on data collected at school and at home, that deaf

children's communicative interactions about reading-related activities using fingerspelling and manual signs with parents, teachers or peers act as precursors and possibly shape the reading-acquisition process to follow. Moreover, children who have these early print interactive experiences will benefit more from reading instruction than children who lack such print-oriented experiences. If this contention is correct, then, it suggests concepts about the use and conventions of print the child needs to know and thus bring from home to the reading-learning situation at school.

At home, parents who learn to communicate early with their children using fingerspelling and manual signs may, in fact, contribute to their children's literacy. Using their manual communication skills, they can support print concept development by pointing out letters of the alphabet on road signs, food labels and in books, read stories to their child, help the child to print names, thereby giving their child informal experiences with print. Equipped with these early informal print experiences, the child will be ready for instruction with a teacher who follows up with such prereading instruction as having the child recognize letters with fingerspelling and words with signs, having stories signed to the child, discussing story information, role playing and reciting stories and having labels explained to them. With activities as these both at home and at

school, deaf children can be focused early on the meaningfulness of print thus beginning the literacy process.

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Footnotes

[1]Background variables as etiology, age of onset, age when the child started using signs, and the family's signing system used with the child are variables which affect language acquisition (Schlesinger & Meadow, 1972). Marie's etiology was rubella. She was diagnosed before 12 months of age and began using signs at 3 years, 1 month. Her parents used SEE (Seeing Essential English) with her. Mark too had a rubella etiology and was prelingually deaf. He started to use signs at age 2 and his parents used Spoken English and Signed English in their communication with him.

[2]Length of stay at a residential school varied across the 45 subjects. Most of the sample had attended a half-day preschool program starting on the average at about age 4 years. Those children who lived in the dorms ($N = 19$) had exposure to American Sign Language from other deaf children and dorm parents.

[3]The sign language skills of parents in this sample varied widely. On the average, 36 parents knew 300 to 400 signs and reported they would learn new signs from their deaf children. At the upper end, 4 parents reported they were skilled users of American Sign Language and Signed English as they had taken course work and socialized in the deaf community. At the lower end, 5 parents said they knew less than 50 signs having dropped out or never attending sign language classes.

[4]While all possible steps were taken to obtain comparable settings, there were some differences. School E (chosen for the treatment because it had the largest number of children), with 23 children in the study, had four teachers for four classes, 1 kindergarten and 3 first grades. School C, with 17 children in the study had 5 teachers, 2 kindergarten and 3 first grades. School C_2, with 5 children and 3 teachers, had 2 kindergartens and 1 first grade. All the teachers taught reading using a whole word approach, Scott Foresman materials, and their own teacher-made booklets and charts. Teachers from Schools E and C_2 also used linguistic controls on their teacher-made materials. To summarize, while the instruction and materials were similar in the three sites, control classrooms contained more full-time teaching adults (teacher/aide-pupil ratio of 1:3) as the experimental classroom (a ratio of 1:5). Children in the control classrooms, while on average younger, were somewhat more knowledgeable about signing and fingerspelling according to our pretests and October parent reports, and had parents and siblings who in October were more likely to communicate using signs and fingerspelling.

[5]Fourteen percent of the control group and 39% of the experimental group were black. Black children had significantly lower scores on the pretest but not on the posttest.

[6]This is not to say that these were the only words learned at school by the children. The point to be made here is that dramatic increases in print word learning occurred used these instructional strategies.

Table 1

Percentage group means, standard deviations for all deaf subjects by treatment on September subtests (Pre) and May subtests (Post).

The number in the parentheses below the mean is the standard deviation.

	Experimental Group (N=23)		Control Group (N=22)	
	Pre $\bar{x}$	Post $\bar{x}$	Pre $\bar{x}$	Post $\bar{x}$
Fingerspelling	2.13	10.60	3.36	6.40
(N=18)	(1.52)	(5.47)	(3.85)	(5.87)
Printing	1.08	1.61	1.50	2.04
(N=4)	(0.67)	(0.58)	(0.96)	(0.78)
Alphabet Knowledge	22.61	25.91	20.18	24.68
(N=26)	(6.83)	(0.28)	(8.97)	(3.54)
Book Recitation	2.52	9.48	3.22	6.00
(N=23)	(1.99)	(6.77)	(5.38)	(5.18)
Book Reading	5.48	12.74	5.14	9.54
(N=14)	(4.78)	(1.84)	(5.73)	(3.79)
Drilled Words	6.74	29.39	7.77	16.23
(N=50)	(8.72)	(19.46)	(13.92)	(16.94)
Exposed Words	8.26	24.69	8.64	17.54
(N=50)	(9.55)	(16.19)	(13.09)	(15.35)
New Words	6.04	19.48	6.45	15.50
(N=50)	(8.15)	(15.74)	(11.25)	(15.58)
Total	54.13	134.17	56.27	97.68
(N=235)	(34.71)	(62.06)	(55.08)	(61.42)

Table 2

Correlations between dependent and discriminant functions

Variable	
Fingerspelling Post	0.5823
Printing Post	0.2917
Alphabet Post	0.2327
Book Recit Post	0.2651
Book Reading Post	0.5431
Drilled Words	0.5469
Exposed Words	0.5129
New Words	0.3661

Table 3

Results of multivariate analysis of covariance and 8 univariate T-tests for effects of training on May posttests for all subjects (N=45)

	T^2 Value	Approximate F	Hypothesis d.f.	Error d.f.	Prob.
Hotellings T^2 Test	86.2928	7.0238	8	28	0.00005***

Posttests	d.f.	Standard Error	t-value	t
Fingerspelling	1	0.56116	4.8806	0.00002***
Printing	1	.0959	-2.4448	0.0196
Alphabet	1	0.3786	1.9499	0.0592
Book Recitation	1	0.8690	2.2219	0.0328*
Book Reading	1	0.4103	4.5518	0.00006***
Drilled Words	1	1.5412	4.5833	0.00006***
Exposed Words	1	0.9379	4.2991	0.00013***
New Words	1	0.7511	3.0683	0.0041**

*p < .05.

**p < .01.

***p < .001.

Table 4

Summary of hierarchical multiple regression analysis on total prereading test score (Post) (N=45)

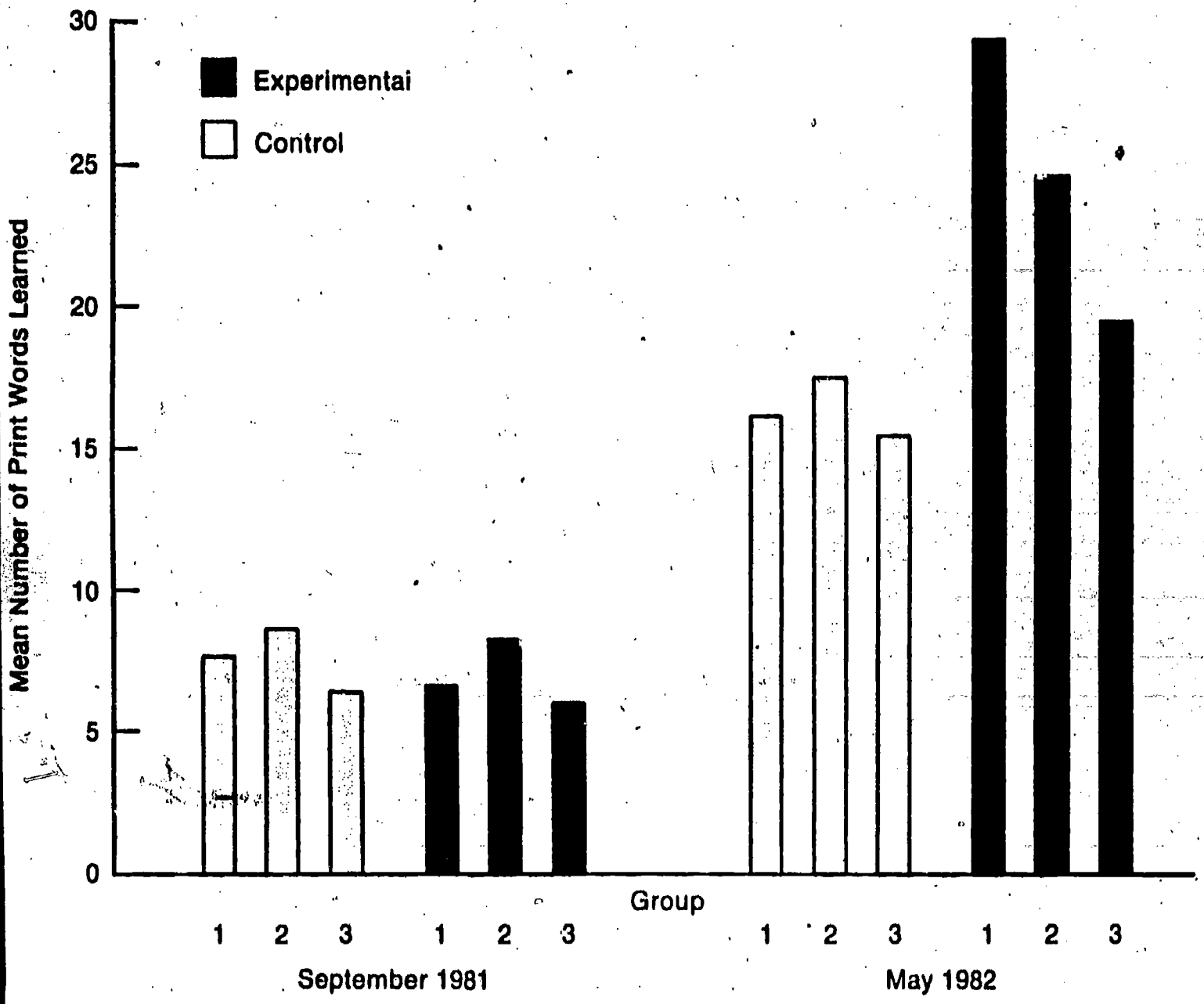
	B	S.E.	R^2 Change	F
Dependent Variable = Total Posttest Score				
$\bar{x}$ = 116.08 S.D. = 63.82				
Steps				
1. Race	-24.71	21.49	.03595	1.32
Sex	4.05	20.23	.00784	0.40
Hearing Loss	1.02	0.92	.02801	1.24
2. Breadwinner's education	-13.90	10.03	.02321	1.92
" occupation	-4.64	4.74	.02165	0.96
3. Age	2.47	0.89	.24760	7.78*
Number of months using manual communication	0.36	0.64	.00538	0.32
4. Pretest	1.05	0.14	.38453	56.31**
5. Treatment vs. control	18.33	7.88	.05555	5.40*

*p < .05

**p < .02

Figure Caption

Figure 1. Mean number of print words learned in Group 1 (drilled words), Group 2 (exposed words) and Group 3 (untaught words) by deaf subjects in September (before training) and in May (after training).


Experimental
Control
Mean Number of Print Words Learned
30
25
20
15
10
5
0
Group
1 2 3 1 2 3 1 2 3 1 2 3
September 1981
May 1982

APPENDIX I

MANUAL PREREADING TEST[ab]

1. Fingerspelling, spelling with letters, printing:

   a. Task: Child is asked to fingerspell his/her name.
   Directions: "My name is J-E-A-N. What is your name?"

   Correct ___ Incorrect ___ Errors ___

   b. Task: Child is asked to print his/her name.

   c. Task: Child is asked to fingerspell several simple words: hat, hot, car, stop, hand

   The example of cat is given.

   Directions: "The sign for cat is CAT (give sign). Can you fingerspell CAT for me?"

   Number of letters correctly spelled out of 6 words: ___

   d. Task: Child is asked to print a name, a word, a letter of the alphabet.

   Directions: "Can you print a name? Can you print a word? Can you print a letter?"

   Name correct ___ incorrect ___ errors ___

   Word correct ___ incorrect ___ errors ___

   Letter correct ___ incorrect ___ errors ___

2. Letter Naming:

   Task: Upper case magnetic letters are spread out on the table. Child is asked to give the manual handshape of each one.

   Directions: "See the letters. Can you sign this letter?"

   Number of letters correct out of 26: ___ errors ___

3. Story Reciting:

   a. Task: Experimenter signs a short story to the child. Child is asked to retell the story.

   Directions: "I will tell you a story. You watch me. Then, you tell me the same story."

   _____ Number of content items _____ errors

   omissions _____

   additions _____

   b. Task: Child is handed a book upside down. He/she is asked to read the book.

   Directions: "Here is the book. Sign the book."

   _____ Child turns the book right side up.

   _____ Child starts from first page and turns each page of book.

   _____ Child signs words in the book.

[a]Adapted from Mason, 1980; McCormick & Mason, 1981

[b]Word list from Griswold & Commings, 1974

4. Sign/Print Recognition:

   a. Task: Child is shown 150 pictures and is asked to give the sign for each picture.
   _____ Number of pictures correctly identified with a sign.

   b. Task: Child is shown 150 print words and is asked to give the sign for each print word.
   _____ Number of print words correctly identified with a sign.

Picture	Sign	Print	Picture	Sign	Print	Picture	Sign	Print
1. baby			19. eyes			37. snow		
2. water			20. flower			38. telephone		
3. airplane			21. nose			39. train		
4. car			22. rain			40. toothbrush		
5. hat			23. socks			41. boy		
6. shoe			24. tree			42. elephant		
7. bird			25. cow			43. pig		
8. dog			26. girl			44. turtle		
9. ice cream			27. horse			45. apple		
10. milk			28. rabbit			46. swing		
11. book			29. candy			47. spoon		
12. cat			30. cookie			48. door		
13. duck			31. bicycle			49. chair		
14. fish			32. ear			50. fork		
15. ball			33. home			51. bathroom		
16. bed			34. mouth			52. balloon		
17. boat			35. pants			53. egg		
18. coat			36. scissors			54. bathe		

Picture	Sign	Print	Picture	Sign	Print	Picture	Sign	Print
55. brush (teeth)			78. jump			101. smell		
56. come			79. wait			102. buy		
57. cry			80. wake up			103. throw		
58. drink			81 walk			104. hot		
59. eat			82. work			105. cold		
60. hear			83. cook			106. more		
61. kiss			84. dance			107. dirty		
62. love			85. get			108. good		
63. sit			86. praise			109. finished		
64. wash			87. smile			110. minute		
65. break			88. give			111. now		
66. fall			89. think			112. today		
67. go			90. tell			113. tomorrow		
68. look			91. climb			114. on		
69. ope			92. fix			115. in		
70. play			93. forget			116. off		
71. sleep			94. help			117. under		
72. wtop			95. hide			118. out		
73. write			96. hop			119. no		
74. bring			97. put			120. don't		
75. catch			98. take			121. not		
76. close			99. want			122. O.K.		
77. hurt			100. roll			123. yes		

Picture	Sign	Print	Picture	Sign	Print	Picture	Sign	Print
124. how			133. mine			142. sorry		
125. what			134. mom			143. good night		
126. where			135. dad			144. black		
127. why			136. grandmother			145. red		
128. what for			137. grandfather			146. yellow		
129. me			138. brother			147. blue		
130. you			139. good bye			148. green		
131. I			140. thank you			149. stand		
132. your			141. please			150. soup		

APPENDIX II

PARENT QUESTIONNAIRE[ab]

Date: _____

1. Child's Name: _____ Birthday: _____
2. Number of brothers _____ sisters _____
3. Any deaf siblings or relatives _____
4. Mother ____ deaf ____ hearing; Father _____ deaf _____ hearing
5. Occupation _____ mother _____ father
6. Years of education:

	Mother	Father
1-8th grade	_____	_____
High School	_____	_____
Vocational School	_____	_____
College	_____	_____
College +	_____	_____

7. Communications used at home with child:

Signs:	used always	sometimes used	never used
Speech:	used always	sometimes used	never used
Fingerspelling:	used always	sometimes used	never used
Signs/Speech/Fingerspelling:	used always	sometimes used	never used
Speech/Fingerspelling:	used always	sometimes used	never used
Signs/Speech:	used always	sometimes used	never used

8. How many years has your child been in school? (Include parent-infant program and preschool.) _____ years
9. How long have you been using sings with your child?
   a) _____ don't use signs _____ since birth of child
   _____ for 1-2 years _____ for 3-4 years
   b) Have taken sign class: _____ Number of years: _____
10. In what kind of situations do you use signs with your child?
   _____ at bedtime
   _____ at meal time

[a]Adapted from Mason, 1980; McCormick & Mason, 1981

[b]Sign list from Griswold & Commings, 1974

_____ when reading to the child

_____ during play activities

_____ when giving directions to others

_____ in conversation

_____ when talking about T.V. shows

11. Who can fingerspell the manual alphabet?

Mother:	some letters	all letters	none
Father:	some letters	all letters	none
Brother:	some letters	all letters	none
Sister:	some letters	all letters	none
Child:	some letters	all letters	none

12. Can your child read your fingerspelling?

Yes, very well. Yes, some. No, none.

13. What letters have you seen your child fingerspell?

_____

14. Does your child point out and sign letters of the alphabet on signs, boxes or books?

Never Once in a while About once a week Nearly every day

15. How many capital letters can your child recognize?

Not any About five About ten More than 20

16. How many small (lowercase) letters can your child recognize?

Not any About five About ten More than 20

17. How many capital letters does your child try to print?

Not any About five About ten More than 20

18. How many different small (lowercase) letters does your child try to print?

Not any About five About ten More than 20

19. Can your child sign the whole alphabet?

No Can sign a few of them in order

Can sign more of them in order ----- Can sign whole alphabet

20. Does sometome teach your child something reading?

No one Relative Parent Brother or Sister Teacher

21. If someone is teaching your child, circle any that are being taught.

Naming letters Signing letters Printing letters

Priting words Signing words Signing stories

Spelling words

22. Are there any printed words you have noticed your child signing? For example, does he sign his name, point out and sign labels on cereal boxes, cans, street signs or billboards? If yes, please list some of them below.

_____ _____ _____ _____

_____ _____ _____ _____

23. How many printed words do you think your child can sign?
Not any About 5 About 10 More than 20

24. Does your child ask for a printed word to be signed to him?
Never Once in a while About once a week About every day

25. Does your child ask to have stories signed to him?
Never Once in a while About once a week About every day

26. Does your child ask for words to be spelled?
Never Once in a while About once a week About every day

27. Does your child make alphabet letters when drawing or painting?
Never Once in a while About once a week About every day

28. Does your child try to spell out the letters in words?
Never Once in a while About every week All the time

29. Do deaf friends or relatives sign stories to the child?
No Once in a while About every week About every day

30. Are any alphabet books signed to the child? Yes _____ No _____

31. Can child sign any of the pictures in an alphabet book? Yes _____ Now _____

32. Does your child understand stories in sign language? Yes _____ Now _____

33. Does your child sign any parts of a story? Yes _____ No _____

34. Place a check mark for a "yes" answer to each question. Add any other words which you or your child use regularly.

Categories	Does parent use this sign with child	Does child use this sign	Can child read this print word	List any very similar words that parent uses to sign to child
Clothes				
coat				
pants				
hat				
hearing aid				

Categories	Does parent use this sign with child	Does child use this sign	Can child read this print word	List any very similar words that parent uses to sign to child
shoe				
socks				
dress				
mittens				
People				
baby				
boy				
girl				
me				
I				
you				
dad				
mom				
Body Parts				
eyes				
ears				
mouth				
nose				
hand				
leg				
fingers				
Counting				
one				
two				
three				
Describing Words				
good				
bad				
cold				
hot				

Categories	Does parent use this sign with child	Does child use this sign	Can child read this print word	List any very similar words that parent uses to sign to child
Food				
apple				
cake				
candy				
egg				
cookie				
gum				
ice cream				
milk				
coke				
meat				
potatoes				
peas				
Animals				
cat				
cow				
dog				
duck				
elephant				
fish				
horse				
pig				
rabbit				
turtle				
Conversing				
good bye				
hello				
thank you				
what for				
where				

Categories	Does parent use this sign with child	Does child use this sign	Can child read this print word	List any very similar words that parent uses to sign to child
Toys				
ball				
balloon				
bicycle				
car				
book				
pen				
pencil				