Chapter 10

American Sign Language and Reading Ability in Deaf Children

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The intent of this chapter is to examine bases of reading ability in signing deaf children. If learning to read is viewed as the task of learning the relation between spoken language and its representation in print (Adams, 1990; Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977), then the task of learning to read in the case of signing deaf children must be doubly complicated. First, of course, is their lack of direct access to spoken language. They do not hear, and presumably do not use, at least not efficiently, sounding out processes that might help them learn to read. Second, the form and structure of the signed language they use is unrelated to either spoken English or its written form. If signed language competence has a relation with reading, it is not obvious why it should. Indeed, most of the literature on reading development and achievement in deaf children does not include deaf children's signed language competence as a variable (e.g., Conrad, 1979; Campbell, 1992; Hayes & Arnold. 1992; Holt, 1994).

Recently, there have been suggestions that American Sign Language (ASL) skills might play a role in reading (Kuntze, 1994; Paul, Bernhardt & Gramly, 1992), in part because of studies showing that deaf children with deaf parents perform well on reading achievement tests when compared to deaf children of different backgrounds (Mayberry, 1989; Moores & Sweet, 1990; Prinz & Strong, 1998; Singleton et al., 1998). One could argue, however, that the relation between signed language and reading is simply fortuitous. A child's skill in ASL provides a linguistic foundation from which development of another language skill such as reading can

take place. Possibly also, experience with ASL forms a symbolic base from which children can learn meaning of words in print. This is essentially the claim that Paul et al. (1992) made: Children who comprehend written text and the message of the text are better equipped to carry out the decoding that is basic to reading ability. Paul et al. also referred to the influence of a community of deaf adults who read as enabling deaf children to imagine themselves as readers. These are important, even essential, elements to reading development, but the question of whether ASL specifically is implicated in reading and writing ability has yet to be addressed.

For the last 3 years, our research group has been involved in a project to study reading achievement in deaf children.[1] Like others who have studied this population, we are intrigued by the unusual challenges deaf children face. Whereas others have studied oral deaf readers (Waters & Doehring, 1990), or hard-of-hearing readers (Arnold & Mason, 1992) and explored to what extent their experience with spoken language aids reading development, our focus is on a population of deaf children whose early experiences instrumentally involve signed language. These are children who grow up using sign language either at home or at school. They are also more likely to have greater degrees of hearing loss: as a consequence, they face a daunting challenge in learning to read (Conrad, 1979; Karchmer, Milone & Wolk, 1979).

The investigation we describe here has three components: (a) a detailed demographic assessment of individual and social variables of deaf students participating in our study, (b) results of a language battery testing interrelation between reading ability and specific language skills, and (c) a descriptive study of classroom instructional techniques involving signing and written English and their role in reading development. The latter component follows from a basic premise we hold, namely, that reading development is unique among the language skills in that it is not natural. It requires presence of language and cognitive ability but is intimately linked to contexts of instruction. Even with good language skills, very few children can teach themselves to read; instead they need guidance by skilled adults. The three components of our research are joined by a design that measures component skills of children who are trying to learn to read with the aid of others and to a large extent within school settings.

The deaf children who participated in our study came from school settings most typical for children of this type of hearing loss (Holt, 1994)—a residential school that employs ASL-based approaches to teaching and a

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public school special program that uses a *total communication* approach.[2] In the latter environment, there is some presence of ASL, used by deaf teachers and competent hearing signers, but it is not officially targeted as a language of instruction. In the former, the school actively seeks to incorporate ASL in the curriculum, and teachers are invited to engage in innovative curriculum development that includes training in ASL. This variation in emphasis on ASL by school setting not only gives us access to children of different backgrounds within a narrow range of overall deaf and hard-of-hearing population, but also allows us to examine the impact of different instructional environments on reading development. Further, because we wanted to study reading instruction, we selected deaf children who were taught in reading classes specifically designed for them. We did not include children who were mostly or entirely integrated into classrooms with hearing children. This investigation focuses primarily on deaf children who use signed language with each other and with their teachers and who attend special classes with other deaf children.

The results of our language battery show that knowledge of specific ASL structures correlates with reading achievement. Young deaf children who perform better on reading tests are those who are also competent in what we call *associative skills,* or have the ability to write down words that are fingerspelled to them, and are able to translate initialized signs. We find that these skills are more likely to be found among deaf children who have grown up with ASL, as with those who have deaf parents, but they are also used by other children who perform well on tests of ASL ability.

When we examine the better readers' demographic backgrounds, we find that they share certain characteristics. Among the significant correlations we find with higher reading scores are having deaf parents, early detection of deafness, and an absence of handicaps. Because the children we studied had similar degrees of hearing loss, which was generally severe to profound deafness, and had similar etiologies, or causes of deafness, which was either deafness from birth or shortly after, the age at which they became deaf was not significantly correlated with reading achievement. Instead, the age at which their deafness was detected and reported in school records turned out to be significant. We believe this variable measures when families start to reorganize their communicative resources and plan alternative schooling for their children.

From our videotapes of classroom teaching techniques, we found examples of how young deaf children become aware of associations between ASL and written text. Using these data, we argue that associative skills such

[2]Because most states support only one residential school, we do not identify the state or the region in which the schools are located to ensure the privacy of the students, teachers, and school administrators in our study.

as those we uncover in our language battery need to be discovered and cultivated by a process of language and reading instruction that teaches children to link ASL morphology to English orthography. We do not view these skills as "naturally" acquired in the same sense that ASL competence is; instead, they must be fashioned by way of instruction.

Our findings lead us to some central issues about the process of learning to read, as summarized in Adams (1990). For young hearing readers, those who can learn to associate sound elements with orthographic representation are more likely to succeed at reading. The better readers in our study have made an alternative discovery in which they form associations between elements of a signed language and elements of a written language as they acquire the ability to read. In addition to the question of whether and how these associations promote reading development is the equally interesting question of how these associations come about. We suggest that these associations are not fortuitous or idiosyncratic discoveries by individual children, but result from systematic exposure to a culture of signers and adult deaf readers who directly and indirectly teach young signers how to make sense of written English text. Our findings emphasize that whereas reading is an individual accomplishment, it is fundamentally a cultural achievement in which forces of society and institutions combine to support a notable alternative route to reading.

STUDY 1: DEMOGRAPHIC AND BACKGROUND ASSESSMENT

Student Characteristics

Mertens (1990) found that most survey research on deaf children concentrates on individual characteristics such as onset of hearing loss, degree of hearing loss, age, and individual performance on specific tests, often to the exclusion of a wide range of variables that measure institutional and social characteristics. Accordingly, we developed a list of characteristics for student backgrounds that measure not only enduring individual characteristics but social characteristics as well, such as hearing status of parents, ethnicity, age of first educational contact, and age when the child's deafness was detected. We also included a measure of when the child began attending school and the length of time the child remained in one type of program. The latter variable, termed *tenure*, was designed to examine the effect over time of a particular school setting on the child's reading achievement.

Because we were interested primarily in reading development during the crucial first levels of school, we solicited participation only from elementary and middle school students. Their parents were mailed letters

explaining the project, including what information would be gathered and what tests would be given to their children. Parents of 135 students returned consent forms, 83 in the residential school and 52 in the public school.[3] With their consent, we gained access to their children's files for the purpose of coding for a set of background characteristics. Also from the files, we obtained the students' most recent Stanford Achievement Test (SAT)–Hearing Impaired[4] scores, including their SAT–Reading comprehension (SAT–R) and the SAT–Math computation (SAT–M) scores. Of the 135 students in our survey, 98 had valid reading comprehension scores and 73 had math computation scores.

The first fact to emerge from our data is that we did not have similar groups of children at the two school settings. The proportion of students with deaf parents in the residential setting participating in our study was nearly five times higher than that in the public setting. The ethnic status of the students in the public setting indicated a much higher degree of heterogeneity than in the residential setting. Deaf children at the public school who participated in our study were nearly twice as likely to have a physical handicap such as impaired vision or mobility compared to those who participated at the residential school.

At least one influence on this pattern of enrollment is educational policy that promotes philosophical choices by parents. Since the 1970s, when public schooling of deaf children became more widely available and residential schools were no longer the dominant (or only) educational option for families, parents needed to decide which school setting to choose for their deaf child (Ramsey, 1997). In our population, deaf parents were far more likely to select the residential school in part because, as many of them told us, they had attended similar schools as children and they continued to believe that such schools best accomodate their ideas about language environments for their children. The residential school we used for our study reported that approximately 12% of their school population, from preschool to Grade 12, are children with deaf parents. The public school district, in contrast, had less than 1% children with deaf parents

[3]The greater representation of residential school students in the study reflects the differential enrollment levels at the two schools. The residential school reports an enrollment of 206 students in the elementary and middle schools compared to 88 students in the public school at the same levels. To evaluate interrelations between reading development, classroom instruction practices, and signing ability, consent forms were not distributed to parents of students who were fully mainstreamed or students with severe emotional or cognitive handicaps because these are students who do not participate in regularly scheduled classes of reading instruction with other deaf students.

[4]The tests that were administered to the students in our study were normed for hearing-impaired students. Although the tests themselves are identical to those given to hearing children, the screening procedure to determine which level of test to give to the deaf child is based on guidelines developed specifically for deaf and hard-of-hearing children.

TABLE 10.1
Demographic Comparisons Across School Settings

Variable	*Public School (N = 52)*	*Residential School (N = 83)*
Handicaps	19%	10%
One or more deaf parents	8%	39%
Ethnicity (% White)	33%	70%
Mean age of first educational contact	3.125 years	2.34 years
Mean age of detection of deafness	2.2 years	1 year
Mean tenure in program	3.5 years	3.2 years
Mean degree of hearing loss[a]	3.06	3.45
Mean SAT–HI Reading Comprehension score[b]	534.42	567.23

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
[a]Pure tone audiometry on ascending scale of 1 to 4, with 4 = profound deafness.
[b]Scaled score.

across all levels of schooling. In our study population, we had a higher proportion of children with deaf parents (20% of our total group of 135 students), almost all of whom had children at the residential school.[5]

The presence of deaf children of deaf parents in our population influenced school group means by nearly every characteristic. Deaf parents are more likely than hearing parents to recognize deafness in their child at an early age and to locate schooling for their deaf child at an earlier stage, pushing means for both of these characteristics at younger ages for children at this school setting. Of our population of deaf children of deaf parents at the residential school, 78% are White, reflecting demographic studies showing that the condition of congenital deafness is more prevalent within the White population in the United States than among other ethnic groups (Holt & Hotto, 1994).

In contrast, the public school's location near an urban center as well as its accessibility to families who recently emigrated to the United States result in a larger diversity of ethnicity among its students. As for why the public school had more children with handicaps and illnesses, it may be that parents want them to remain closer to home, where medical care is more convenient. As discussed next, we found many of these characteristics to interact with reading achievement (Table 10.1).

A key point here is that any attempt to measure the effect of school setting on reading achievement requires analyses that recognize that popu-

[5]Possibly, the higher participation rate of deaf parents in our study was due to our description of the goals of the study as exploring factors of "sign language and reading," a topic of specific interest to middle-class deaf parents.

lations in the two types of school settings are not randomly distributed in terms of characteristics. This is not a surprising discovery, but it also bears noting that although school populations may vary in terms of characteristics such as ethnicity and family income, they also vary in terms of the proportion of children with deaf parents and by consequence, the average age of detection of deafness among their students. Average age of detection in turn influences the average age of enrollment in an educational program suitable for deaf children. Few demographic studies include these characteristics, although as we discuss next, they interact with reading achievement. Our study suggests that although in principle, all options of schooling are available to families with deaf children, educational policy of the last 30 years has led to quite different distributions of students across different schools.

Reading Achievement

Of the 98 students with valid reading comprehension scores (across both school settings), we found three factors to correlate significantly with reading achievement: deaf parents, age of detection, and length of time the child has been in school (tenure). One factor negatively correlated with reading achievement: the presence of handicaps. The need for variables that measure social characteristics was borne out by our discovery that age of detection of deafness correlated with reading achievement. The longer the parents waited before confirming deafness, the greater the negative impact on reading achievement. These variables taken together point to the strong influence of early language experience and school experience on reading achievement among profoundly deaf children. As might be expected, the presence of handicaps complicates the linguistic and cognitive profile of the child, leading to overall difficulty in reading development (Table 10.2).

Returning once more to the issue of school setting, we found that if reading achievement scores are compared across school settings, average scores at the residential school are significantly higher than those at the public school, but if children with deaf parents are removed from the comparison, neither school has an advantage. Because the subject of schooling has such emotional content in the national debate over the future course of deaf education, we refrain from any claim based on our data that either the residential school or the public school has a clear advantage in fostering reading achievement. More of the students attending the public school in our study had handicaps, came from different ethnic backgrounds, and in some cases, started school later because they arrived from a foreign country. All of these characteristics complicate reading development under any circumstances. These observations notwith-

TABLE 10.2
Correlations of SAT–HI Reading Comprehension With Demographic Variables

Variable	*N*	*SAT–HI Reading Comprehension*
Deaf parents	98	.39**
Age of detection	91	–.27**
Tenure	98	.44**
Age of onset	98	.08
Handicaps	98	–.34**

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
**$p < 0.01$.

standing, it is clear that the challenge of teaching deaf children to read is one shared by all schools.

STUDY 2: SPECIFIC LANGUAGE SKILLS AND READING ACHIEVEMENT

A central question of our study is whether and how ASL plays a role in reading development, beyond providing a linguistic and cognitive basis for the development of new language skills. To answer this question, we developed a battery of five tests in which specific ASL skills were tested. A total of 31 deaf children in four classrooms were given this battery of tests: two fourth–fifth grade (n = 18) and two seventh–eighth grade classrooms (n = 13), one at each level at a residential and public school for participation in our language testing study. Each child was individually tested on the battery.

Three tests measuring general ASL competence were given: Two were previously developed by Supalla et al. (in press) and a third was developed by our group. The Verb Agreement Production test (Supalla et al., in press) asks the student to view action between two individuals and sign a response in which they inflect a signed verb that corresponds to the action. Their responses were also videotaped and then coded. The third test. Sentence Order Comprehension (Supalla et al., in press), presents students with signed sentences on videotape in which sentence order is manipulated. Students are then asked to point to a picture from a set of four that represents the meaning of the sentence. In the Imitation task, which we developed, students viewed a videotaped ASL sentence, signed by a native signer, and were asked to repeat the same sentence back to a video camera.

The 12 sentence items varied in complexity, with each item no longer than a single sentence. For scoring, semantic substitutions were accepted as correct,[6] but production errors or deletions in the signed response were coded as incorrect (see Mayberry & Fischer, 1989).

The remaining tests were based on a previous study of classroom practice in residential and public schools (Ramsey & Padden, 1998). In this study, we observed teachers—both deaf and hearing—using initialized signs and fingerspelled words at strategic points in classroom instruction about reading and writing. Initialized signs involve replacing the handshape of an ASL sign in order to create related vocabulary, for example, the ASL sign CLUSTER has many related initialized signs: GROUP, FAMILY, SOCIETY, DEPARTMENT, ASSOCIATION.[7] Sometimes teachers used initialized signs in place of ASL signs, but many times they were used in sequence with ASL signs in contrastive ways to highlight English vocabulary. In one example, while giving a spelling lesson, a deaf teacher used the ASL sign GARDEN, followed by an initialized counterpart, GARDEN, to emphasize that the children should write the word *garden*. Where initialized signs only represent one letter, usually the first letter of the English translation of the sign, fingerspelled words represent the entire sequence of letters that comprise the written word. When fingerspelling, signers execute in rapid sequence handshapes that correspond to each letter in the word. As with initialized signs, we saw teachers also use fingerspelled words in sequence with ASL signs and initialized signs. One teacher was explaining about volcanoes, during which she used an initialized sign, VOLCANO, and then immediately in sequence fingerspelled the word *volcano*.

Using examples of vocabulary we saw in our classroom study, we developed two tests that would evaluate how well students knew the association of these vocabulary items to their English counterparts and were able to write them in English. The Initialized Signs test involved 20 items on videotape, each featuring a native signer producing a sentence containing exactly one initialized sign. At the end of each sentence, the signer directed the student to "write [initialized sign]." The tester briefly paused the videotape as the student wrote a response, and then the next item was shown. For example, one sentence was as follows: BOY NOT FOLLOW RULE. NOW WRITE "RULE." Because this test yielded very few correctly spelled responses, we scored by a weaker standard in which the word did not need

[6]For example, a few students substituted Signing Exact English vocabulary, for example, BUS, for signs in the test sentences. They were accepted as correct if the meaning was the same or similar as the test vocabulary.

[7]The convention for representing ASL signs in English is to translate them using single word glosses in capital letters. Initialized signs are represented with a capitalized gloss as well, with the letter corresponding to the handshape of the sign underlined. Fingerspelled words are glossed with single letters joined by hyphens, for example, B-U-S, "bus."

TABLE 10.3
Correlations of SAT–HI Reading Comprehension With ASL Tests

Test	*N*	*SAT–HI Reading Comprehension*
Verb Agreement	22	.51*
Imitation	23	.46*
Sentence order	24	.76**

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
**p* < 0.05. ***p* < 0.01.

to be spelled correctly but needed to be recognizable as the target word by three naive independent readers.[8]

On the Fingerspelling task, students watched a sentence on videotape containing one fingerspelled word and were asked a question to aid their recall of the fingerspelled word. In one example, students were shown the signed sentence (translated in English), "The girl needs *ice* for her drink." Following the sentence, the signer on videotape asked "What did the girl need?" We scored according to an exact written replication of the fingerspelled word; that is, the response had to be correctly spelled.

Beginning first with our three tests of ASL ability, we found all to correlate with the student's score on the SAT–R. Interestingly, the relation held for deaf children of hearing parents who would be expected as a group to have less experience with ASL. Of the three tasks, the Sentence Order Comprehension seemed to be the easiest, with students scoring on the average 80% correct. In this task, students were asked to recognize the agent of the signed sentence and select the picture that corresponded to the identity of the agent. The Imitation task was the most difficult, with the average score at 45% correct. The task measures the ability to comprehend, recall, and reproduce sentences in ASL, all of which would appear to draw from not only linguistic ability but memory as well. The Verb Agreement Production measures ability to produce correct ASL verb inflections and does not require recall. Students scored on the average 70% correct (Table 10.3).

To evaluate the possibility that the relation between the ASL and reading tests was a measure of general test-taking skill rather than a relation between two language skills, we examined the students' SAT–M scores to see if this

[8]We recruited undergraduate hearing students from a child development class to read each misspelled attempt. If three students independently agreed on what the intended word was, and if it matched the test item, we scored it as correct.

too had a relation to performance on ASL tests. As it turned out, SAT–M did not correlate with either the Imitation or Verb Agreement Production tests but it correlated with the Sentence Order Comprehension, a task that, for most of our students, was easy to complete. We are not confident that this latter task produces enough variation in scores to observe relations with other skills. Last, the SAT–M also correlated with SAT–R, most likely because this test involves some reading of math problems (Table 10.4).

For students with less skill in ASL, the Fingerspelling task was very difficult to complete. Some struggled with even three- or four-letter words like *wax* or *bark*, reporting instead a collection of letters that did not appear in the word. Others were able to write some of the letters of the word but could not retain their correct order. When we compared test scores, we found that performing well on the task correlated with performance on the SAT–R *and* our ASL tasks (Table 10.5). It is perhaps not surprising that there is a relation between fingerspelling and reading if fingerspelling

TABLE 10.4
Correlations of SAT–Math Computation Wtih Language Tests

Test	*N*	*SAT–HI Math Comprehension*
Verb Agreement	16	30
Imitation	18	.18
Sentence order	18	.62*
SAT–HI reading	73	.75**

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
**$p < 0.05$. **$p < 0.01$.

TABLE 10.5
Correlations of Fingerspelling Test With Language Tests

Test	*N*	*Fingerspelling*
Verb Agreement	25	.71**
Imitation	26	.87**
Sentence order	25	.64**
SAT–HI reading	22	.43*

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
**$p < 0.05$. **$p < 0.01$.

is seen as a code for print, but it is also interesting that strong ASL skills also play a role (Table 10.5).

A different pattern was found for the Initialized Signs test (Table 10.6). There was no relation between having deaf parents and the student's score on the Initialized Signs test. However, this skill and fingerspelling are highly correlated, which suggests that they are related to each other. Additionally, scores on the Initialized Signs task correlated highly with the ASL measures. This suggests that, as hypothesized, this group of tasks is interrelated. Because initialized signs represent only one alphabetic letter, typically the first letter of the word, the task requires students to know how to spell the rest of the translation without any further clue. As might be expected, students who had better reading ability performed better on this task.

The composite portrait offered by the relation between language skills and reading ability is an intricate one, worth elaborating at some length here. We have demonstrated that there is a relation between certain tests of ASL ability and reading achievement and that this is not a spurious one based on general test-taking skill. Additionally, we found a modest relation between reading skills and what we call *associative skills,* or being able to recognize and translate initialized signs and understanding fingerspelled words, then writing them down. Because associative skills and ASL skills are strongly related, we believe that these special skills that involve both ASL and representations of English are good sites for further research into reading ability in signing children.

So far we have demonstrated only that there are relations, not whether early acquisition of fingerspelling or initialized signs promotes reading development. It is entirely possible that development of reading skill leads to skill in fingerspelling comprehension and translating initialized signs. Hirsh-Pasek & Treiman (1982) advanced this view. From studies of young deaf children, some as young as 3 years old, it is clear they can recognize

TABLE 10.6
Correlations of Initialized Signs Test and Language Tests

Test	*N*	*Initialized Signs Test*
Verb Agreement	23	.76**
Imitation	25	.74**
Sentence order	24	.71**
SAT–HI reading	21	.80**

Note. SAT–HI = Stanford Achievement Test–Hearing Impaired.
**$p < 0.05$. **$p < 0.01$.

fingerspelled words without knowing their counterparts in print (Kelly, 1995; Padden, 1991; Padden & LeMaster, 1985). Indeed, there can be a long dissociation between the two skills until the child begins to learn to read: In some cases, these young children are surprised to discover that fingerspelled words have counterparts in print. These studies suggest that although fingerspelling, reading, and writing are related by virtue of their coding of the alphabetic system, the timetable for development in each may be very different and uncoordinated until later in life. Of special interest is how and where the systems converge to produce a coordinated set of knowledge about English in print. Our fingerspelling task was not solely a recognition task in which children were simply asked to report the meaning of the word, but it required students to write the words in English. This skill may take place later, when students are able to bring all three skills—fingerspelling, reading, and written spelling—to bear on the task. Again, it is interesting to see that when these skills are marshalled to complete the Fingerspelling task, the student is more likely to have very good ASL skills as well, supporting our claim that the successful deaf signing reader is one who can draw from several composite skills.

STUDY 3: MODES OF READING INSTRUCTION

In this study, our goal was to observe more closely instructional practices of teachers involving print, and to study observable reading processes in individual deaf students. For the first part of the study, involving instructional practices, four classrooms were videotaped three times in one academic year, once each in the fall, winter, and spring. Two classrooms were at the elementary level, one at each school setting, and the remaining two were at the middle school level, also one at each school setting. Each visit yielded 1 week of videotaped classroom activity. For the second part of the study, each student participating in the classrooms was videotaped while reading a story aloud. From these observations, we aimed to learn more about institutional influences on reading behaviors.

Reading Processes

A task was devised in which a member of our research staff asked each student in the classroom study to "read aloud" or sign from a book selected as being at or slightly above their reading level (we used their teachers' judgments). If students wanted assistance with individual print words, it was given. Although we do not assume that this task for deaf children is identical to reading aloud for hearing children, nor that it is an easy one to do, the children generally complied because reading aloud in signs is

a common task in both school settings. The transcribed signed reading aloud was compared to the target story and coded for miscues. Conventional miscue categories were used, including omissions, substitutions, self-corrections, and observation of sentence boundaries. We also noted fingerspelling and mouthing, as well as use of initialized signs and classifier signs while reading aloud.

We found that students had widely varying reading aloud behaviors, and some could not retell with comprehension after reading aloud a story. Aside from the general difficulty many had, at least two major patterns of reading behavior could be observed in students, one characterized by "attacking and analyzing words," and another, by "seeking meaning." The differences are best exemplified by comparing the performance of two fourth-grade students, Billy and Roy,[9] who are native signers. Billy has a deaf mother and a hearing father, and Roy has two deaf parents. Billy has always attended a public school; Roy attended a public school briefly but is currently a student at the residential school.

Billy is not an exceptional reader: He scored in the 56th percentile on the SAT–R of deaf readers his age. When Billy read aloud, his attention was focused on individual words. To Billy, reading meant mapping individual signs onto print words or morphemes. This strategy led to many miscues, most of which resulted in sentences that did not make sense within the meaning of the story. For example, in an illustrated story about baseball, he signed "flying mammal" in response to the print word *bat,* and "swim" in response to *swing.* In the former he was prompted with the correct sign BASEBALL BAT. However, Billy's confusion persisted, and in the next occurrence of *bat,* he fingerspelled the word, suggesting that he did not have a sense of the word or the story. On the latter, he hesitated as he made the miscue, rechecked the print, did not self-correct, and signed "SWIM" again. Billy was unable to respond to the text as he read, did not indicate dialogue or represent character shifts, and failed to observe sentence boundaries or punctuation marks. Billy attempted to represent each English morpheme with a sign. He also made fluent and frequent use of SEE (Signing Exact English)[10] lexicon, including pronouns and copulas (HE, SHE, IS), although he used very few content signs from the SEE lexicon. He mapped ASL signs onto print words, but all were uninflected, and he did not use classifier predicates. As he struggled to decode every word, his pace of reading slowed.

[9]The names we use are pseudonyms.

[10]Billy's teacher employed a version of a pedagogical tool used by some educators to represent English vocabulary, called Signing Exact English (Gustason et al., 1980) and more commonly known by its acronym, SEE. This pedagogical tool offers a vocabulary book of devised initialized signs to be used in place of ASL vocabulary.

At the end of the reading aloud task, Billy was asked to retell the story. Not only did his retell fail to relate the print story, it did not stand alone as a meaningful story. Rather, Billy signed a series of marginally related ideas, strung together with THEN. We know that Billy's difficulty with the written narrative is not because he lacks language or narrative skills, because in another task not discussed at length here, students were asked to retell from a video cartoon. On this signed task, Billy performed well. Billy's difficulty is because he does not comprehend written text very well and cannot use his decoding attempts to build up a narrative.

Our second reader, Roy, is a fifth grader who attended a public school Total Communication program for deaf students through first grade, then transferred to a residential school, where he lives in the dorm. Roughly comparable to Billy, he is in the 58th percentile of deaf readers his age according to his SAT–R score. But in contrast to Billy, Roy's attention during reading was focused on seeking meaning in the text. Like other meaning-seeking readers in our sample, Roy scanned each page of text before he began reading. Between signed utterances, he kept his gaze on the page much longer than Billy, suggesting that he was reading beyond individual words. He observed sentence boundaries and other punctuation marks, represented character shifts as characters spoke, and consistently recognized and self-corrected his miscues.

Roy matched individual signs to words in print selectively. Sometimes he signed a one-to-one match, with one ASL sign for an English word; but often he translated in which the match was not exact. For example, an illustrated story about a dispute between the Sun and the Wind had this sentence "They saw flowers opening and birds flying." Billy signed "THEY SEE FLOWER OPEN BLOOM AND BIRD FLY-WITH-WINGS CL: trace path birds flying around." Just as Billy's dominant strategy was to force an exact match between parts of words and signs, Roy's dominant strategy was to look at sentences or even larger text structures and seek coherent meaning in them. Roy devoted much less attention to representing individual English words in signs, and used SEE lexicon sparingly, alternating with fingerspelling (e.g., once he signed THE, but the rest of the time he fingerspelled it).

We view these differences as artifacts of experience and pedagogy. Billy and Roy's reading scores are not significantly different, yet their reading strategies are distinct. Billy's interpretive skills are very limited; he must first demonstrate word comprehension before he can complete text comprehension. Roy is allowed latitude in adding and expanding on the meaning of the text he is reading. He not only has to recognize (not necessarily decode) words in a sentence, but also comprehend their meaning in terms of the narrative. In essence, the two school settings offer different hypotheses of reading development: the public school, that decoding individual

words and building vocabulary from word recognition underlies reading development, and the residential school that word comprehension derives from understanding the text as a whole. The more top-down mode of the latter approach follows from the school's commitment to bilingual education, in which students are routinely taught to compare meaning in ASL and English. The more bottom-up mode of the public school derives from the school's interest in monitoring vocabulary development in English. The literature in deaf education is represented by both points of view, and as our encounters with the two school settings demonstrate, schools are still struggling to evaluate which best aids reading development.

We are not prepared at this time to argue that one or the other approach to reading behavior leads to superior results. Instead our point here is that children do not happen into one or the other type of reading behavior, but are guided into doing so by specific pedagogical approaches. Schools' choices of pedagogy are not incidental, but drawn from their ideas about the nature of reading in deaf children, whether it is fundamentally an English decoding skill or an associative skill between languages. At the residential school that Roy attends, the curriculum emphasizes bilingual approaches, and the types of top-down activities that Roy uses are specifically taught to him.

Instructional Practices

We found further contrasts between the two school settings when we studied teachers' methods of talking about English print. This component of our investigation was drawn from videotaping five classrooms at two school settings, comprising a total of 90 hours of videotape. Seven teachers were featured, with two classrooms sharing team teachers. Each teacher was videotaped individually three times in an academic year, one week each in the fall, winter, and spring. Three of the 7 are public school teachers and the remaining 4, residential school teachers. Three are native signers, 1 at the public school district, and 2 from the residential school. Three of the teachers are deaf, 1 at the public school and 2 at the residential school (Table 10.7).

From these data, we took a sampling of six 15-minute segments featuring each teacher, with a total of 42 segments across all teachers. Because on our first pass, we noticed a differential use of fingerspelling and initialized signs across teachers, we started first with a simple frequency count. Each fingerspelled word and each initialized sign used by the teacher was transcribed for the duration of the sampled segment. Comparing average occurrence of fingerspelled words and initialized signs across samples for each teacher, we found first that deaf teachers in either setting finger-

TABLE 10.7
Distribution of Teachers Across School Setting

	Native Language	
Teacher Group (N = 7)	*English*	ASL
Residential school		
Deaf	0	2
Hearing	2	0
Public school		
Deaf	1	0
Hearing	1	1

spelled more than twice as often as hearing teachers. Deaf teachers fingerspelled an average of 176 words (including repetitions of the same word) in our sample and hearing teachers fingerspelled an average of 75 words. The deaf teacher at the public school accounted for more instances of fingerspelling than her other two hearing colleagues at the same setting combined. But school setting was influential: Residential school teachers fingerspelled an average of 152 words compared to the public school teachers' average of 74 words. Within the residential school group of teachers, although one deaf teacher had a very large number of instances of fingerspelling, there was little difference between the second deaf teacher and the two hearing teachers. In sum, fingerspelling is used more by deaf teachers but also more by teachers who work in the residential school.

When we were counting the number of instances of fingerspelled words, we noticed that some of the teachers repeatedly fingerspelled the same word in short intervals, and further, they typically combined fingerspelled words with ASL signs and at times, initialized signs in what appeared to us to be a process of stringing together similar types drawn from different systems. When we transcribed these chained sequences, they first appeared to be repetitions, but they were actually variations on a theme: fingerspelling, print, and signing all linked together to suggest equivalence and commonality. One teacher, for example, in a lesson about volcanoes, fingerspelled the word *volcano*, then pointed to the same word written in chalk on the blackboard, then used an initialized sign VOLCANO, all in rapid sequence, one after the other. These "chaining" structures immediately struck us as places where associations could be cultivated between signs and printed words. As with fingerspelling, this technique was used selectively; some teachers favored it far more than others. Deaf teachers used an average of 30 instances of chaining across their samples whereas

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TABLE 10.8
Mean Number of Language Structures by Teacher Group

	Language Forms	
Teacher Group (N = 7)	*Fingerspelling*	*Chained*
Residential school		
Deaf	176	230
Hearing	275	5.5
School setting		
Deaf	152	21.5
Hearing	74	8.7

hearing teachers used chaining a low average of 5.5 times. Residential school teachers used chaining an average of 21.5 times and public school district teachers an average of 8.7 times (Table 10.8).

Why are fingerspelling and chaining structures more prominent among deaf teachers? We can think of two answers. First, the structures are amply present in everyday ASL. Deaf adults use fingerspelling in the natural course of signing, with each other and with children. Fingerspelling is not only a frequently used system, found in signers of all ages, social classes, and ethnicities, but is fully integrated in ASL grammar (Padden, 1998). Likewise. chaining structures are frequent. In routine everyday ASL, signs are followed by fingerspelled words, for example, TRASH-CAN T-R-A-S-H; or in classifier signs and signs: ROUND-OBJECT P-L-A-T-E. Kelly (1995) described "sandwiches," or structures where repetitions of the same form appear with an intervening contrasting form, such as a fingerspelled word inserted between two repetitions of a sign with related meaning. Kelly found that these structures are pervasive in the early language environments of deaf families with young deaf children.

Second, it may be that redundancies in sign structures are necessary where visual information is rapid and vulnerable. As deaf people accustomed to the requirements of visible language and the demands of signing in visual environments, these teachers repeated words, phrases, and sentences as a means of making their signing clear and accessible to their students. What we see being used in the classroom is an elaborate and purposeful extension of routine structures in ASL, to include not only signs and fingerspelled words but also initialized signs and even written words on the blackboard. Hearing teachers, on the other hand, repeat vocabulary less often, and seem not to be aware of chaining structures, unless as we have found, they teach in a residential school.

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ASSOCIATION AND REPRESENTATION

We return to what we believe is the most interesting question of this inquiry: Why is there a relation between specific sets of ASL abilities and reading ability given that the two systems have little in common? The relation holds even for deaf children of hearing parents who acquire ASL skills at school, although it is more prominent in native signers. This question, it should be noted, is not the same as asking whether ASL is *necessary* for reading and writing development in deaf children. Deaf children who grow up with oral deaf parents who do not sign are reported to succeed at reading (de Villiers, Bibeau, Ramos, & Gatty, 1993), demonstrating at the very least that there must be more than one possible route to reading development in the deaf child. We leave the question of which reading strategies are effective or efficient for a fuller discussion; the question of how specific ASL structures come to have a relation to reading and writing skill is worth asking. We have always understood learning to read as a task of linking two related systems, one a representation of the other. But what is revealed by the case of signing children is that unusual, even unexpected, relations can be cultivated, it appears, by systematic exposure to systems of meaning.

Our argument is a variation on those offered by a number of individuals in which the analytical capabilities of human beings are influenced by the presence of written literacy in the culture. Goody (1987), Donald (1991), and Olson (1994) made claims that the pervasive presence of an alphabetic system in a culture drives the possibility that individuals will discover analysis by phoneme, to appreciate that words have smaller units beyond the level of the syllable. The presence of alphabetic literacy in all facets of everyday life, they argued, has accelerated the transition from illiteracy to literacy in an individual's life to a matter of a few years, somewhere between the second and third years of life to the fifth or sixth. To reach every aspect of the child's life, societal resources are fully deployed, from the spread of book technology to the daily presence of adults who themselves are skilled readers and trained to guide the child into life as a reader. Olson (1994) specifically further argued that phonological awareness is an unusual cognitive skill that is promoted and cultivated by the massive presence of alphabetic literacy in the early lives of children growing up in literate environments. Exposure to rhyming games and songs that are characteristic of early schooling serves as a precursor to developing reading skill.

Signing deaf children are also surrounded with alphabetic literacy, but oral games and songs are not directly available to them; instead, their parents and teachers offer other language games, some explicit but others inexplicit. A comparatively massive opportunity for young native signers

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may be the system of fingerspelling where, at a young age, deaf children practice not just the skill of fingerspelling but also learning regular orthographic sequences that characterize words. They also practice using a common morphological form in ASL, the initialized sign whereby the handshape of the sign is usually marked, drawing not from the phonemic inventory of ASL signs but from the alphabetic inventory of fingerspelled letters. When these children come to school, particularly those schools that are committed to signed language as a basis of instruction, these sign language games are not only continued but explicitly highlighted as a form of English language instruction.

We reiterate that there is nothing natural about reading. For all children, an association must be made. It may seem that associating "like" systems, an oral language and an alphabetic system based on the language, is easier than associating unlike systems, but the matter of what is alike and what is not alike has a surprising range. Take, for example, Read's (1975) discovery of young hearing children's "creative spellings." Not only did the children spontaneously create their own spellings, they did so using an unexpected analysis: Instead of linking sounds of a spoken word with letters of the same word in print, the children were linking the *names* of the letters of the alphabet with letters of a word in print. The invented spelling RID does not refer to *rid* but to *ride*, in which the letter *I* is represented according to its name. Invented spellings such as these are short-lived bursts of creativity that last only until the weight of cultural convention forces them to be replaced. Eventually children switch to spelling by phonemic analysis. But the first inventions are entirely reasonable; they just are not conventional.

In our earlier work (Padden, 1993), we found that when deaf children invented their spellings, they made different associations, not by the names of letters but by the visual characteristic of the written characters themselves. They were not linking spoken words with print words but alphabetic letters to print words. In other words, they were forming links from within the system itself, creating novel ways of developing orthographic competence. In a short time, they managed to capture orthographic regularities, from constraints on doubled letters to characteristics of letter clusters in English written text. For example, the spelling attempts contained possible doubled consonants and avoided impossible doubling, such as *-hh-* or *-ww-*. Despite this novel nonphonemic approach, many of them went on to become adequate spellers. In fact, one characteristic of average deaf readers is that they tend to be better spellers than they are readers (Dodd, 1980; Hanson, 1986). Very possibly, a more visual analysis of orthography is superior to a sound-based one if spelling ability is the goal.

What we find in our data is a continuation of our earlier discovery: Deaf children seek links between accessible systems, not between words they

cannot hear or speak but between signs that have some tangible link to English print, in this case, fingerspelling and initialized signs. Furthermore, there is evidence from our studies that these links are not entirely fruitless: The better readers in our sample were better at recognizing fingerspelled words and writing them down in print. They were also better at recognizing that initialized signs had a link, although small and tenuous, to words in print. These links are not easy to make, and again, there is nothing natural about them, but they are cultivated from consistent and, we would argue, massive exposure organized and orchestrated by one's culture. Deaf children who grow up with ASL are exposed not only to early language experience, which undoubtedly contributes to reading success, but they also grow up learning strategies for linking systems, in this case, ASL and written English.

Because we suspect we cannot leave this issue without a few parting comments, we return briefly to the question of whether we have evidence that knowledge of ASL is necessary for acquisition of reading ability in young deaf children. This is an issue fraught with distractions of all kinds. If evaluating optimality were the only aim, then by the same token, we could argue that hearing children should pursue the strategy of deaf children when learning to spell; that is, they should learn to spell visually, not auditorily. Without trying to be facetious, it underscores a point about the nature of reading and writing: It is a language skill that is always learned under limited circumstances. Chinese-speaking children learn to read not by associating elements of Chinese to an alphabetic system but to an ideographic script. English-speaking children learn to associate sounds of English, not via fingerspelled handshapes but via English written text. Signing deaf children, we are starting to learn, form associations that have yet to be described in the reading literature. Unfortunately, some of the reading literature on deaf children is wistful and hopeful that somehow optimal strategies based on those used by hearing children can be adapted for use with deaf children. What this literature ignores is a fundamental principle about learning to read and write that we are starting to discover must also hold for deaf children: That it is not merely a linguistic or cognitive achievement (although it undoubtedly is) but it is a social achievement of marshalling cultural resources to instruct the younger members of the group (Duranti & Ochs, 1986; Heath, 1983). Viewing signing deaf children as cultural beings has always been controversial, but it is probably the best strategy for mapping out the nature of reading development in this population.

If we pursue the trajectory of reading development in the deaf population further, we are likely to encounter interesting twists. At least one will be the discovery that signing deaf adults who are skilled readers can perform phonological analysis on written English words even though they do not hear and do not speak intelligibly. It may be argued, and some

have already, that any capable mastery of an alphabetic system must at some point appreciate its underlying phonological system (Hanson, 1989; Hanson, Liberman, & Shankweiler, 1984; Hanson, 1989). Evidence from skilled deaf adult readers suggests strongly that this is so. But it is unclear at what point deaf readers master this ability. Some research suggests they do not do so initially (Schaper & Reitsma, 1993; Waters & Doehring, 1990), so the ability must have developed at a later point. Possibly, signing deaf children begin with associating elements of ASL to print, and then over time convert this knowledge to knowledge about the oral aspects of print. However the trajectory is to be represented, a description of reading ability in young deaf children will necessarily chronicle transitions through reading development, in which composite skills such as fingerspelling, morphological analysis, and phonological analysis converge to create the deaf reader. The picture that is beginning to emerge is one of a remarkably different route, one that draws from an assortment of cultural and individual capabilities. The portrait of the successful deaf reader must indeed be a unique one.

As we conclude, we offer the following summary points. First, we find a strong correlation between deaf children of deaf parents and comparatively higher reading achievement scores. This relation may be due to background characteristics shared by deaf children of deaf parents, which include early first language exposure and the fact that most are White, are introduced to school earlier, have less likelihood of handicaps, and have longer experience at school. All these characteristics play a role in reading and school achievement. Deaf children of hearing parents who share these characteristics also are more likely to have higher reading scores when compared to other deaf children less advantaged in these ways.

Second, our findings show that skill in fingerspelling interacts with reading achievement. We do not know whether skill in fingerspelling makes reading development possible, or if good reading skill leads children to fingerspell more and recognize fingerspelled words better. Delving deeper into this question requires a more refined set of tests, which our next project will develop. We also find that good readers can report English translations for initialized signs. Again, we do not know what role initialized signs may play for bilingual deaf children. It is possible that initialized signs may provide an initial push to beginning readers by helping them recall the first letter of English words, but they still must learn to complete the full English word. Most interesting, we find that skill in both fingerspelling and writing down English translations of initialized signs strongly correlates with ASL competence.

Third, our findings are limited to the question of reading development in severely to profoundly deaf children who use signed language in everyday contexts. Our observations of reading instruction suggest that families and

institutions play a role in cultivating certain skills as means of acquiring competence in reading. We expect that deaf children in general have multiple routes to reading ability and that we have identified only a subset of these possible routes. A complete study of reading development in the entire population of deaf and hard-of-hearing students will likely identify several subgroups, each with a different array of language skills.

Fourth, different school settings organize reading instruction differently. We find from comparing reading and re-tell abilities of deaf children who are matched in family background that they may have very different reading strategies depending on which school they attend. One school we studied emphasizes translation ability whereas the other emphasizes decoding skills.

Finally, from our early analyses of teacher language in the classroom, we find again that school settings play a role. Residential school settings seem to engender more fingerspelling and more chaining structures, which we see to be predominant in classes involving literacy education. On the other hand, deaf teachers regardless of school setting are more likely to fingerspell and are more likely to use chaining structures. We do not argue here that fingerspelling and chaining are sufficient techniques for teaching reading, but that they stand out as two of the more noticeable examples of differences among teachers across classrooms. The profile of the skilled signing deaf reader suggests that these techniques may play a role in cultivating the abilities they share.

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