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ACCESS TO PRINT AND FORMAL INSTRUCTION IN READING ACQUISITION

by

Jeffrey Lawrence McQuillan

A Dissertation Presented to the

FACULTY OF THE GRADUATE SCHOOL

UNIVERSITY OF SOUTHERN CALIFORNIA

In Partial Fulfillment of the

Requirement for the Degree

DOCTOR OF PHILOSOPHY

(Education)

May 1997

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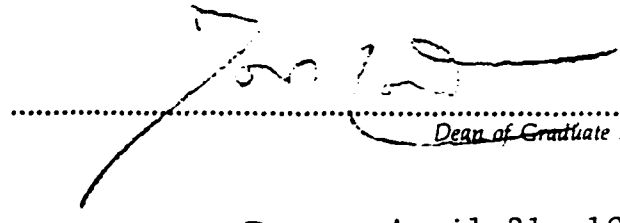
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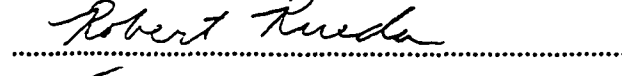
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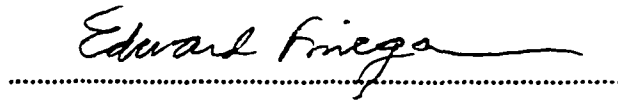
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ACKNOWLEDGMENTS

I would like to thank my dissertation committee members Stephen Krashen, Robert Rueda, and Edward Finegan for their guidance. I would also like to thank Lucy Tse for her insightful comments and assistance.

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CHAPTER I

INTRODUCTION

The purpose of this dissertation is to analyze the effects of access to print and formal instruction on initial literacy acquisition and subsequent development. This introduction is divided into three parts: first, a general theoretical framework for understanding the acquisition of oral and written language; second, a statement of the research questions and importance of the study; and third, the organization of the rest of the dissertation.

Theoretical Framework

Krashen (1981, 1996b) has proposed that language acquisition is a result of a single causative variable: the comprehension of messages that contain linguistic elements slightly beyond the person's current level of competence. Described first in his Input Hypothesis (1981) for first and second language acquisition and later in the Comprehension Hypothesis for literacy (1996b; see also Smith, 1994; Goodman & Goodman, 1979), Krashen holds that acquisition results when a person receives "comprehensible input" or messages that contains "i + 1," where "i" stands for the current level of acquisition, and "i + 1" for the next linguistic element the person is ready to acquire. The more comprehensible input containing i + 1 an acquirer receives, the higher the level of language acquisition attained. This general relationship has been supported by evidence in both first (L1) and second (L2) language acquisition for both oral (Asher, 1994; Cross, 1977; Hart &

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Risley, 1995; Krashen, 1981, 1985; Swaffer & Woodruff, 1978) as well as in written language (Anderson, Wilson, & Fielding, 1988; Elley & Manguhbai, 1983; Elley, 1991; Krashen, 1993; Taylor, Frye, & Maruyama, 1990).[1]

Figure 1 is a representation of this general model for language acquisition.

Figure 1
General Model of Language Acquisition

Reception of
comprehensible input-----> Language acquisition
containing i + 1
(listening/reading)

While Figure 1 represents the central relationship in acquisition, the usefulness of the general model can be improved both theoretically and practically by integrating into it two additional factors: the source of input (access) and the role of instruction.

Access

What is often ignored in discussions of language and literacy acquisition, but logically implied in Figure 1, is a source of input. We know from studies of L2 acquirers, for example, that access to input as measured by length of residence in a country is positively correlated with higher levels of language acquisition when the input is comprehensible to them (i.e. they are at least at an intermediate level of proficiency) and they have interaction with their surroundings (Krashen, 1976). Similarly, there is evidence that access to books is also associated with more

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literacy development (Elley, 1992; Krashen, 1995). Although clearly one must actually receive the input (listen, read) in order to acquire, variations in the supply of input indirectly affect the level of acquisition, and may explain large individual differences in proficiency.[2]

Instruction

It has been claimed by some researchers that exposure to comprehensible input is itself insufficient to acquire the ability to read, and that some form of explicit instruction is necessary for at least initial reading acquisition to take place, thus distinguishing the acquisition of oral language from its written form (Ehri & Sweet, 1991; Share, 1995; Stanovich, 1994). Those who support view point to the fact that while virtually everyone acquires oral language (Pinker, 1994), not everyone learns to read, and thus literacy is "unnatural" (Gough & Hillinger, 1980; Share, 1995). Share (1995), for example, has stated that children must first receive certain meta-linguistic training in the awareness of phonemes as well as in the connection between sounds and letters in an alphabetic system before being able make sense of text.

Clarification: What Is "Instruction"?

In order to talk about the role of "instruction" in literacy acquisition, it is helpful to define the term. We can distinguish between two types of external assistance, both of which come from another speaker/reader of the language, both of which typically occur in the process of oral and written language acquisition,

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and both of which can come before or during the acquirer's reception of a given "piece" of new input. The claim here is that both types may be helpful to the acquirer in comprehending new input, although neither is necessary.

Meta-linguistic assistance.

This is information about the language system itself, either written or oral, conveyed consciously to the acquirer (in Krashen's terms, "learning" (1981)). Assistance of this type includes providing information about sound-letter correspondences, doing exercises aimed at improving phonemic awareness, and explaining grammar rules. Such knowledge may be useful to the acquirer in understanding input, especially when his/her background knowledge and the context of the input are insufficient to understand the message.

Smith (1994) gives a good example of how meta-linguistic knowledge can be of help in comprehending text. Suppose a child is confronted with the following sentence but is unable to read the last word:

The man came riding in on his h*orse*.

Knowledge that the "h" at a beginning of a word makes a certain sound would reduce the number of possibilities that the reader had to choose from. She would know, for example, the word could not be "car" or "train." Explicitly teaching a child the sounds that letters make could contribute somewhat to comprehension of text and thus indirectly to literacy acquisition.

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Giving meta-linguistic assistance is what I will refer to as "formal instruction." For literacy, this typically takes place in school through the use of phonics training and the teaching of the alphabet, although parents sometimes also give their children some meta-linguistic knowledge at home by teaching them letter shapes and sounds (Durkin, 1966; Yaden, Smolkin, & Conlon, 1989).

Elaborative assistance.

Elaborative assistance includes all other information provided to acquirers which helps them understand input. In the case of oral L1 acquisition, a more advanced speaker may help make input comprehensible to the acquirer by way of "semantic contingency" (continuing on about the topic introduced by the child's previous utterance), a slower rate of speech, restatement of the message, using "here-and-now" topics, and similar devices (Newport, Gleitman, & Gleitman, 1977; Snow, 1983). Second language teachers similarly use elaborative devices such as re-statements, realia, and "foreigner talk" to make new input comprehensible to the acquirer (Freed, 1980; Krashen, 1981).

For written language, the acquirer may be assisted by verbal explanations of the story and reference to illustrations of the text. Studies of storybook reading, for example, show that parents give elaborative information about the story by describing the pictures, explaining the meaning of words, and giving background information on topics which appear in the story (Snow & Ninio, 1986; Smolkin, Conlon, & Yaden, 1988; Yaden, 1988).

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Reformulation of the General Model

Figure 2 re-states the hypothesis for language acquisition with the clarifications noted above.

Figure 2
Expanded General Model of Language Acquisition

Source of comprehensible input (Access)	-------->	Reception of comprehensible input containing i + 1 (with elaborative and/ or meta-linguistic assistance) ----------> Language acquisition

The model predicts that an increase in access to comprehensible input will tend to lead to greater reception of the input (reading/listening), which in turn leads to higher levels of language acquisition. This reception can be facilitated by both elaborative and meta-linguistic assistance, although neither is strictly speaking necessary.[3]

Research Questions

The purpose of this study is to determine how the two variables identified in the theoretical framework above--access and formal instruction--relate to the acquisition and development of literacy. Specifically, the following research questions are addressed:

1. Can initial reading acquisition by children as evidenced by knowledge of the "alphabetic principle" take place through access to comprehensible

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text without meta-linguistic assistance (formal instruction)? What role does elaborative assistance play in initial reading acquisition?

2. Can initial reading acquisition by children as evidenced by other measures of literacy (self-report, reading comprehension assessments) take place without meta-linguistic assistance?
3. Does access to text have a significant and substantial impact on literacy development among children even after controlling for the effects of meta-linguistic assistance?
4. Does access to text have a significant and substantial impact on literacy development among adolescents in assessments of academic reading proficiency?

Research questions one, two, and three will address the effects of both access and instruction on literacy acquisition and development; question four will deal only with access.

Importance of the Study

The field of literacy has expended a considerable amount of energy in the past fifty years debating the causes of individual differences in reading achievement. These theoretical and methodological debates have centered largely on questions of type of instruction (e.g. Chall, 1983; Adams, 1990) and individual cognitive processes (e.g. Stanovich, 1986). Policy makers have in turn focused on

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these same questions in attempts to provide a remedy for disparities in literacy development among schoolchildren (Honig, 1996).

The influence of access to texts on literacy acquisition and development, however, has received relatively little attention in the research literature, and it is still unclear how strong of an influence it may have relative to other variables which affect acquisition, particularly the presence or absence formal instruction. This dissertation re-focuses the debate by exploring the extent to which access affects reading acquisition, as well as how and why certain types of assistance may (or may not) be helpful or necessary for such acquisition to take place.

This re-focusing has both theoretical and practical implications. For literacy theory, it allows us to put various elements in perspective and see possible underlying commonalties between the acquisition of oral and written language. For educational policy, it can help define which areas (e.g. instruction, access) should receive the greatest amount of resources in order to affect changes in literacy development.

Organization of the Dissertation

The dissertation is organized around the four questions outlined above, followed by a general conclusion and discussion. Question 1 is taken up in the next chapter, Chapter II, through a narrative meta-analysis and re-interpretation of available correlational and experimental studies on the acquisition of the alphabetic principle. Studies on the impact of "environmental print" on children's early

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reading ability will be reviewed, as well as experimental investigations which have attempted to measure the effects of exposure to print on initial literacy acquisition. Chapter III addresses Question 2 through a narrative review of studies and evidence on children who learned to read outside of school, and includes an analysis of new data on the incidence of early reading outside of school from a nationally representative survey of parents. Chapter IV attempts to answer Question 3 through a statistical path model based on state-level data drawn mostly from the 1992 National Assessment of Educational Progress (NAEP) of fourth grade reading scores and various characteristics of print access, reading frequency, and formal instruction. Question 4 is addressed in Chapter V by means of a statistical analysis of data on state-level high school reading scores and print access. Chapter VI is a general discussion of the results of the study, with some further speculations on the nature of literacy acquisition and development. The Appendix contains an "applied" case study of reading policy and practice in the state of California, with a focus on how print access plays a critical role in understanding literacy development.

Due to the nature of the analysis, background information and methodological considerations for each question are taken up separately in the chapters, with one exception: The literature review for Chapter V (Question 4) is provided in Chapter IV, since there is considerable overlap in the scope of the issues addressed.

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Notes

1. Despite various critiques of the details of Krashen's theory when first proposed to explain second language acquisition (e.g. McLaughlin, 1978; Gregg, 1984), there is general agreement among theorists that the reception of comprehensible input is critical in language acquisition, and that it accounts for a major portion of L2 competence (Larson-Freeman & Long, 1991; Van Patten, 1987).

2. Given a source of comprehensible input, the actual amount of listening or reading may be determined by other factors not represented in the model, such as affective and environmental variables (e.g. for literacy, the presence of role models of reading, space and time to read (Whitney, 1996)). Krashen (1982) has also hypothesized that the reception of comprehensible input may not be sufficient for language acquisition to take place. There are also affective variables, such as self-esteem, motivation, and group membership, that may affect the extent of the acquisition. These variables can act as a "filter" (Dulay, Burt, & Krashen, 1982) preventing the input from reaching "Language Acquisition Device" in the brain. The strength of the filter may determine how much and what type of language is acquired. We will not consider these affective factors in this analysis, but recognize them as potentially important in explaining individual variations in acquisition.

3. It is difficult to imagine, however, a case where at least some elaborative assistance would not be needed to help an acquirer understand oral or written messages. Note also that meta-linguistic knowledge may be useful or perhaps

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even necessary to some degree in reading acquisition. At issue here is whether external, meta-linguistic assistance must be provided to the acquirer in order to "crack the written code."

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CHAPTER II

ACQUIRING THE ALPHABETIC PRINCIPLE: IS FORMAL INSTRUCTION NECESSARY?

One of the central controversies in current reading theory revolves around the relationship between the "alphabetic principle" and learning to read. The alphabetic principle has been defined by Share (1995) as knowledge of both letter-sound correspondence and "phonemic awareness," the conscious knowledge that speech can be segmented into minimal units of sound (e.g. the ability to name the three phonemes of "cat" as /c/, /a/, and /t/). A grasp of the alphabetic principle may help us to "recode" or "sound out" written words. Two claims have been made concerning this relationship: (1) the alphabetic principle is necessary for a child to learn how to read; and (2) children must typically be taught the two above-mentioned components explicitly (Adams, 1990; Ehri & Wilce, 1985; Share, 1995; Stanovich, 1993). Share, for example, has stated that preliterate children who are exposed to print have "not been found to spontaneously induce discovery of the alphabetic principle" (1995, p. 160), and that therefore "explicit instruction" is necessary to "bring the decoding possibilities of an alphabetic orthography to a child's attention" (1995, p. 160).

The first claim has been disputed by a number of other researchers. Smith (1994) and Goodman (1996), for example, have argued that the ability to recode words into sound is not central to what fluent readers do, and not a prerequisite to

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reading. It is recognized, however, that children who can read independently can normally also recode, so that the ability to do the latter is at least related to the former, even if the relationship is not causal.[1] This chapter will focus only on the second claim, that the alphabetic principle requires instruction. I will argue first that the studies cited by Share and others, while consistent with their position, are insufficient to support the claim that explicit instruction is necessary; and second, that it is equally plausible that the alphabetic principle, and more importantly, the ability to read, does indeed come primarily from exposure to comprehensible text, even without meta-linguistic assistance.

Background: Two Views on the Naturalness of Reading

Goodman and Goodman (1979) have posited that reading acquisition shares fundamental similarities with oral language acquisition: "Children learn to read and write in the same way and for the same reason that they learn to speak and listen. That way is to encounter language in use as a vehicle for communicating meaning" (p. 138). Drawing upon Halliday's (1969) categorization of the functions of oral language, Goodman and Goodman state that written language is acquired for similar uses (e.g. instrumental, regulatory, personal, informative) and along a similar developmental path when children perceive the need to communicate.[2]

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The focus of both the beginning and proficient readers, Goodman and Goodman contend, is always on meaning, and a "high level of conscious awareness of the [linguistic] units and system" is not necessary to their task. Such meta-linguistic knowledge of text (e.g. letter-sound correspondences) is acquired largely as a consequence of that concentration on meaning. In other words, explicit meta-linguistic knowledge is not needed before one begins reading but is developed along with reading. Smith (1983) makes a similar point by stating that learning about the particular properties of written language comes from "hearing written language read aloud" (p. 47) and not primarily from meta-linguistic instruction.

Several theorists have criticized this "reading is natural" position, and have instead proposed that initial reading acquisition consists of movement through a series of stages that at some point requires explicit, meta-linguistic assistance. Gough and Hillinger's (1980) two stage model is probably the most straightforward of these proposals, and illustrates the basic principle of the others (Ehri, 1992; cf. Stuart & Coltheart, 1986). Their first stage is "logographic" or "paired associate" learning of words, where children use distinct visual features of the word itself or the context associated with text as "cues" to remember it by. Hence the child might focus on the "hook" of the "J" in "John" to identify this word, or the double, stacked circles of the letter "B" to remember "Bob." Gough and Hillinger argue, however, that this first stage strategy is limited and unproductive; eventually the child runs out of distinctive features with which to

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"memorize" in this fashion. Gough and Hillinger hold that readers must at some junction make reference to the sound a word would make in order to store it in memory, since "it defies the imagination to suppose that the child could learn 50,000 items [an adult's reading vocabulary] by arbitrary associations" (p. 186).[3]

The second stage is "cryptoanalysis," or what others have called "alphabetic" reading (Ehri, 1992). Here children learn to that letters or groups of letters represent sounds (phonemes), and that this correspondence allows one to "recode" written words into sound, which (if in the child's oral vocabulary) he/she can then identify. In other words, this stage is marked by the acquisition of the alphabetic principle. Ehri (1992) breaks this stage up into three intermediate stages (partial, full, and consolidated alphabetic), but the end result is the same: Children are able to link letters or groups of letters to the pronunciation of words. Eventually, children are able to identify most words automatically without this constant recoding because "the brain processes the word's pronunciation and meaning without any effort directed at decoding the word" (Gaskins, Ehri, Cress, O'Hara, & Donnelly, 1996, p. 317). Gough and Hillinger argue that the movement from logographic to alphabetic word identification cannot be accomplished by children on their own--it is a qualitative "jump" which requires explicit, meta-linguistic assistance.

Share (1995) advances a slightly different view of how children learn to read, which he terms an "item-based" rather than "stage-based" acquisition of

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recoding ability. Rather than posit a primarily logographic stage followed by an alphabetic one, Share holds that children use phonological information to identify words at various stages depending on their frequency and familiarity, and that only less familiar, low-frequency words require recoding. Even so, the initial ability to recode must normally be taught, according to Share, so in practice his position is the same as Ehri, Gough, and others.

Problematic Evidence on the Acquisition of the Alphabetic Principle

Two types of studies have been cited to support the position that instruction is necessary for acquiring the alphabetic principle: examinations of "environmental print" exposure, and training studies of children who are not yet able to read independently. This evidence suffers from two principle shortcomings: first, a failure to take into account the types of contextual support available to children in their encounters with print; and second, an underestimation of the duration and amount of the input that may be needed for acquisition to take place.

Overspecified Print

The distinction between meta-linguistic and elaborative assistance made in Chapter 1 dealt with help given by another, more proficient reader. Clearly this is not the only, or even most common, type of help available to children learning to read. Text is often found in situations that contain extra-linguistic clues, such as pictures and illustrations, which give clues as to its meaning. These clues can

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sometimes provide so much information that reference to the actual text is unnecessary for comprehension, resulting in text that is overspecified. Conversely, the text could have too few extralinguistic clues for a reader to comprehend the message, making it underspecified. The ideal situation is when elaborative clues are somewhere between these two extremes. When text is properly specified, the background information the reader brings to bear in comprehending the text helps him/her reduce the number of possible alternatives in meaning, but does not eliminate them. Some attention to the text itself must occur to understand the message.[4]

Some studies on the relationship between pictures and word learning have been claimed to show that extra-linguistic clues "distract" children from word learning. In fact, what they really demonstrate are the effects of overspecification. In Samuels (1967), for example, two groups of kindergarten children were shown isolated words printed on index cards. One group had the words read aloud to them (one type of context), another group had the words read aloud and saw pictures (two contexts). When the words were shown to both groups without pictures and asked to name them, the one-context group performed better than the two-context group.

The use of illustrations here clearly overspecified the print in the two-context condition, since children could get the meaning of the words without attending to the text. Extra-linguistic clues are likely to properly specify print

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when they give enough context for understanding the text, but not replace it.[5] Acquisition under such conditions may be incremental in nature, similar to that described by Nagy, Herman, and Anderson (1985) in their examination of vocabulary acquisition, where they showed how new words are acquired gradually through several exposures in meaningful context. Under such conditions, simple pass/fail measurements like the one used in Samuel's study may not capture incremental increases in print knowledge.

Discussions of whether print exposure alone can lead to reading acquisition must take these distinctions into account. We would not expect, for example, that children exposed to highly contextualized "environmental print" (e.g. brand name logos like "McDonald's" or a "Stop" sign) will necessarily acquire any insights into the linguistic elements of the text embedded there, since the surrounding extra-linguistic clues in effect replace the text in conveying the meaning.

This prediction is confirmed by studies on the question. Masonheimer, Drum, and Ehri (1984) studied one hundred three- to five-year-old children who could identify at least eight popular "environmental print" signs (e.g. Pepsi, Carl's Jr.). The children were tested to see whether they could read those same words without the contextual support provided by the pictures or graphic information that normally accompanies them (e.g. no golden arches with the word "McDonald's"). In addition, these environmental print "experts" were also given tests of word recognition from items drawn from early primers. Of the one-

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hundred children, only six of the children were able to read any of the primer words, and a mere 6% could read more than one of the eight environmental print words without contextual support. The researchers conclude that reading words does not "evolve directly out of environmental print experiences" (p. 265).

A partial replication of Masonheimer et al. by Stahl and Murray (1993) yielded essentially the same results. Stahl and Murray tested one hundred and thirteen kindergarten and first graders for knowledge of environmental print (with and without contextual support), phonological awareness (blending, segmentation, phoneme isolation, and phoneme deletion), alphabet names, isolated word identification from a graded word list, and a passage read aloud and retelling. Through a series of hierarchical multiple regression analyses, the researchers found that scores on the graded word list accounted for more variance in predicting out-of-context environmental print reading than did the ability to identify the in-context text. In other words, the ability to recode isolated words was more important in reading the de-contextualized environmental print than identifying the contextualized environmental text. Stahl and Murray conclude that "environmental print learning accounts for little word learning" (p. 233).

As stated earlier, this interpretation is correct: Children do not need to attend to the text when the extra-linguistic clues convey all of the required meaning. Exposure to this type of print is not sufficient to lead to the ability to read decontextualized text in and of itself, nor has that been claimed (Goodman,

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1986; Harste, Burke, & Woodward, 1982). Children need exposure to other types of text--properly specified text--for the alphabetic principle to be acquired.[6] Exposure to environmental print may lead, however, to incremental increases in other types of print knowledge, as we shall see below.

Short Exposures and Impoverished Input

The acquisition of oral language takes place over several years, with large amount of input provided to the child (Pinker, 1994). There are variations among children in terms of rate of acquisition of various linguistic elements, even though they appear to follow a general developmental path (Brown, 1973). Similarly, we should expect that acquisition of the aspects of written language will take place over a long period of time, and may require considerable amount of exposure to input. No one would expect that a child exposed only to a few hours of a language, for example, would extract all of the necessary linguistic information contained in the input, any more than an adult could acquire a second language with just a few hours of a language class. Such a test is equally inappropriate in written language acquisition, yet the claim that explicit meta-linguistic instruction is necessary is based in part on studies which provide such limited input. Consider the following cases cited by Share (1995):

Carnine (1977): Carnine took two groups of pre-readers (26 total) and randomly assigned them to either Phonics or Look-Say instruction. The Phonics group got two hours of training in sound-letter correspondences, blending, and the

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pronunciation of eight letters. No information is given on the Look-Say treatment, which also lasted about 2 hours, but it is assumed that the children were simply shown the words in isolation and told to memorize them. After the training, both groups were tested on pronouncing six new words with "regular," one-to-one letter-sound correspondence, six new "irregular" words, and the eight letters used in the Phonics treatment. The results are shown in Table 1 (from Carnine, 1977; p. 639):

Table 1
Comparison of Phonics and Look-Say Training in Carnine (1977)

	Regular Words	Irregular Words	Letters
Phonics	5.5	0.6	8.0
Look-Say	1.7	0.0	4.7

The Phonics group did better than Look-Say students in decoding words in isolation. But contrary to Share's claim, this study does not offer convincing evidence showing that exposure to print alone does not lead to knowledge of letter-sound correspondence. First, the length of the children's exposure to text was extremely short, only two hours. (Nevertheless, the Look-Say group was able to pronounce some of the new words in isolation, even though they had no explicit training other than exposure to words which used those letters/sounds during the treatment period.)

Second, Carnine reports that before the training sessions the children in both groups "knew four or fewer experimental sounds [letters]," although no

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specific mean scores were provided (p. 637). Yet the Look-Say group had a post-treatment mean score of 4.7 out of 8. This may be simply a chance fluctuation, and may not signify any real progress by the Look-Say group. It is also possible, however, that some knowledge was acquired without any meta-linguistic instruction. If we make the unlikely assumption that the mean letter knowledge score of the Look-Say group was 4, the most conservative estimate is that children on average made a gain in letter knowledge of 17% in two hours, a small but perhaps significant growth in letter knowledge. In a different context (vocabulary acquisition), Nagy and his colleagues have shown that small increases in knowledge can be cumulatively very significant given a sufficient amount of input (Nagy, Herman, & Anderson, 1985), as noted previously. If anything, then, Carnine's results indicate that exposure to print may indeed lead to letter-sound knowledge in the absence of any explicit training, and are counter-evidence to the hypothesis that instruction is necessary for such acquisition to occur.

Byrne (1992): Byrne conducted a series of studies to show that children need "independent information about the segmental nature of the speech stream and the way this is represented by the letters of the alphabet" in order to begin to read (p. 6). Such information, Byrne argued, must come in the form of explicit training of the type phonics instruction typically provides. His experiments explored the ability of children to pronounce novel words after short exposures to a training set of words or symbols representing letters. In Experiment 3, for

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example, a group of 11 children were taught the words "bat" and "fat" in isolation. Most children were able to identify the words after about 10 minutes. This training constituted the entire "exposure to print" for the experiment. The subjects were then given several new words representing minimal pairs, distinguished only by their first letters, either "b" or "f" (e.g. "bell" and "fell", "big" and "fig"). On average, children could not distinguish the new words above the level of chance, although individual scores were not provided. In other experiments, however, Byrne found that it wasn't that the children couldn't distinguish between units of print at some level, since they had relatively little difficulty differentiating between short phrases that differed by only one word, such as "little boy" and "big boy." The problem, Byrne concluded, was that distinguishing phonemes was particularly difficult for children, and could not come from exposure to print alone.

The amount of print the children were exposed to--two words--and the 10 minute duration make Byrne's conclusions very questionable. Byrne himself acknowledged that two items may not be enough for children to acquire the requisite phonemic representation. In a subsequent experiment, he increased the amount of words shown to the children to four, still clearly not sufficient to test any hypothesis on the effects of print exposure.

Byrne & Fielding-Barnsley (1989): In the first of a series of experiments included in this study, Byrne and Fielding-Barnsley report that 20 preliterate children were exposed to three symbols (not letters) each representing separate

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phonemes; that is, a red triangle represented the sound /f/, a blue circle representing /b/, and a green square represented the sounds /at/. The children were unable to distinguish between a set of novel symbol-words ("fat" and "bat") comprised of one of the two phoneme symbols. These same children could, however, distinguish novel symbol combinations when the symbols represented whole words or syllables (e.g. a yellow square representing "bus" and a purple diamond representing "stop"). The authors concluded that their results confirmed the findings of their earlier work on the inability of children to "spontaneously" discover the alphabetic principle (p. 316). But the study suffers from precisely the same weaknesses as the previous experiments: the use of a very short exposure time, combined with the minimal amount of input possible.

Seymour & Elder (1986): Seymour and Elder's study is cited by Share and others as demonstrating that even long-term exposure to text does not lead children to gaining insights into the alphabetic principle. The researchers looked at 26 children (ages 4.5 to 5.5) in a first grade classroom over a year's time. The children were taught to read by the "look-say" method plus some "phonics-based" instruction in spelling. Although extensive test data was gathered on the children, very little information is given as to the actual instruction. What we are told is that the teacher used a "whole-word" method, where words were "taught [120 words] by presentation on flash cards and in illustrated booklets for practice in identification and naming" over the course of one school year (p. 6). The

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emphasis on memorizing individual words can be seen in the way the researchers, one of whom spent about 2 days per week in the classroom, discussed "reading" with the children: "Do you remember any [words] you learned this week?" and "Is this one of your reading words?" (p. 19). The test of the children's derivation of letter-sound correspondence was a series of isolated word lists given throughout the year, on which appeared both taught and new words. Very few of the children were able to pronounce any of the novel words.

Despite a long period of exposure, Seymour and Elder provided the children in this study with very impoverished input. It appears that little connected, meaningful print was used in the instruction. The classroom studied by Seymour and Elder demonstrated that focusing on individual word memorization via flash cards in a print-poor environment is not a good method of teaching reading, but does not provide very persuasive evidence on how any significant exposure to text affects reading acquisition.

The Ehri Studies: Share also cites additional studies by Ehri and her colleagues on the inability of children to acquire the alphabetic principle from exposure to print, but these, too, are flawed in many of the same ways as the previously discussed research designs. Ehri and Wilce (1985), for example, found that early readers were better able to remember a list of isolated words when presented with modified phonetic spellings (e.g. "knee" spelled "NE") than with

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visually distinct spellings (e.g. "knee" spelled "Jo"). Prereaders, however, were better able to remember words presented with visually distinct spellings rather than with the phonetic spellings. From these results, the researchers concluded that the movement from prereader to reader involves shifting from a "visual," logographic strategy (where words are seen as whole symbols) to an alphabetic strategy (where words are seen as consisting of letter-sound correspondences). Ehri and Wilce state that this movement "cannot be regarded as evolving 'naturally' out of encounters with print in the environment," because the change is qualitative in nature (p. 174).

Here again we see the same problem of limited exposure: Prereaders were exposed to the lists of isolated words over a three day period for a limited amount of time (exact time not specified). As in the studies discussed above, there was no exposure to real text, and hence no test of whether this hypothesized qualitative jump can be accomplished without explicit instruction of the type advocated by Ehri. The researchers also state that "phonetic instruction is essential" in reading classrooms, although there is no indication that their own "reader" group received any such instruction (p. 177). The participating children were all from pre-school and kindergarten classes.

In Ehri and Sweet (1991), the researchers examined which factors were associated with success in "fingerpoint-reading" by children. Thirty pre-readers

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who had received no formal instruction in reading nor had participated in storybook reading in school were given pretests in letter knowledge, isolated word recognition, and phonemic awareness, among other things. The treatment consisted of the experimenters reading a story to the child several times, pointing to the words as they did, followed by the child reading and pointing to the words. The storybook sessions took place over two days, with a total of 40-60 minutes per child. Following the sessions, the child was asked to read isolated lines of text, isolated words in the text, and point to certain words in the text as the experimenter said them. Among the conclusions of the authors were that "even novice word readers [those who could recognize at least one preprimer word prior to the treatment] did not learn to read many individual words out of context as a result of fingerpointing-reading practice" (p. 454).

Even in this brief exposure, some gains were apparently made by the children. Ten of the subjects (28%) were able to tell the difference between the text they had read in the story and an altered text substituted in the same book, illustrating that may have acquired some knowledge of print/letters even from the short exposure, similar to the incremental acquisition noted earlier in the vocabulary acquisition studies by Nagy. Five children (14%) who could not read any of the pre-primer words on the pre-test were able to read some of the words when presented with the complete text, and exhibited the ability to segment blends into phonemes. These results are at least suggestive that children made some gains

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due to the fingerpoint-reading. (Note also that constantly pointing at the text while reading would very likely result in the children shifting their attention from meaning to form, and hence may be a quite "unnatural" type of exposure to print.)

Other investigations by Ehri and colleagues (Ehri & Wilce, 1987a; Ehri & Wilce, 1987b; Scott & Ehri, 1990) also involved extremely short training periods where the entire amount of exposure ranged from 40 minutes to about 3 hours, and always involved isolated lists of words or, in one case (Ehri & Wilce, 1987a), nonsense syllables.

Gough, Juel, and Griffith (1992). Finally, Stanovich (1993) cites Gough, Juel, and Griffith as providing evidence that exposure to print alone does not lead to alphabetic insights. But the only test of this claim are two experiments reported on in the article involving exposure to a list of four words for a short training period. Like the Byrne studies discussed above, this is clearly an inadequate test of Share's hypothesis.[7]

Acquisition of the Alphabetic Principle Without Meta-Linguistic Instruction: Suggestive Evidence

The evidence typically put forth to support the necessity of meta-linguistic instruction in early reading acquisition is insufficient or at best ambiguous. There are other naturalistic and classroom studies which, while not without faults, suggest that exposure does indeed lead to acquisition of the alphabetic principle in

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the absence of meta-linguistic assistance when text is provided in appropriate, elaborative contexts, and of sufficient quantity and duration.

Naturalistic Studies

Several studies of "emergent literacy" among young children before they begin attending school attempt to examine the effects of exposure to print over a longer period of time and with more varied types of input than those used in experimental training situations. While it is not in most cases possible to determine whether the children in these studies have received the kind of meta-linguistic instruction recommended by Share and others as necessary for learning to read, in most cases it seems unlikely. Research on early readers (Durkin, 1966, 1974-75), for example, has found that formal instruction by parents is usually limited to teaching children letter names and perhaps letter shapes, but does not typically extend to systematic, explicit instruction in areas such as phonemic awareness.

McGee, Lomax, and Head (1988) examined the way in which emergent readers read not only environmental signs and labels (e.g. McDonald's, Pepsi, "Stop"), but also "functional" print, defined as the types of text found in the home (e.g. a grocery list, a book, a telephone book, a coupon). This latter category would more likely include print that is properly specified--that is, print within a context that gives the reader some background information to reduce the number of possible meanings, but that does not completely eliminate uncertainty and thus requires some attention to the actual text. McGee and his colleagues interviewed

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eighty-one children ages three to five attending preschool and kindergarten classes. Using a detailed coding scheme, they determined what children could read from both functional and environmental categories, and what details they attended to in attempting to comprehend the text in question. Children were classified by whether they could read eleven or more of the primer words from a list ("expert"), one to ten words from the list ("novice"), or no words ("nonword"). There was little difference in the percentage of children among the three categories who could read the environmental print example presented to the children, confirming that this is probably the first type of print that children attend to, but not one which leads immediately to independent reading. The expert readers attempted to read the functional print items at a much higher rate (79%) than the novice (51%) or nonword readers (28%).

However, some of the nonword and novice readers who made attempts to read the functional items did so by attending to the text itself (the "graphic detail"), not just the surrounding symbols or drawings on the page. While McGee (1986) later commented that the percentage of nonword readers who attended to the specifics of the text (16%) was low, an alternative explanation is that there exists a gradual developmental sequence in early readers as they acquire knowledge about text. The researchers also found that there were more attempts to respond to functional print with individual letters among the nonword and novice readers than among the expert readers, again suggesting that there is an awareness of these

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aspects of print even before word reading begins, particularly as children encounter print that is more properly contextualized.[8]

Other studies corroborate McGee et al.'s findings on the attention to graphic detail paid by very young children in identifying words in their environment. Hiebert (1978) found that preschool children had an awareness of print that extended to being able to distinguish the where words began and ended in text, and Harste, Burke, and Woodward (1982) provide extensive evidence of prereaders applying both "holistic" (use of extra-linguistic cues) and "graphic" (use of letters) strategies in reading environmental print.

Further evidence that incremental variations in print knowledge may well be explained by exposure to certain types of meaningful text comes from Lomax and McGee (1987). Here the researchers tested children ages three to seven on a variety of measures, including concepts about print, graphic and phonemic awareness, and word reading. As can been seen in Table 2, there is some awareness of both print concepts and letter-sound correspondence among young children, and even some phonemic awareness.

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Table 2
Growth in Print Knowledge Over Time

Item	Total Possible	Age 3	Age 4	Age 5	Age 6
Environmental Print (in context)	20	73.5% (14.70)	87.2% (17.44)	93.8% (18.75)	97.8% (19.56)
Functional Print	40	35.8% (14.30)	56.8% (22.70)	75.3% (30.10)	81.4% (32.56)
Phonemic Awareness (initial sound)	20	20% (4.00)	58.7% (11.74)	86.5% (17.30)	95% (19.00)
Letter Sounds	21	21.2% (4.45)	53.8% (11.13)	87.5% (17.50)	97.2% (20.44)
Word List	100	.05% (.05)	.83% (.83)	27.2% (27.15)	75.4% (75.39)

(adapted from Lomax & McGee, 1987; Table 2, p. 246)

Environmental print awareness is one of the first stages of literacy acquisition for these children, with three year olds identifying nearly two-thirds of the words in context. Awareness of functional print items is also present at an early age, and more importantly continues to increase up through the onset of formal schooling. There are substantial increases in letter-sound correspondence knowledge and phonemic awareness between ages three and four and four and five. The ability to read words in isolation, indicating acquisition of the alphabetic principle, is not seen at all until age five, however.

One interpretation of these trends in the data is that exposure to print leads to gradual acquisition of the two components of Share's definition of the

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alphabetic principle, which in turn leads children to acquire the "insight" that can be used to recode words in isolation.[9] (Recall that children can identify words in context before they can in isolation (Ehri & Sweet, 1991), suggesting that reading words in isolation often requires something more than reading connected text--namely, the ability to recode letters into sounds.) Lomax and McGee found through structural equation modeling analysis that their data were consistent with a very similar path to the one proposed here, with concepts of print leading to attention to graphic detail, which in turn led to phonemic awareness and letter-sound correspondence, and finally to isolated word reading.

Formal Settings

In addition to measures of literacy development by children prior to school entry, there are classroom studies of teachers who refrain or de-emphasize explicit meta-linguistic instruction but provide other forms of contextual help. These studies report that children are able to acquire the alphabetic principle through primarily elaborative means of assistance with text.. Reutzel, Oda, and Moore (1989) assigned three in-tact groups of kindergartners to one of three experimental conditions for the period of one school year. One group received traditional reading readiness instruction, including letter names and sounds, basic sight words, auditory and visual discrimination tasks, and some storybook reading by the teacher. The "immersion in print" group received extensive "big book" reading, read-along taped books, and some aspects of language experience approach

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(where the teacher writes down and reads stories dictated to her by the students). The final group, "immersion plus teacher-led instruction," received the print-rich environment of the second group plus daily, explicit lessons in certain print concepts, including word, letter, word matching, and directionality.

The researchers observed each class every three weeks to check for treatment fidelity, and teachers were also frequently observed by their school's principle for the same purpose. Pre- and post-tests were administered on isolated word reading, letter sounds, and print concept knowledge. The results indicate that, despite lacking the explicit, systematic instruction in phonics or phonemic awareness, the immersion in print group scored better than the traditional readiness group on a test of isolated word reading (effect size = .53), and there was no difference between the immersion plus instruction and the immersion only groups. It appears that exposure to meaningful print over an extended period of time can lead to acquisition of word reading and the implied acquisition of the alphabetic principle.

Ehri and Sweet (1991) criticize this interpretation of Reutzal et al., saying that the immersion only teacher may have been giving direct instruction that served to spur her subjects acquisition of the alphabetic principle given the types of activities she was engaged in. But the treatment description in this study is unusually ample in this study, and treatment fidelity was confirmed by several

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checks. Thus there seems little reason to suspect that explicit instruction was taking place in the immersion-only classroom, although it is certainly possible.

In one of a series of studies on the effects of engaging pre- and early readers in meaningful print, Freppon's (1991) results are, like the findings of Reutzal et al., suggestive that exposure to text can lead to children's discovery of the alphabetic principle. Freppon found that children in a first grade, "literature-based" classroom with "no traditional, systematic, and sequenced phonics instruction" did as well or better on traditional measures of recoding ability as those children exposed to such instruction (p. 147-148). It is important to note that the teachers in Freppon's study did occasionally focus on some aspects of "graphophonic information," but that this instruction was largely spontaneously given and "triggered by a student's response" while reading (p. 147). There is no indication that meta-linguistic instruction on letter-sound correspondence or phonemic awareness was necessary for children to begin reading, although we do not know what type of instruction the children received before entering first grade.[10]

Other studies of interventions based upon supplying greater access to print and more elaborative assistance to early readers have found similar results. McCormick and Mason (1986) gave of a group of at-risk kindergartners several simple text picture books to take home, with instructions to the parents to read them to their children. Although this intervention was minimal, one year later

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these children showed significant gains in several aspects of print knowledge compared to a control group, including word and spelling knowledge (effect sizes were .47 and .45, respectively). Purcell-Gates, McIntyre, and Freppon's (1995) study of children low in print exposure and subsequently written language knowledge before entering school found that they made dramatic gains in lexical and syntactical knowledge after exposure to a literature-based classroom environment in kindergarten and first grade. The researchers concluded that "one can acquire [written language] knowledge given exposure to it after beginning school" (p. 678). In most cases, however, this option has not even been tried, as poor readers very often are placed in "remedial" programs with a strong, explicit skills orientation (Allington, 1983).

Discussion

There are serious problems with the evidence cited to show that children cannot acquire the alphabetic principle without instruction. The interpretation of studies of environmental print by Masonheimer et al. and Stahl and Murray fail to take into account the overspecified contexts in which that type of text is found. Conclusions drawn from a series of experimental training studies rely on untenable assumptions about the length and amount of input needed for print exposure to have an impact. Other evidence suggests that children appear to come to insights into the alphabetic principle in the absence meta-linguistic assistance through exposure to meaningful texts with elaborative assistance. These studies show that

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both phonemic awareness and letter-sound correspondence knowledge appears to be acquired slowly through exposure to print. The evidence is consistent with the hypothesis that acquisition is a process beginning with "environmental" and functional print, moving through stages of greater attention to graphic detail in an attempt to comprehend texts. This acquired knowledge of print and the way it functions appears to lead ultimately to the ability to read some words independently in context and, finally, in isolation.

It should be again emphasized that our alternative interpretation of the available evidence is, like's Share's version, still very much open to debate. This is due in part to the nature of the phenomenon being studied. The naturalistic inquiry required to determine if print exposure can lead to the alphabetic insight by necessity lacks the experimental control needed to give us a "clean" test of the hypothesis. Further discussion of this point will be taken up in Chapter 6.

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Notes

1. Reading comprehension and recoding ability are clearly not identical, however. Children trained in phonemic awareness, for example, make large gains in tests of recoding but only small to moderate gains in reading comprehension (Krashen, 1996a; Bradley & Bryant, 1983). Conversely, some adults classified as "dyslexic" show poor recoding ability and a slightly slower reading rate, but apparently normal passage comprehension (Elbro, Nielsen, & Petersen, 1994). Stohard & Hulme (1996) also provide evidence that some children who have difficulties in comprehension have normal recoding skills, and some poor decoders exhibit normal level of comprehension.

There are differences in how phonological awareness is defined in the vast literature on the topic. Stanovich (1992), for example, proposes that we reject the term "awareness" completely and instead talk about a phonological continuum from "deep" versus "shallow" types of "sensitivity." A task that required a child to match words based on rhyme (e.g. "talk" and "walk") would tap a shallow level of sensitivity, whereas a test that required a child to delete or isolate a phoneme in a word (e.g. pronounce /cat/ without the /c/ sound) would indicate a deep level of sensitivity. Share (1995) appears to take the position that phonemic awareness of the "deep" kind is necessary for reading acquisition, so this is the definition I will use for this chapter.

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2. A "Need" Hypothesis is not the only possible reason why literacy is acquired, however. Krashen (1981) holds that language acquisition only requires that the input received by the acquirer by comprehensible and contain new linguistic information.

3. Smith (1983) notes, however, the connection between sound and the meaning of words in oral vocabulary is no less arbitrary than between their written form and meaning, yet clearly we have sufficient memory for storing these associations for oral language.

4. This notion of using of background knowledge (context) to reduce the number of possible alternatives is from Smith (1994). I thank Stephen Krashen (personal communication) for the classification of over-, under-, and properly specified text.

5. Braun's (1969) partial replication of Samuels' study suffers from similar problems. Not surprisingly, early readers strongly prefer texts with pictures to those without (Samuels, Biesbrock, & Terry, 1974).

6. McGee (1986) notes that Jones and Hendrickson (1970, cited in McGee) found that environmental print awareness developed before knowledge of print and book handling, indicating that it is one of the earliest encounters with text that children have. See also discussion of McGee, Lomax, and Head (1988) below.

7. Share (1995) also cites Juel (1983) as relevant to his case against print exposure and reading acquisition. Juel studied the effects of different levels of letter string frequency in words and decodability on word recognition both in context and in

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isolation. Her subjects were a group of adults and 2nd to 5th grade children, all of whom could already read. No information is given on instruction or exposure to print among the children, as it was not part of Juel's research design. She found that greater contextual support facilitated the speed with which her subjects could identify words, especially for low frequency items. But it is difficult to see how this study has any direct bearing on the question of whether exposure to print leads to early insights into the alphabetic principle.

8. Ehri and Sweet (1991) argue that McGee, Lomax & Head's (1988) results on noticing letters is not the same as remembering letters. But it is also possible that attending to letters precedes remembering letter names, and thus their finding bears on the question of alphabetic principle acquisition.

9. Heibert (1981) conducted longitudinal studies which she later re-analyzed (Heibert, Cioffi, & Antonak, 1984) in order to determine an order of reading concept acquisition. Her re-analysis found that the acquisition of letter name knowledge preceded knowledge of certain concepts of print. However, Lomax and McGee point out that the particular statistical procedure Heibert et al. used to arrive at that ranking involved rather stringent, "pass/fail" criteria for acquisition that might have missed more incremental changes (1987, p. 241).

10. A longitudinal study by Mason (1992) provides very interesting evidence on the relationship between home literacy environment and acquisition of "subskills" (pseudoword reading, letter and word reading, and spelling). Mason found that, at

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the beginning of kindergarten, there were significant, moderate to strong correlations between home reading and writing activities and a combined factor of decoding skills (reading and writing by child, r = .51; number of books at home, r = .35; reading to child, r = .38). One interpretation of this evidence is that exposure to print leads to better recoding.

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CHAPTER III

LEARNING TO READ: EARLY, LATE, AND NON-INSTRUCTED READERS

In most schools, children are expected to learn how to read by the end of first grade. Failure to do so usually leads to special assessment and placement in a remedial reading program, often but not always with an emphasis on explicit, meta-linguistic instruction (Allington, 1983). The California Reading Task Force Report, for example, recommends schools assess and provide "rigorous, proven interventions" by the middle of first grade for students who have "reading difficulties" (CRTFR, 1995). The rationale for such prescriptions is based partially on the notions that (a) children who do not learn to read at a certain level by a certain age will be unable to "catch up" to their age peers, and (b) children need formal instruction in order to learn how to read. In this chapter, I will examine evidence on early reading acquisition from studies containing retrospective and self-reports and general measures of reading comprehension, arguing that children can learn to read primarily through elaborative assistance and without the use of systematic, meta-linguistic instruction. Moreover, this acquisition can take place at relatively late ages with no ill effects on their long-term reading development.

I will first review the research on learning to read without formal instruction and its prevalence among children in the United States; second, I will analyze several studies on the relationship between the age children learn to read

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and their long term reading proficiency; and third, I will present several published accounts of "late" readers and their implications for the age/instruction issue.

"Natural" and Precocious Readers

The issue of whether explicit teaching is required in learning how to read can be addressed in part through several case studies which have been published on "natural" readers. Goodman and Goodman (1982), for example, reported that their daughter Kay learned to read on her own, and at age 6.5 could read at a fifth grade level on a standardized measure of reading (p. 221). They report that their daughter began reading "with no instruction" independently at the age of five years, six months (p. 221). Despite a lack of formal teaching, Kay's reading did not come without support from her parents. Her environment was "rich in language experience. She has always been read to, listened to, and talked to. Singing, poetry, nursery rhymes, and oral family language games are daily fare in her home" (p. 221).

Torrey (1969) investigated the case of John, who learned to read without any adult instruction at age 5. John's mother, who had a tenth grade education, reported that no one had "read to or taught him" to read. He did, however, watch a great deal of television, where many children shows had objects labeled. John was not pressured by his parents into reading. His exposure to sufficiently specified print--in games and on television--was apparently sufficient to allow him to begin reading independently. Forester (1977) cites the cases of two girls, a five-

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year-old and four-year-old, both of whom learned to read without instruction. The five year-old began reading after her grandmother gave her a common form of elaborative assistance, reading to her. The four year old began reading after listening to tape recordings of children's books. Forester notes that the children took "obvious pleasure" from their reading (p. 164).

There is also case study and survey evidence on learning to read without formal instruction from the research on "precocious" readers, usually defined as those children who are reading at a high level (at second or third grade norms) upon entering first grade. The earliest reports of such readers date back to the first part of this century (reviewed in Coltheart, 1979; and Torrey, 1979). More recently, Henderson, Jackson, and Mukamal (1993) reported on the case of Max, a young boy who learned to read without formal instruction at the age of 3.10. As in the case of John discussed above, Max seemed to benefit from early television viewing in learning letters and words. His parents report that after watching the television game show "Wheel of Fortune," Max appeared to know the names of many letters and could read certain labels on food packages at the age of one year, nine months. When Max was two, his mother began offering some meta-linguistic assistance by using letter magnets to spell words out for him on the refrigerator related to kitchen activities. The mother also started to write short stories for Max about the day's events and read these to him, in addition to reading regular storybooks to him twice a day.

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Survey studies confirm that a certain number of children learn to read without school instruction. Durkin (1966) conducted two studies in which she examined 49 precocious readers in California and 30 in New York. In the California study, Durkin found that more than half the children received only occasional instruction from parents and/or siblings in learning to read, although all of the parents reported that they read to their children. Being read to was also the most important factor indicated by the children themselves as motivating them to learn how to read. Similar results were found in the New York study, where all of the parents of early readers reported reading to their children.

Jackson, Donaldson, and Mills (1991, cited in Jackson & Lu, 1992) studied 116 children who were reading at a third grade level or higher upon entering first grade, including some children whose first language was not English (Jackson & Lu, 1992). King and Friesen (1972) found 31 children who were reading upon entry into kindergarten. Some of these children undoubtedly learned to read with adult assistance, but there is no evidence that they did so with any systematic, formal instruction usually associated with school--phonics training, phonemic awareness exercises, and other skill-building activities.

There are some common characteristics in the backgrounds of these precocious readers. First, as Jackson (1988) comments, parents of precocious readers "rarely give the impression of having pushed children toward goals that the children did not share" (p. 203); that is, children were not pressured to read before

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they felt ready. Second, precocious readers were usually given extensive elaborative assistance by being read to by their parents (Jackson, 1988; Plessas & Oakes, 1964; Teale, 1978; Torrey, 1979). Of course, these activities may have led to the phonological insights that are thought by some to be critical to learning to read (Goswami & Bryant, 1990), or it may be that these children needed only a minimum amount of meta-linguistic assistance in order to "crack the code" and begin recoding. The case of Max reported in Henderson et al. (1988) may be an instance of this, where watching a letter-game on T.V. and having his mother spell words for him was sufficient assistance to allow him to be able to recode. Still, the little assistance they received was certainly not the systematic instruction often thought necessary, and since it occurred within the context of considerable elaborative help, it is difficult to say whether it was necessary or merely helpful. Third, early readers come from environments where children saw how text conveyed meaning, including seeing adults who valued reading and being continually exposed to new books in the home (Brenna, 1995). Finally, early readers usually show a strong desire to read and like to read independently for pleasure (Forester, 1977; Brenna, 1995). Given proper conditions of a supportive environment, some children clearly can and do learn to read without being explicitly taught in formal settings, and in many cases, with little intervention other than being given easy access to print and being read to by others.

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Is Learning to Read Without Formal Instruction Common?

While such reports of "natural" and precocious readers are suggestive, there have been no attempts to provide an estimate of just how common learning to read outside of school is using a larger population of children. As noted earlier, two published estimates are available in Durkin (1966), who reports that in her first study, slightly less than one percent in her sample of over 5,000 entering first graders in the Oakland, California school system could read at least 18 of the 37 pre-primer and primer words on her test. In her second survey of 4,465 first graders in New York City, the percentage of early readers was slightly higher, about three and a half percent. From Durkin's evidence we may conclude that few children learn to read outside of school.

Information contained in the National Household Educational Survey (NHES) conducted by the U.S. Department of Education provides us for the first time with data to answer this question. The survey gathered data on a variety of home literacy practices from over six thousand parents of children ages three to nine living in the United States.

The NHES was based on random sample subject selection representative of the entire U.S. population, and thus its results allow us to obtain a generalizable estimate of early reading. Using the raw data files provided in electronic form by the National Center for Educational Statistics (U.S. Department of Education, 1993), data were analyzed from those variables which asked parents at what age

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their child began to read, whether the child was currently attending school (kindergarten or above), and what practices commonly associated with early reading the parents engaged in.

Tables 3 and 4 below show the number of children reading by age and by enrollment in a formal education program.

Table 3
Age That Child Began to Read (Parent's Report) (N = 4560)

Age	Number	Percent
1	4	.1
2	18	.5
3	124	3.0
4	376	8.2
5	1358	29.4
6	2156	47.6
7	489	10.5
8	35	.7

Table 4
Current Age and Ability to Read Story Books Independently for Those Who Are Not Currently Enrolled in Any Formal Education Programs (Parent's Report) (N = 2266)

			Age			
Can read independently?	3	4	5	6	7	Total
Yes	46	52	25	15	15	153 (6.7%)
No	1188	865	206	6	1	2113 (93.3%)

Parents' estimates of the age at which their child began to read are reported in Table 3. If we assume that the earliest likely exposure to formal instruction is kindergarten (roughly, age 5), then nearly twelve percent of all children in the

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United States learn how to read at some level without formal teaching in school. This seems to be a conservative cutoff point, since not all kindergarten and pre-school programs teach children to read. Another way to approach the problem is to examine only those children who are not enrolled in any school or early education program. Table 4 gives the number of children between the ages of three and seven in this category, and whether or not they are able to read independently. The percentage of uninstructed readers is lower (6.7%) than the parents' retrospective reports found in Table 3.

The lower figure may be due to one of several factors. First, reports of a child's current activity may be more accurate than memory of past events. Second, the question parents were asked was much more specific and restrictive in Table 4 ("Can your child read story books independently?") than in Table 3 ("At what age did your child begin to read?"). In the former case, parents were given a level of performance that the child must meet to answer in the affirmative; in the latter, the parents were left to define what constituted being able to read. Third, it may be that those who do not participate in any formal schooling also differ in other respects from the general population in ways which affect early literacy.

An examination of the mean income and level of parents education reveals this is the case: parents of children who are not enrolled in early education programs tend to have lower mean incomes and less education than those whose children are attending school (income (on 1 to 9 scale): enrolled = 6.93 (3.05),

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unenrolled = 6.23 (2.86); parents education (on a 1 to 5 scale): enrolled = 3.03 (1.16), unenrolled = 2.73 (1.07)). Although the difference is in both cases statistically significant (income: $t = 10.45$, $df = 4115.43$ (unequal variances), $p < .001$; parents education: $t = 11.49$, $df = 10{,}886$, $p < .001$), it is not large. The effect size for income is .33; for education .22, both very modest.

Among those children who are not enrolled in school, there are also small differences in literacy practices in those homes where children are reading and those who are not, as reported in Table 5. Children who are reported as being able to read story books independently have slightly more books than those who do not, are more likely to have visited the library in the past month, and have been read to more often by their parents. These differences are all statistically significant or strongly trend toward significance, although the effect sizes are very small (effect sizes: number of books = .04, library visits = .07, read to = .04).

Table 5
Literacy Practices in Homes Where Children Are Not Enrolled in Education Programs by Ability to Read Independently

	Readers	Nonreaders
Has more than 50 books*	90%	83%
Is read to more than 3 times a week**	88%	76%
Has visited the library in the last month***	42%	34%

* Chi-square = 4.06 (Yates Corrected), df = 1, p < .05 (n = 2419)
** Chi-square = 5.19 (Yates Corrected), df = 1, p < .05 (n = 1178)
*** Chi-square = 2.98 (Yates Corrected), df = 1, p = .08 (n = 2392)

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The percentage of early readers from retrospective and current parental reports (Tables 3 and 4, respectively) are both much higher than Durkin's one to three and a half percent. It is tempting simply to dismiss the reports of parents as unreliable due to the "social desirability" of responding that their child can read and rely on the more "objective" tests used by Durkin. We should also consider, however, that Durkin's measurements were very limited (37 words in isolation on her test) and used in a setting in which students may have been very apprehensive (children were tested during the first days of first grade). More importantly, Durkin's subjects in Oakland came largely from a lower-middle and low income district, where the average student was likely to have less access to print (Morrow, 1983). Durkin states that her New York City subjects were more "heterogeneous" in their socio-economic status, although no detailed breakdown was given in her report. The NHES data, on the other hand, represent all income and educational classes in the proportion they are found in the U.S. population.

It seems likely, then, that Durkin's one percent estimate is probably too low, and that we should (cautiously) treat the parent's reports in the NHES survey as truer estimates of the number of children who learn to read before formal instruction in school. It should be pointed out that children learning to read outside of school may be receiving both elaborative and meta-linguistic help from parents or siblings, including being read to and instruction in letter names and shapes. Other studies of early readers indicate, however, that this help does not

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typically extend to the systematic instruction that is thought by some to be necessary by some for children to learn to read (Durkin, 1966; Jackson, 1988).

Age of Learning to Read and Later Reading Achievement

Nonexperimental Designs

While it is clear that some young children can and do learn to read without formal instruction, there remains the related question of whether learning to read by a certain age per se provides children with longer-term benefits in reading achievement. Two types of research design have been used in studies which attempt to answer this question. It is important to distinguish between the two and the kind of information each design can give us. The first type is a non-experimental, "static group" design (Campbell & Stanley, 1966), where the researchers take a group of children already reading by the age of school entry and compare them to a group of children who are nonreaders. The two groups' reading scores are then compared over a period of years in order to determine the effects of the age at which reading began on eventual reading achievement.[1]

At least four studies have made such comparisons, and all four have found that early readers maintain their advantage over non-readers into the later years. Durkin's (1966) investigation discussed above of 30 early readers and 30 non-readers at school entry found that the early readers were still reading at a higher grade level than their first grade nonreader classmates in the third grade.

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Sutton (1969) found similar results with a group of 46 early readers and 59 non-readers; the early readers were still better by grade 3, although she did not analyze her data for statistical significance. The mean score for Sutton's early readers (n = 46) was 5.67 on the Gates Reading Achievement test by the end of third grade, compared to 4.32 and 4.57 for the comparison groups of students who began reading in first grade (n= 59 and 29, respectively). Morrison, Harris, and Auerbach (1971) looked at 58 early reading first graders in New York, all of whom outscored the nonreader first grade children through the third grade. The differences in reading comprehension at grade three were significant (mean score on Metropolitan Advanced Primary Reading Test: early readers = 4.2, regular students = 3.4), although no test statistics are reported so that effect sizes could not be computed.

Tobin and Pikulski (1988) tracked a group of early readers and nonreaders through grade six, and reported that the early readers continued to score significantly higher than the nonreaders in a number of standardized measures. At the end of sixth grade, the early readers did better on the Gates-MacGinitie Reading Tests (total reading mean scores: early reader = 630.8 (40.1), regular readers = 582.6 (37.2); calculated effect size from test statistic = 1.2), as well as on informal measures of oral reading, reading speed, mean instructional level, silent reading, and comprehension questions. All of these difference were statistically significant with moderate to large effect sizes.

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There is a problem with using the evidence provided in these studies, however. When using static group comparisons, there is a risk that factors other than the intervention may account for the differences between the two groups. In the case of the early readers, it may be that some factor other than the age at which they began to read is the cause of the difference between reading scores in the later grades.

A closer examination of the early reader groups in the studies reviewed above reveals the presence of such factors. In Durkin (1966), for example, four of the five selected case studies of one early reader group found that their homes had a large number of books. Since exposure and access to print is a strong predictor of eventual literacy development (Krashen, 1993), it is likely that the continued gains made by these early readers is attributable to the print rich environment of the home, and not to the age began reading per se. Sutton reported that the median level of the father's schooling in her early reader group was 15, compared to 12 for the nonreader fathers. While this is only a rough measure of socio-economic status, and subsequently print environment at home, it is at least plausible that the early reader/nonreader groups differed in their access to books. Morrow (1983) found that children in the homes of better educated parents showed more interest in books and have more books in the home. Tobin and Pilulski and Morrison, Harris, and Auerbach provided no data on the home print environment of their subjects, but given the evidence on the literacy backgrounds

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of other early readers noted by Jackson (1988) and Plessas and Oakes (1964) above, it again seems reasonable to suppose that there were differences in access between their groups as well which help account for the long term success of the early readers, rather than being attributable to the age at which they began to read.

Experimental and Quasi-Experimental Designs

A second and more reliable study design is an experimental or quasi-experimental one, where children are (ideally) assigned randomly to two groups, or at least matched according to certain important variables. One group receives early instruction in reading and one does not. In this way we can see whether age itself is responsible for the long term differences in reading development. Table 6 summarizes the results of four such studies, all of which found that the gains made by readers who begin to read "early" are short term in nature and/or have little to no long-lasting effects on reading proficiency. Since each study used different standardized measures and reported their results with different sample statistics, I have converted the data, when available, into effect sizes to make a more general comparison of the results (Light & Pillemer, 1984).

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Table 6
Experimental Studies of Early Readers

Study	Grade Reading Scores Measured[a]	Significant Difference Favoring Early Readers?	Effect Size[b]
Bradley (1956)	November, 2nd	Yes	+1.8
	June, 2nd	No	-.06
	June, 3rd	No	-.67
Gray & Klaus (1970)	June, 1st	No	n/a
	June, 2nd	Yes	n/a
	June, 3rd	No	n/a
Durkin (1974-5)[c]	September, 1st	Yes	+.86
	March, 2nd	Yes	+.59
	March, 3rd	No	+.34
	March, 4th	No	+.50
Hanson & Farrell (1995)	Fall, 12th	Yes	+.10

[a] Standardized reading comprehension scores were used for all studies.
[b] "+" favors early reader group. Effect sizes were determined according to formulas provided by Wolf (1986) from the sample statistic used in the original study.
[c] Effect size calculated from the mean reading raw scores reported by Durkin.

In Bradley's (1956) study, two groups of 31 first graders were matched on several measures, including the father's socio-economic status. One group received instruction at the beginning of first grade, according to normal school practice. The second group was divided into three subgroups according to what the teacher determined was their "reading readiness." These three groups began to receive reading instruction when the teacher believed them ready; the first subgroup at five months, the second at eight months, and the third at ten months after school entry. The early reader group did better during the initial tests given

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two months into grade two, but those differences disappeared by the ninth month of that same school year, with the "delayed" readers actually doing slightly better at the end of grades two and three. Note in Table 1 that the effect size of the early reading treatment declines steadily throughout the three years, from +1.8 to -.67.

Gray and Klaus (1970) studied 61 at-risk children who were randomly assigned to three groups: one group participated in a ten week summer reading and reading readiness program each of the three summers prior to the group's entry into first grade, another group attended summer school two summers prior to first grade, and the third group received no special instruction. The differences among the three groups were significant only in the second grade, with the control group doing a bit better than both groups in the first grade and actually outscoring the group that received the earliest interventions in all three grades. It should be noted, however, that despite the early intervention, there is no indication that the experimental group was actually reading by the beginning of first grade, and therefore may not have been a true case of early readers.

Durkin (1974-75) compared two groups (total of 33) of four year-olds randomly assigned to two treatment groups, one which received special reading and reading readiness instruction, and one which attended a normal kindergarten program. Her six year study showed that while the early reader group did better in the first and second grades, no significant differences were present by grades three and four. While the early reader group still outscored the nonreader group at the

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end of the study, the advantage was marginal, with the effect sizes exhibiting an overall declining trend as the children got older.

Finally, Hanson and Farrell (1995) looked at a large sample (n = 3,959) of high school seniors, about two-thirds of whom had participated in a kindergarten early reading program. The intervention, the Beginning Reading Program (BRP), was carried out during the school year 1972-73 in 24 of the 25 school districts which took part in the longitudinal study. The researchers gave measures of reading comprehension to all those who were high school seniors in these same districts. The combination of those students from the non-BRP district plus those students who transferred into the BRP districts after kindergarten gave the experimenters a control group with whom to compare the students who learned to read in the BRP program. The design of the study was post-test only--only the reading scores from grade 12 were used to compare the possible effects of the BRP treatment--and assignment was not random. Hanson and Farrell found that those students who were in the BRP program scored significantly higher than those who did not ($F = 6.2$ (degrees of freedom not given), $p < .001$).

While the large number of subjects made the difference in mean scores significant in the analysis of variance, the effect size was very small, only .10, making the practical significance of the results questionable. There are also some plausible reasons for the difference in scores which may help account for even this slight advantage attributed to the early reading program. Those districts which

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elected to use the BRP may have other institutional qualities besides the kindergarten program which may have affected reading performance, such as better reading programs at the upper levels and/or better libraries which in turn could have affected senior high reading scores. It seems likely that districts which self-selected into the BRP project made other special efforts to assist students' reading performance compared to those districts which did not participate in the BRP, making any claims about the exclusive effects of the kindergarten intervention component of their programs on long-term results at the very least somewhat suspect.

From the above studies there appears to exist what we may term a "Tortoise and Hare Effect" for age and learning to read: children who learn to read early in experimental studies do better starting out, but the gains made are negligible and insignificant by as early as the third grade. This is consistent with cross-national comparisons which examine age of initial reading instruction and later achievement. Reporting on data from the International Educational Assessment, Elley (1992) states that countries which begin reading instruction at ages five and six have some initial advantages, but that those children who began "late" as seven-year-olds have usually caught up by age nine. It is important to note that those countries include in Elley's survey which delayed instruction until age seven were economically well-off and reported an ample supply of books in

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the home, suggesting that access to print, not age, is the critical ingredient in achievement (Krashen & McQuillan, 1996).

The case of reading appears is like that of spelling: instruction leads to initial gains, but they are short-lived. Hammill, Larsen, and McNutt (1977), for example, found that elementary spelling instruction helps at lower grades, but its effects are largely temporary. Students who received spelling lessons did better in grades three and four than those who received no instruction, but this difference disappeared by grade five. Similarly, learning to read by a specific age does not appear to be the critical variable in long-term reading achievement.

This is not to say that there is no relationship between the level of reading performance in first grade and later years. Several studies (Juel, 1988; Lundberg, Frost, & Petersen, 1984; Shaywitz, et al., 1995) have found that children who are poor readers in the early years tend to be poor readers in later grades (up to grade six in one study). These studies use "static group" designs, however, and as such are not able to isolate age of independent reading as critical to long-term development. What the evidence reviewed here suggests is that learning to read before a certain age, all other factors being equal, does not in and of itself confer any lasting advantages in later grades. Arguments in favor of early intervention based on "earlier is better" do not, then, find support in the data available.[1]

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The Case of "Late" Readers

In addition to examining early readers and early reading intervention programs, effects of age and formal instruction in learning to read can also be addressed by examining evidence on children who learned to read relatively late compared to their age peers. While I have not found any formal study of children who learn to read after the end of first grade without first being placed into a remedial program or given special formal instruction, there are some interesting biographical and self-reports of such "late readers." Schulman (1986) reports that learning to read late did not prevent many eminent men and women from eventual academic or professional success. Einstein is reported to have learned to read at age 9, Aguste Rodin at age 10, and Woodrow Wilson at age 11.

There are also several (little known) published cases of children as old as 11 years old learning to read without any school or formal intervention, and without any apparent harm to their eventual literacy development and educational success. These accounts come from publications within the "home school" community, from parents who choose not to send their children to school. The experience of such families affords a rare look at how children learn to read without instruction after an age when their nonreading schooled peers are placed in reading remediation.

Table 7 shows seven cases I found in a review of ten years of one popular publication of home schoolers, Growing Without Schooling. This sample is

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admittedly small, and not necessarily representative of how home schoolers learn to read. I selected only those cases which met two criteria: the children learned to read well after they would have been expected to read in a regular school setting (in one case five years after the equivalent of first grade); and they apparently did so without systematic, meta-linguistic instruction. The evidence has some other important limitations. The measure of reading level is only an estimate, since home schoolers are often required only to submit a portfolio-style assessment of their children's academic progress. It can be argued, however, that this "ecological" approach to evaluation, measuring what children do in real-world settings, is at least as valid as standardized instruments. While we are not able to study all of the interactions of the children with their parents to determine if indeed formal instruction is taking place, there is at the same time no indication that any of the parents had special training in reading instruction or even elementary education in general, arguing against the possibility of effective remediation by traditional methods. Overall, the accounts give at least prima facie evidence that learning to read can be done by some children at a more advanced age without either instruction or detriment to the long-term performance of the reader.

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Table 7
Cases of Late Readers

Name	Age Began Reading	Formal Instruction?	Age/Reading Level When Case History Reported
K.S. Stein (1994)	7.5	No	7.5/Can read science project kits with technical vocabulary
A.A. Sheffer (1987)	8	No	10/Comic books (unspecified titles)
K.M Mason (1993a)	9	No	15/12th grade level[a]
D.M. Mason (1993b)	10	No	10.5/Spiderman,[b] Boston Globe sports page
K.D. Davis, cited in Sheffer (1987)	10	No	12/Comic books (unspecified titles)
H.K. Kerman (1993)	10.5	No	16/Mercedes Lackey novels (best sellers)
W.M. Mott (1993)[c]	11.5	Some	13.5/9th grade level

[a] Mason states that D.M. reads "like a very literate adult," but does not give examples. I have roughly equated this to a grade 12 reading level.
[b] Spiderman reading level is estimated at 4.1, with a range of 1.8 to 5.2 (Wright & Sherman, 1993).
[c] Mott reports that W.M. received intensive skills instruction but that these were all without success. It was only when intervention stopped that he learned how to read--on his own.

The cases deserve closer examination. Stein (1994) states that her son, K.S., enjoyed being read to but showed no great interest in reading himself. Having read Smith's Reading Without Nonsense (1979), she was committed to allowing him to read when he felt ready. K.S. would identify "very basic stuff--a label here and there" but never read anything else. One day, Stein writes, they were working on a science project together, and K.S. began to read the directions

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himself: "He proceeded to read to me, almost effortlessly, a 100-word paragraph which contained words like 'solenoid,' 'nonmagnetic,' 'rectangle,' 'lengthwise,' 'downward,' and 'workable'" (p. 24).

Sheffer (1987) cites the case of A.A., who was designated as having a Specific Learning Disability at the age of 8, half way through first grade. She was pulled out of school by her mother, who then "let her totally alone" and "never gave her an assignment or pressures" (p. 4). By the age of 10, she began to read books and comic books.

Mason (1993a) reports that her daughter, K.M., "could not/did not want to read" at the age of eight and a half. Having tried earlier to push her to learn math, and finding that the pressure made her "hate arithmetic," Mason decided not to intervene with her daughter on reading. Then it happened: around her ninth birthday, "she began to read, and two months later she could read at the level of her literate friends. Then she expanded her reading, and now [age 15] she reads the way very literate adults do" (p. 28).

Mason (1993b) also describes the case of her son, D.M., who was the latest of her three children to read. The summer D.M. was 10, Mason reports that he could only read a word or two. In the fall, he began "to read store signs and notices with a vengeance." Then at night, "sometime past midnight, he read his way through a fat Spiderman annual his older brother Luke gave him for his birthday last year." He also began reading the sports page of the local newspaper.

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One day, Mason took him to the local science museum, where he began to read aloud "long paragraphs of technical writing discussing "'atmospheric conditions', and 'helium gases in the stratosphere'" (p. 11). Davies (cited in Sheffer, 1987) states that her son, K.D., also began reading at the age of 10. "From reading only a few words," Davies writes, K.D. "jumped into whole sentences, often containing fairly difficult words," and now reads mainly comic books at age 12 (p. 5).

The case of H.K. (Kerman, 1993) is particularly interesting for the way her mother describes how she came to be an avid reader. H.K. was reading at a "bare Cat in the Hat level" at the age of 10 and a half. Kerman states:

> During the course of the next year, she did learn the basics about reading, although I shall never know how, since she refused instruction as much as always. We continued to read out loud to her, and she rarely read to herself. My main consolation was that she loved books and didn't think badly of herself. At the age of 14, she started to read Scott O'Dell's books. The first one took her two months to read. Two months later, she had read four or five of them. Within six months, she was reading full-length adult fantasy novels, almost entirely feminist by such authors as Mercedes Lackey. She read voraciously now at the age of 16. (p. 27)

Finally, there is the case of W.M. (Mott, 1993), who at eleven and a half, still did not read despite "sit down lessons with phonics and slogging through books word by word." When his mother decided to take "all hands off his learning, he taught himself when he was ready." She reports that at the age of 13.5, he reads at a ninth grade level.

There are four points I believe are worth emphasizing in reviewing the accounts of late readers. First, little or no explicit instruction was required for the

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children to learn how to read, as was the case with early readers. This was true even in the case of a child formally diagnosed as "learning disabled." Second, no pressure was placed on the children by their parents, again a finding consistent with the studies of precocious readers. Third, all of the children made extremely rapid progress once they began to read of their own volition, in most cases reaching grade level within two years and in some cases surpassing the reading proficiency of their peers. Fourth, elaborative assistance (being read to) and access to books was all that was necessary to ensure their reading development.

Age, Formal Instruction, and Intervention for Late Readers

From the review of the evidence, it appears that neither learning to read by a given age nor formal instruction are necessary for all children for long-term reading success. The larger question for educators is whether or not children who are not reading by a specified point in time should undergo some special "reading intervention." The evidence cited above suggests that delaying learning how to read until a later age does not need to result in an academic catastrophe, with children falling further and further behind. While many educators argue that action must be taken if children are not reading by the end of first grade in order to avert problems in the future (e.g. Slavin, Madden, Karweit, Dolan, & Wasik, 1991), it appears that such failure is more likely due to the artificial timetables of school itself, and not to any natural process of reading development that requires such interventions. The underlying assumption of current practice that reading

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development must progress in a chronologically set order is, based on the evidence reviewed here, empirically questionable. Students may make leaps in their reading proficiency at different times, as in the late reader cases discussed here.

An insistence that young nonreaders learn to read according to schedule can also lead to unnecessary and perhaps damaging assessment and labeling. Morawski and Brunhuber (1993) provide interesting insight into the possible long-term dangers of school-imposed expectations of reading. In a study of the early reading recollections of 62 adult readers (32 proficient, 30 remedial), they found that remedial readers (most of whom learned to read in school) expressed external locus of control when describing their beginning reading experiences; they believed someone else was in charge of the rate at which their reading developed. The authors point out that "success in reading is related to internal locus of control, while reading difficulties are related to external locus of control" (p. 41-42). An environment where reading is in effect required by a certain age does not seem conducive to providing the low stress, low anxiety tone needed to develop confidence in one's ability to read and an internal locus of control.

There is a considerable body of evidence to support the proposition that access to print and self-selection of text are the key ingredients at intermediate and advanced stages of first and second language literacy development, not formal instruction (Krashen, 1993; Pilgreen & Krashen, 1994; Lance, Welborn, & Hamilton-Pennell, 1993). The evidence on early reading thus converges with

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findings for later stages of literacy development, suggesting that the critical variables in literacy acquisition are similar at all levels. It seems reasonable that, barring serious neurological or physical disability, children who are provided access to print in with appropriate elaborative assistance would learn to read and make progress without aggressive interventions. The argument here is not an anti-pedagogical one, however. Rather, it is that teachers should supply the sort of elaborative support found among the early and late readers, assistance which makes texts more comprehensible and interesting to children.

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Notes

1. I have excluded from this review a number of more recent longitudinal studies, such as Juel (1988), which examine a cohort of children on certain meta-linguistic tasks as they progress through school. These studies usually do not specifically address "early" readers who arrive to school already reading without formal instruction, but rather examine predictors of long-term reading success in terms of specific (usually phonological) abilities upon school entry.

2. There are at least three other arguments used by advocates of early reading intervention. First, it is argued that there exists a Matthews Effect for reading; that is, students who are behind in reading in first grade will fall further and further behind their age peers as they get older (Stanovich, 1986). Shaywitz and his colleagues (1995), however, provide strong evidence that poor readers do not become worse relative to other readers as they progress through school, and in fact seem to make stronger gains as they get older, even when the data are adjusted for possible regression effects. Shaywitz, et al. did find that poor readers do not "catch up" to good readers, at least in the six years of data they analyzed (grades 1 to 6), although they do begin to close the gap.

Second, early intervention supporters claim that bridging the gap between poor and good readers early will lead to eventual success in higher grades. It follows from this claim that it is important for children to be reading (or have related "reading skills") at grade-level from the very beginning of their schooling.

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The evidence reviewed here on early reading does not support the assumption that early intervention is in fact sufficient for long-term reading success. Intensive "reading recovery" programs involving one-on-one tutoring in the early grades have had some success in affecting reading achievement in later grades, although the outcomes are rarely measured after more than a few grades (e.g. Pinnell, Lyons, Deford, Bryk, & Seltzer, 1994). It should also be noted that early intervention programs are very costly (Hiebert, 1994), so the efficiency of the program versus other, less expensive interventions must be considered.

(Stanovich (1992) has stated that the initially small gains found in early intervention programs that emphasize phonemic awareness training (e.g. Bradley & Bryant, 1983) will have large, cumulative effects in the long run, countering claims by Yaden (1984; see also Krashen, 1996a) that such interventions may not warrant the effort expended on them. Unfortunately, the only experimental evidence he cites is an unpublished paper by Bryant in 1987, an apparent follow-up to his 1983 training study with Bradley.)

Third, it is argued that the gap between poor and good readers cannot be bridged (or perhaps is more difficult to bridge) in the later grades. There is some evidence, however, that just as early intervention is not sufficient, it may also not be necessary. M.C. Smith (1993) examined the reading performance 87 adults twenty years after they graduated from high school. In a multiple regression analysis, he found that reading scores from grades nine and twelve accounted for a

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large portion (79%) of the variance in the subjects' current reading proficiency, but the addition of first grade scores made no significant contribution to the variance explained. Smith's report does not specify whether first grade reading scores were highly correlated with the scores from later grades, which, if true, would make his findings about the importance of the high school level reading scores somewhat less convincing. From Smith's presentation of the results, however, it appears as though a series of hierarchical regression analyses were conducted to compare the different amounts of variance accounted for by different grade levels, so that if the upper and lower grades were highly correlated, this effect would have shown up in his results. Smith's data suggest then that reading performance in the first grade is not critical for long-term success, and therefore that intervention made in later years may be more important than early grade programs. It is also important to point out that the gap between "poor" and "good" readers in some the longitudinal studies conducted is often not very large. In Juel (1988), for example, the poor readers were only slightly below grade level upon entry into middle school (3.5 at the end of fourth grade).

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CHAPTER IV

THE EFFECT OF PRINT ACCESS AND INSTRUCTION ON READING DEVELOPMENT

Despite general agreement on the importance of wide reading in literacy acquisition (Elley, 1994; Krashen, 1989, 1993; Nagy, Herman, & Anderson, 1985; Stanovich & Cunningham, 1992), relatively little attention has been paid to the effect of access on reading development, that is, the extent to which the availability of reading materials influences how much and how well children read, as discussed in Chapter 1. This is perhaps because it has been assumed that there are no substantial differences in access to reading material among children, or that differences in reading are due primarily to individual cognitive or instructional factors. However, there is a small but growing body of evidence suggesting that access to print does indeed vary greatly among schoolchildren, and that these differences can account for a large amount of variance in reading achievement among schoolchildren (Constantino, 1994; NCES, 1994a; Lamoine, O'Brian, Brandlin, & McQuillan, 1997; Smith, Constantino, & Krashen, 1996; Allington, Guice, Baker, Michaelson, & Li, 1995).

This chapter attempts to provide a test of the effects of both access and meta-linguistic assistance provided to children on literacy acquisition by examining state-level data drawn primarily from a nationally representative sample, the 1992 National Assessment of Educational Progress (NAEP) reading test as administered

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by the U.S. Department of Education. A path analysis is proposed to help account for the relationship between various measures of print access, amount of reading, meta-linguistic instruction, and reading achievement.

Background

While understanding the relationship between access to reading materials and reading achievement would seem to be of great practical importance for schools, relatively little research exists specifically addressing the topic. There have been some studies confirming the clear link between the amount of time spend reading in and out of school and reading achievement (Anderson, Wilson, & Fielding, 1988: Taylor, Frye, & Maruyama, 1990), and researchers have certainly suggested the connection between amount of reading and access (e.g. Fielding, Wilson, & Anderson, 1986; Krashen, 1993). Yet there have been very few demonstrations of how much of a difference access can make in reading achievement at various levels, for example, or what types of access are most critical in promoting more reading among children.

What has been established is that there are wide, sometimes dramatic differences in print access among individual students, schools, and communities. Elley's (1994) study of reading achievement among more than 200,000 students in thirty-two countries found that the number of books available at home and in the school library varied significantly among students. Among the participating countries, the average number of books in the home varied from 25 to 174, and

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books per student in the school library from as few as 0.3 to as many as 28.9. In the United States, the mean number of books in the home was 137, but the standard deviation of 94 indicates considerable differences across the sample population. Similarly, the number of books per student in the school library was 19, but the standard deviation was 13.7. Data from large, nationally representative samples collected by the U.S. Department of Education corroborates these findings of variability in print access. The National Assessment of Educational Progress report (NCES, 1994a), for example, found that the percentage of fourth graders reporting more four types of reading materials in the home ranged from 25% to 46% among participating states.

Several smaller sample studies have found similar disparities in print access at home, in school, and in the community. Allington et al. (1995) surveyed school libraries in twelve high and low-income neighborhoods in New York and found that high-income neighborhood schools had and average of 21.5 books per student, while low-income schools had only 15.4 volumes. Disparities among schools were also reported in magazine subscriptions, size of classroom libraries, and access policies. Smith, Constantino, and Krashen (1996) compared the number of books and print materials available for students in low-income and high income communities in the Los Angeles area. Children living in two economically depressed communities had respective averages of 0.4 and 2.67 age-appropriate books in the home; those living in the high income district had 199.2. The

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situation was similarly unequal at school and in the community: School libraries in the low-income community had around 3 times as many books per student, and public libraries had twice as many books per person. LeMoine et al. (1997) found disparities in the library access policies within and among school districts in southern California. Students from high achieving schools serving largely middle class children allowed greater access to books, more time to read in school, and more liberal check-out policies than those from lower-achieving schools in largely low-income neighborhoods.

A few recent investigations have suggested that these differences in access can explain a large portion of the variance in reading achievement scores among school districts, states, and countries. Lance, Welborn, and Hamilton-Pennell (1993) found at the state level that the access to books in school via the library was the most powerful predictor of academic achievement among several variables analyzed, controlling for socio-economic status. (At two of the six grade levels that Lance et al. analyzed, school library quality was actually a more powerful predictor of reading scores than SES measures.) Krashen (1995) found a similar relationship for elementary school students when examining data at the national level in the United States. Elley's (1994, 1996) comparison of reading score, home environment, and school and public library data from several countries came to the same conclusion, that access to print was a significant and powerful correlate of reading achievement. Controlling for differences in economic

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conditions among the participating countries, Elley found that the size of the school library was the most important factor in distinguishing the reading scores of nine-year-olds between the high and low scoring nations, with an impressive effect size of .82. (Frequent silent reading time was the next most important variable, with an effect size of .78). The tie between access to books and reading scores supports numerous other studies (Krashen, 1993) which have shown that self-selected, free reading contributes substantially and directly to literacy development. There is also limited experimental evidence on the positive impact of increasing print access and subsequent reading achievement. Elley and Manguhbai (1983) and Elley (1991) both found that "book flood" programs led to significant increases in reading achievement among large samples of English as a second language students.

Both the home and the community also play a role in providing children with access to reading materials. Evidence from studies on poverty and print access suggests that there is often an indirect connection between socio-economic status and reading achievement, via the number of books and print materials typically available in the home and the community. In an analysis of a large national data set on U.S. school children, Ortiz (1986) found that students from low socio-economic status (SES) families had fewer reading materials at home and were exposed to less reading in the home compared with students from more highly educated families. However, Ortiz also found that when controlled for level

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of SES, the impact of reading materials in the home and the extent of family reading was significant and substantial, suggesting that print environment was the critical variable affecting reading acquisition, not poverty per se.

White's (1983) meta-analysis of almost 200 studies on SES and academic achievement provides evidence consistent with this hypothesized relationship. When studies examined SES and academic achievement with the individual student as the level of analysis, the strongest correlations were found with "home atmosphere", (r = .58) rather than income (r = . 31) or education (r = .19). Studies which examined "home atmosphere" in White's analysis included in their definition a variety of variables, including reading materials in the home. Similarly, Okagaki, Frensch, and Gordon (1995) found that in a sample of low SES Latino youths, the high achieving students came from significantly more literate environments than their less successful peers, again indicating that print access, not poverty itself, was one of the most critical determinants of academic achievement. As noted above, however, those in poverty are more likely to have more limited access to print than those who are not (Elley, 1996; Morrow, 1983; NCES, 1994a).

Despite these strong connections between print access and literacy, the debate over which factors contribute most significantly to reading acquisition among elementary age children has centered largely on questions of individual cognitive processes (Adams, 1990; Stanovich, 1994) and pedagogical practice

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(Chall, 1983; Stahl & Miller, 1989). Print access has rarely been included as a variable, with a few notable exceptions such as Krashen (1993, 1995, 1996a), Elley (1991, 1994, 1996a), Stanovich's studies on print exposure (e.g. Stanovich & Cunningham, 1992), and Greaney (1996; Greaney & Clarke, 1973). Experimental psychologists, for example, have examined issues such as word recognition, phonological processing, and eye movements in attempting to understand reading acquisition and development. The research on instruction has focused on whether initial reading instruction should emphasize meta-linguistic assistance such as phonics or phonemic awareness training. Several researchers have concluded that this evidence points to the necessity of greater attention to meta-linguistic elements in reading instruction to reduce the disparity in reading achievement (Stanovich, 1986; Adams, 1990).

Method

Drawing from the research on literacy acquisition discussed above, a set of seven constructs were hypothesized to influence reading achievement. Table 8 lists the sixteen measured variables that were selected to represent these constructs. All data were drawn from the NAEP Data Compendium Report (NCES, 1994a) unless otherwise noted in Table 8. The NAEP is a biannual assessment of academic progress among a nationally representative sample of over 26,000 students in grades four, eight, and twelve. Only students in the fourth grade sample were used in this analysis, since specific information for other grade

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levels was unavailable for all of the factors of interest. Forty-one states plus the District of Columbia and Guam participated in the 1992 testing, but since data were not available on Guam for some of the variables, it was excluded from the analysis, resulting in a total sample of 42.

First, a correlational analysis was run on all sixteen variables. An exploratory factor analysis using principal components extraction and varimax rotation was conducted on those measured variables thought to be indicators of the relevant latent variables in order to see whether there was justification for the creation of composite scores among the variables in question. The six latent variables hypothesized were Poverty, Print at Home, School Library Quality, Public Library Quality, Free Reading, and Skills Instruction. Reading Comprehension and Use of the Library, each having only one indicator, were excluded from the factor analysis.

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Table 8
List of Variables Used in Analysis of NAEP Data

Poverty	1. School Lunch: percentage of schools in the state with more than 75% of their students enrolled in free lunch programs. 2. Children in Poverty: The percentage of children 5-17 years-old in the state who live in families with income below the federal poverty line (Bureau of the Census, 1995).
Print at Home	3. Books at Home: percentage of families having more than 25 books in the home. 4. Magazines: percentage of families subscribing to at least one magazine regularly. 5. Newspaper: percentage of families subscribing to a newspaper.
School Library Quality	6. SL Books: the number of books per pupil in the school library (White, 1990). 7. SL Subscriptions: the number of magazine subscriptions per pupil in the school library (White, 1990).
Public Library Quality	8. PL Books: the number of books per person in the public library (NCES, 1995). 9. PL Subscriptions: the number of magazine subscriptions per person in the public library. (NCES, 1995).
School and Public Library Use	10. Library Use: the percentage of students who checked books out of the school or public library for their own enjoyment at least once in the last month.
Free Reading	11. Books Read: the percentage of students who read at least one book for their own enjoyment in the last month. 12. Frequency: the percentage of students who read for fun on their own time at least once a month. 13. Sustained Silent Reading (SSR): the percentage of students who are provided time for reading books of their own choosing in school at least once a week (as reported by the student).
Skills	14. Phonics: the percentage of teachers who place a heavy emphasis on phonics in reading instruction. 15. Decoding: the percentage of teachers who devote almost all of the instructional time to decoding skills.
Reading Comprehension	16. NAEP Score: the average state NAEP 4th grade reading score.

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Following the exploratory factor analysis, composite scores of the variables were computed and reliabilities of the factors (Cronbach's alpha) were determined. Next, a path model was tested through a series of simultaneous multiple regression analyses to determine the beta weights and significance of the paths in the structural equations (Kerlinger & Pedhazur, 1973). In addition, a goodness of fit test was calculated for the model as a whole. Finally, two hierarchical multiple regressions were run to test the contributions of various factors of the model to the amount of variance explained.

Results

Table 9 shows the means and standard deviations of the sixteen variables, along with the reliability estimates of each of the hypothesized composite variables. Table 10 lists the correlations among the variables. Several of the relationships were significant. Most notable are the strongly positive correlations between Books in the Home and NAEP score, and the negative relationship between the measures of poverty (School Lunch and Children in Poverty) and books in the home, as well as the poverty indicators and reading achievement. Children in poverty are also less likely to be given time to read in school in SSR programs, consistent with LeMoine et al. (1997), and have poor quality school and public libraries. There is a ceiling effect on several variables, including the number of families with more than 25 books, use the school and public library, and all three of the free reading measures (books read, frequency, and SSR). This may attenuate

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effect of these variables in the subsequent correlation and multiple regression analyses (Jaeger, 1990). Also, the high levels of intercorrelation among the variables pose the issue of a high degree of multi-collinearity, a problem discussed below.

Table 9
Means and Standard Deviations of Variables and Factor Reliability (N = 42) in NAEP Path Model

	Mean	SD	Reliability
POVERTY			.87
School Lunch	13.47	11.29	
Children in Poverty	20.05	8.17	
PRINT AT HOME			.93
Books at Home	87.74	5.89	
Magazines	62.67	6.50	
Newspapers	68.47	5.30	
SCHOOL LIBRARY			.78
SL Books	17.21	5.07	
SL Subscriptions	5.67	2.77	
PUBLIC LIBRARY			.65
PL Books	2.76	.94	
PL Subscriptions	7.34	2.97	
LIBRARY USE	84.53	2.81	n/a
FREE READING			.80
Books Read	92.81	1.95	
Frequency	87.35	2.38	
SSR	81.23	3.82	
SKILLS			.88
Phonics	13.70	6.40	
Decoding	19.9	8.92	
NAEP SCORE	215.65	9.77	n/a

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Table 10
Correlations Among Variables in NAEP Path Model

	1	2	3	4	5	6	7	8	9	10
1. School Lunch	1									
2. Children/Poverty	80	1								
3. 25 Books	-78	-71	1							
4. Magazines	-54	-60	86	1						
5. Newspaper	-42	-51	73	80	1					
6. SL Books	-36	-50	54	64	58	1				
7. SL Subscriptions	-20	-29	38	49	36	76	1			
8. PL Books	-25	-39	62	65	58	36	20	1		
9. PL Subscriptions	-30	-41	57	66	58	41	23	84	1	
10. Use Library	-66	-71	68	60	68	55	36	41	47	1
11. Books Read	-54	-60	57	43	55	36	07	38	41	67
12. Freq. Read	-26	-35	56	58	69	36	02	59	59	63
13. SSR	-53	-57	71	56	60	42	27	47	49	62
14. Phonics	77	70	57	-36	-30	-22	-08	-27	-30	-60
15. Decoding	79	72	70	-52	-34	-29	-13	-35	-42	-58
16. NAEP Score	73	-73	87	81	70	49	38	62	58	70

	11	12	13	14	15	16
11. Books Read	1					
12. Freq. Read	72	1				
13. SSR	62	58	1			
14. Phonics	-51	-23	-40	1		
15. Decoding	-62	37	-62	81	1	
16. NAEP Score	42	41	58	-59	-58	1

Note: All correlations above .30 are significant at the .05 alpha level.

Table 11 shows the results of the exploratory factor analysis. The factor analysis results reflect the predetermined number of six factors hypothesized to exist. The results were very close to what was expected based on theoretical considerations, with two exceptions: the poverty and phonics indicators loaded onto a single factor, and the Sustained Silent Reading (SSR) variable loaded on to its own factor (Factor 6). All other variables loaded on to distinct factors as anticipated. It was decided to separate the phonics and poverty variables into

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separate composite scores as originally proposed, since while related, the poverty of a state and its use of skills instruction are clearly two separate constructs. The SSR variable was added to the composite variable of free reading, justifiable again for theoretical reasons, since SSR is likely to contribute to the amount of pleasure reading done, as well as previous research, which has found that children in SSR programs do more free reading overall than those who do not (Pilgreen & Krashen, 1994; Greaney & Clarke, 1973).[1]

Table 11
Factor Loadings for Latent Variables in Path Model

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Phonics	.9195	-.14045	-.0100	-.1282	-.0008	.0406
Decoding	.8497	-.2117	-.0438	-.1747	-.2261	-.3078
School Lunch	.8755	-.0129	-.1084	-.0693	-.3248	-.1557
Poverty	.7846	-.1518	-.2743	-.2151	-.2261	-.0686
PL Books	-.1411	.8870	.0977	.1725	.2364	.0962
PL Subscriptions	-.1837	.8856	.1589	.2046	.1432	.1076
SL Subscriptions	-.0577	.0807	.9396	-.1157	.1112	.1247
SL Books	-.1786	.1745	.8618	.2530	.2177	.0093
Books Read	-.4703	.1323	.0778	.8045	.0627	.1790
Frequency Read	-.0704	.4102	-.0032	.7767	.3441	.1605
Newspaper	-.1584	.3301	.2919	.4359	.6881	.1070
Magazines	-.3195	.4582	.3848	.1389	.6539	.1258
25 Books	-.5629	.3424	.2401	.1551	.5786	.3050
SSR	-.3492	.2389	.1804	.3518	.2166	.7646

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Table 12
Intercorrelations Among Variables in Path Model

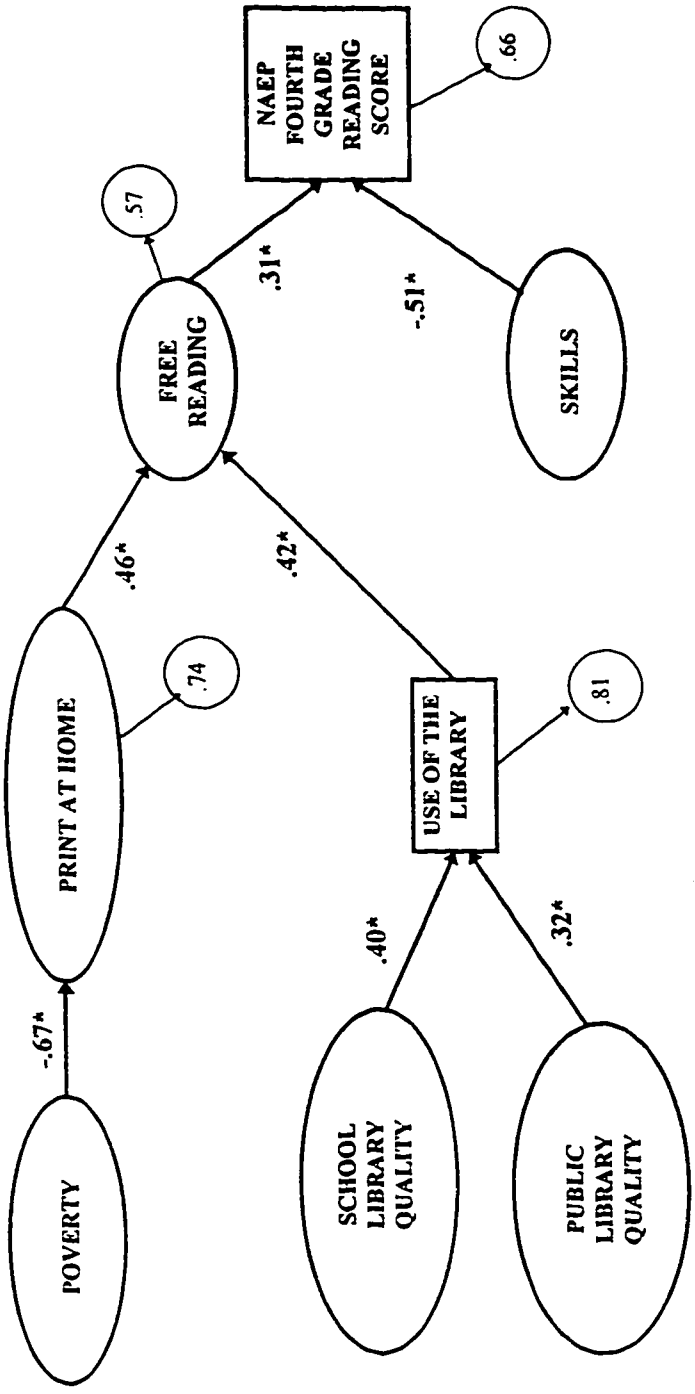
	1	2	3	4	5	6	7	8
1. Poverty	1							
2. Print/home	-67	1						
3. Library Use	-72	70	1					
4. School Lib.	-39	59	51	1				
5. Public Lib.	-36	68	47	36	1			
6. Free Reading	-58	73	73	37	59	1		
7. Skills	83	-54	-62	-23	-39	-57	1	
8. Score	-77	86	70	47	61	57	-62	1

All correlations above .30 are significant at .05 alpha level.

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Figure 3

Path Model of 1992 Fourth Grade NAEP Reading Scores



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Composite scores were created for each latent variable, and the intercorrelations are shown in Table 12. Figure 3 shows a path model that was constructed based on previous research rationale outlined above, which indicates that poverty affects print environment in the home, which in turn affects the amount of free reading done and subsequent reading achievement. Library quality is also thought to affect use of the library, which in turn affects the amount of free reading done and consequently reading achievement. Finally, phonics instruction is thought to affect reading achievement directly. Beta weights are indicated in Figure 3, along with the disturbances/errors for each dependent variable (calculated from the square root of 1 - R squared (Pedhazur, 1982)). The alpha level of significance was .05. All the hypothesized paths were significant.

All of the path coefficients were positive except those between Poverty and Print at Home, and Phonics and Reading Achievement. The greater the level of poverty, the less print in the home. The strongly negative path between phonics instruction and reading comprehension indicates that more skills instruction was related to lower reading scores in a state.

To calculate the relative amount of variance that each factor accounted for in the model, a hierarchical multiple regression was performed as suggested by Kerlinger and Pedhazur (1973), entering the factors closest to the final dependent variable first. Results are shown in Table 13, Order A. In addition, to test the relative contributions of print and home factors, another regression analysis (Order

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B) was run examining the effects of print access and use versus instructional method and poverty.

Table 13
Hierarchical Regression Analyses on Path Model Variables

Order A	Factor	R Square	R Square Change
	Free Reading	.45	—
	Skills		
	Library Use	.81	.36*
	Print at Home		
	School Library	.85	.04*
	Public Library		
	Poverty		
Order B			
	Free Reading	.61	—
	Library Use		
	School Library		
	Public Library		
	Print at Home	.80	.19*
	Skills	.82	.02*
	Poverty	.85	.03*

* $p < .05$

The total amount of variance accounted for both models (all variables entered) was 85%. In Order A, free reading and skills accounted for 45% of the variance in NAEP reading scores, with library use and print at home adding a significant 36%. Poverty along with school and library quality added no significant increase in the variance explained. In Order B, print access via the library and free reading account for 61% of the variance, with print at home adding a significant 19%. The amount of skill use and poverty both contributed additional amounts of variance and, although the changes were significant, they were very small.

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The goodness of fit for the model was tested by seeing whether the model accounted for a greater amount of variance than a simple simultaneous multiple regression of all the independent variables on reading comprehension--that is, greater than 85% (see Table 13) (Pedhazur, 1982). The generalized squared multiple correlation was computed by the formula one minus the product of the squared residual path coefficients (1 - R squared) as determined by each regression equation in the model. The result of the test was .95, demonstrating that the model is able to account for more variance than the simple regression equation.

Limitations

There are several limitations to the analysis which make these findings only suggestive at this point. First, the path analysis technique itself is not, strictly speaking, able to demonstrate causality, and the small sample size of this study prevented us from using more sophisticated structural equation modeling techniques in testing the goodness of fit of the model to the data (Schumacker & Lomax, 1996). Second, using the state as the level of analysis obscures other possible confounding variables that may affect student performance.

Third, the small sample size (n = 42) and relatively large number of predictor variables (seven) means that statistical power is low for all inferential statistical analyses, and thus the results presented here must be treated with considerable caution (Pedhazur & Schmelkin, 1991). Nunnally and Bernstein (1994) point out that under these conditions sampling error will cause both the

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value of R squared (amount of variance explained) and the individual beta weights to be unstable and unreliable. Thus, R squared reported in the saturated or "full" model with all seven predictors entered (Table 6, Orders A and B) is very likely biased upward. The sign, strength, and significance of the individual regression coefficients in the proposed path model, being derived from a series of separate equations with fewer predictors, may be more trustworthy.

Fourth, there are very high intercorrelations among the variables (multicollinearity), which makes it difficult to separate the impact of individual predictors. A test of multicollinearity--determining whether there is a large amount of variance explained when all of the variables are regressed on themselves--confirmed that it appears to be present to a high degree, as shown in Table 14. The results of other studies of influence of print access on reading proficiency, however, gives us some confidence that the relationships found here are real, despite these problems.

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Table 14
Amount of Variance Explained With All Path Model Variables Regressed On Each Other

Variable	R^2
Poverty	83%
Home	78%
Library Use	75%
Skills	73%
Free Reading	69%
Public Library	60%
School Library	39%

Discussion

The results provide further support to the proposition that print access has a strong and powerful effect on reading scores through the amount of free reading done by children, even without including meta-linguistic assistance in the analysis. The high amount of variance explained by the access and free reading factors alone--80%--speaks to the importance of these variables in literacy acquisition and development. The relationships between poverty and print at home, and library quality, library use, and amount of reading are also consistent with previous research on libraries and their impact on reading achievement (Krashen, 1995). The finding regarding the very negative impact of phonics instruction is more problematic, since it may be argued that poorer readers need more phonics instruction, and therefore the direction of the path from Phonics to Reading Comprehension is misleading. It may also be that phonics instruction is most

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effective in the early grades (Adams, 1990), and that evidence on its use in grade four will not properly measure its impact on reading achievement (but see Appendix, note 1). In any case, the increase in the amount of variance explained by this instructional factor was, although significant (Order B), small once all other factors were entered into the regression analysis.

Access to print does, then, seem to have a significant influence on reading acquisition among school children, at least as measured by the instruments used in NAEP standardized assessment. One practical implication of these relationships is that schools can make substantial contributions to their student's literacy development by increasing access to print in the school library, particularly for those students who have no other source of reading materials at home or in the community. As noted above, students from low-income communities and schools often have little access to print at home or in the school library.

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Note

1. It should be noted that the factor loading of SSR on the free reading factor was the fourth highest SSR loading on a factor (.351), and that SSR correlated very highly with the two other variables included in the composite, frequency of reading and books read. Also, the specification of the EFA to produce six factors and the loading of poverty and phonics variables onto a single factor meant that at least one other variable had to be loaded onto a distinct factor.

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CHAPTER V

HIGH SCHOOL READING ACHIEVEMENT AND PRINT ACCESS

Several studies have shown that access to print via library holdings have a direct and powerful impact on reading achievement scores, as noted in the previous chapter. Lance, Welborn, and Hamilton-Pennell (1993) found that the quality of the school library was a powerful predictor of academic achievement among several variables analyzed at the state level. Krashen (1995) found a similar relationship for elementary school students when examining data at the national level in the United States, and Elley's (1992, 1996) comparison of reading score and library data from several countries came to the same conclusion. The tie between access to books and reading scores supports numerous other studies (see Krashen, 1993 for a review) which have shown that self-selected, free reading is an important factor in literacy development.

This chapter seeks to expand and confirm previous findings on predicting reading comprehension scores with measures of print access (Krashen, 1995) by examining data from high school students in the United States, using the Verbal section of the Scholastic Achievement Test (SAT) scores as a measure of reading achievement. In order to determine relative importance of possible causal variables in reading achievement, the impact of school library software holdings, books per pupil in the school library, public library circulation, overall per pupil expenditures, and teacher-pupil ratio were examined.[1]

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Method

The following variables were selected for examination, with the 50 states and the District of Columbia (N=51) used as the units of analysis:

1. Scholastic Aptitude Test (SAT)--Verbal Section: As a measure of reading comprehension and vocabulary knowledge, the mean score of each state from the verbal section of the SAT test from the year 1987-1988 was used, as reported in Snyder and Hoffman (1990). However, since a state's mean SAT score is very strongly and negatively related to the percentage of total high school students taking the exam (r = -.86), this percentage was used as a weighting variable in the analysis to control for this source of bias in the scores.

2. Books per pupil in public schools: The most recent national data on school library holdings is from the school year 1985-1986 (Cahalan, Hernandez, & Williams, 1987; reanalyzed in White, 1990). Total number of books per pupil for White's "high school" category were used.

3. Per pupil expenditure in public schools: As a control for different socio-economic status differences among states, per pupil spending was included for the year 1987-1988 as found in Snyder and Hoffman (1990).

4. Computer software: Due to the increased spending on computers by school library media centers (Cahalan, Hernandez, & Williams, 1987; Miller & Shontz, 1989), the average number of machine-readable titles in the high school library for 1985-1986 school year was included, as reported in White (1990).

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5. Public library circulation: Krashen (1995) found that public library circulation by state was a significant predictor of elementary student reading scores. To test whether a similar relationship exists at the high school level, the per capita library circulation by state in the year 1989 as reported in Podolsky (1991) was included.

6. Teacher - pupil ratio. In order to provide some rough measure of classroom instructional quality, the teacher to pupil ratio for the school year 1987-1988 was included as given in Morgan (1990).

Results

Table 15 presents the means and standard deviations for the dependent and independent variables, and Table 16 provides the intercorrelations for all the variables. Three relationships were significant: SAT scores were positively correlated with both the number of books per student in the school library and the per capita public library circulation, while the number of books per pupil was negatively correlated to the teacher to pupil ratio. It appears that states that have less library holdings also have more crowded classrooms. No other significant correlations were observed.

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Table 15
Descriptive Statistics of Variables in SAT Analysis

Variable	Mean	Standard Deviation
SAT-Verbal Score	451.82	30.14
Books Per Pupil in Library	15.31	4.97
Total Expenditures Per Pupil	4231.04	1152.67
Software Holdings in Library	42.11	59.64
Public Library Circulation Per Capita	5.81	1.79
Teacher-Pupil Ratio	17.19	2.39

Table 16
Intercorrelations Among Variables in SAT Analysis

	Books	Expenditures	Software	Public Library	Teacher-Pupil
SAT-Verbal[a]	.29*	-.13	.01	.34*	-.11
Books		-.06	-.10	.10	-.37**
Expenditure			-.04	.17	-.20
Software				.09	.04
Public Library					.01

[a] Partial correlations controlling for percent of student taking the SAT by state
* = $p < .05$, ** = $p < .01$

Table 17
Multiple Regression Analysis of SAT Variables

Predictor	b	beta	Standard Error	t	p
Books	1.1500	.2339	.6946	1.65	.10
Expenditures	-.0032	-.1705	.0025	-1.23	.22
Software	.0338	.0732	.0622	.54	.58
Public Library	4.18	.3227	1.7664	2.36	.02
Teacher-student	-1.0376	-.1070	1.3555	-.75	.45

Note: $R^2 = .21$, adjusted $R^2 = .12$, $F = 2.44$, $p < .05$.

Table 17 shows the results of the multiple regression analysis, using the S.A.T. Verbal scores as the dependent variable (weighted by the percentage of

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students taking the exam by state), with all predictor variables entered simultaneously. Public library circulation was the only variable to meet the .05 alpha level for significance, although books per pupil came very close (p = .10). None of the other variables--teacher-pupil ratio, computer software holdings, or per pupil expenditures--were good predictors of S.A.T. verbal performance. The amount of variance accounted by the combined variables was a modest 21%.

A separate multiple regression analysis was also conducted using the total number of books in the school library (from White, 1990) as a predictor of S.A.T. scores (in place of the amount of book per pupil). Surprisingly, the total number of books turned out to be a significant and negative predictor of S.A.T. reading scores (b = -.38).

Limitations

Unlike the analysis of the NAEP data in Chapter 4, there appeared to be only a small degree of multicollinearity indicated among the independent variables as indicated by the correlation matrix. Nevertheless, to test for this potential problem, all the independent variables were regressed on one another. The results shown in Table 18 indicated a very small amount of variance predicted by the other variables.

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Table 18
Amount of Variance Explained With All SAT Variables Regressed On Each Other

Dependent Variable	R^2
Teacher-Pupil Ratio	19%
Books	18%
Per-Pupil Expenditure	10%
Public Library Circulation	6%
Software Holdings	2%

Discussion

The present study found that the school library quality and public library use were the most important predictors of reading achievement at the high school level in the United States, even when controlling for such factors as per pupil spending, classroom size, and amount of computer software available. It is consistent with other findings at the international, national, and state level for both elementary and secondary students, and supports a wider body of evidence that self-selected pleasure reading is a strong predictor of reading performance (Krashen, 1993).

The current findings differed somewhat from Krashen's (1995) analysis at the elementary level in terms of the importance of software. While the present analysis found no effects for software on reading scores, Krashen found that same variable tended toward significance in predicting National Assessment of Educational Progress (NAEP) scores for fourth graders in the United States. Lance et al. (1993), however, did not find any impact in their study at the state

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level for a school library computer factor (consisting of the number of computers in the school library and the number of uses made of them) for five of six grades examined, and a significantly negative impact for grade two. Analysis of the effect of computers on developing literacy have shown little to no impact in many other school settings (Krashen, 1997).

Krashen (1995) found that his variables predicted 60% of the variance, while the present analysis predected a much smaller amount, 21%. The difference may be due to variable selection--his use of a measure of library service in place of the current study's use of teacher-pupil ratio. It may also be that the SAT Verbal section taps long-term literacy development that may be better accounted for by previous exposure to books or other factors than by current indicators such as those used here.

As in previous studies, school expenditures did not directly predict reading scores among high school students. Lance et al., in a more sophisticated path analysis, found that spending affects reading achievement only so far as it has an impact on the collections of the school library. A more detailed examination of the relationship between total spending and library expenditures is needed to confirm this finding at the national level.

Class size as determined by teacher-student ratio did not by itself predict high school reading achievement. Again, Lance et al.'s path model found that such a relationship was mediated by the school library: teacher-student ratio was related

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to school library media center size, which in turn predicted reading achievement. The significant correlation in the current study between teacher-student ratio and books per pupil supports Lance et al.'s finding in that the larger the average classroom, the fewer the number of books per student in the school library. We might hypothesize that this is a function of overall expenditures made on the school, but total per-pupil expenditures in our analysis was not significantly correlated to either books per pupil or teacher-student ratio, so it is not clear why books and class size are correlated here.

The negative relationship between total number of books and SAT-Verbal scores is somewhat puzzling. Krashen reports (personal communication, September 15, 1995) that there was a slightly negative but nonsignificant correlation between total number of school library books at the elementary level and NAEP scores ($r = -.03$). Lance et al. (1993), on the other hand, found that the total number of books was positively and significantly related to reading achievement. It appears, then, that in some cases the number of books per student is the critical factor, in other cases, the total number of books. Krashen has hypothesized that there may be a minimum threshold of total number of books and books per person before either measure will have an impact on reading scores. If the total number is too low, adding a small number of books will not have an impact until the number reaches a critical mass; if the total number is very high, then a ceiling effect will occur. The number of books per pupil may be similarly

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affected. If a school of 100 students has 10,000 books (ratio of 100 to 1), adding 10,000 more--and doubling the per pupil ratio to 200 to 1--may not have any dramatic effects. A "floor effect" would no doubt also be applicable here. It is above this lower threshold of a minimum number of total books and below some theoretical saturation point that increasing the per pupil ratio would have an impact.

Unfortunately, little is known about what these minimum and maximum figures are for school libraries, since there has been so little research in this area. No doubt the impact of the school library collection size will also be a function of the availability of print from other sources, especially the home. Elley (1996) has shown, for example, that school libraries can have a particularly powerful "compensatory effect" in developing countries where schoolchildren have few sources of reading materials at home and in the community. Thus, even modest collections may have a significant impact on students who otherwise have little access to books.

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Notes

1. Krashen (1995) found multicollinearity (high intercorrelation) among the variables used in his study, which, in addition to the use of only one measure per variable, indicates that replication is called for. The present chapter, by using a separate set of data points from previous years, seeks in part to confirm those findings.

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CHAPTER VI

CONCLUSION

This dissertation has attempted to identify how two factors, access to written input and type of assistance, affect literacy acquisition. In this concluding chapter, I will briefly review and discuss the results of each of the four research questions, implications of these results, and some related issues in literacy development.

Summary and Discussion of Results

1. Can initial reading acquisition by children as evidenced by knowledge of the "alphabetic principle" take place through access to comprehensible text without meta-linguistic assistance (formal instruction)? What role does elaborative assistance play in initial reading acquisition?

The model of literacy acquisition proposed in Chapter 1 holds that more proficient readers can offer children learning to read two types of assistance, elaborative and meta-linguistic. It was hypothesized that neither of these are necessary in learning to read, but both may be helpful. Evidence on one indication of initial reading acquisition, the ability to recode words into sound (the alphabetic principle) was found to be insufficient to support a strong version of what we may call the "Instruction Hypothesis," that explicit, meta-linguistic assistance is needed in order for children to learn how to read.

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First, researchers have failed to take into account the generally overspecified nature of the input used to measure print exposure, environmental print. Because children can derive the necessary meaning of many logos and signs without attending to the text, reception of this input does not necessarily lead to any acquisition of specific features of the writing system. Other forms of written input, or environmental print that is more properly specified, would appear to be needed to make the text more salient and comprehensible. Although it may not always lead directly to independent reading, environmental print does serve a function in helping children learn to read. As Goodman (1986) and others have noted, children begin to see that written language has a purpose and meaning, even if they are not paying close attention to the "graphic" detail of the letters and words embedded in it.

Strangely, there has been relatively little research of precisely what type of exposure helps children acquire initial literacy. Snow and her colleagues (Snow & Goldfield, 1982, 1983; Snow & Ninio, 1986) conducted a series of studies on the discourse of "storybook" reading between children and parents, and Yaden (Smolkin, Conlon, & Yaden, 1988; Yaden, Smolkin, & Conlon, 1989; Yaden, 1988) has looked at the types of elaborative questions children ask during storybook reading sessions. Both of these sets of studies give us some insight into the nature of adult assistance to prereaders. Yet there is relatively little experimental or ethnographic research on precisely what types of elaborative

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assistance or contextual help beginning readers acquire certain aspects of text. Possible exceptions to this gap in the research are Ehri's studies on fingerpointing-reading and Samuels' earlier work on illustrations and isolated word learning, but neither these are necessarily representative of normal print exposure for early readers, and both have methodological problems as discussed in Chapter 2.

A second problem encountered in the evidence on acquiring the alphabetic principle was the unrealistic estimations of the quantity and duration of input that are likely to be needed to acquire the information contained in the input. The very short exposures used in most training studies, some no more than a few minutes, and extremely impoverished input (a few words) are not likely to lead to any easily measurable acquisition of linguistic information, and are completely inadequate to test whether children can acquire linguistic information from exposure alone. Research from oral language (Pinker, 1994) and other aspects of written language acquisition (Nagy, Herman, & Anderson, 1985) suggest that many aspects of the language are acquired very gradually, often over a period of years, not minutes. This of course places severe limitations on the type of evidence available to answer this question, since it is almost impossible to observe children carefully over long periods of time to see what sort of assistance they might receive when learning to read.

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2. Can initial reading acquisition by children as evidenced by other measures of literacy (self-report, reading comprehension assessments) take place without meta-linguistic assistance?

Our examination of other evidence on the role of meta-linguistic instruction and early reading acquisition found that children can and do learn to read outside of school before any formal, systematic training. Survey and case study reports of "early readers" find that these children appear to receive a great deal of elaborative assistance from parents and siblings by being read to and given a "print-rich" environment. Some meta-linguistic instruction is also going on, but, when it is reported, appears to be limited to letter names and sounds and perhaps some help in spelling. The number of children learning read outside of school also was found to be much higher than previously reported. Perhaps as many as one out of every ten children arrive at school already reading at some level, according our analysis of data from a nationally representative sample of U.S. parents.

Similar to the case of early readers, the parents of home schooled children who learn to read relatively "late" report that their children received mostly elaborative help in combination with lots of access to reading materials. Some of these parents report giving no meta-linguistic instruction to their children, who nevertheless learned to read and made rapid progress in reading proficiency. It was also found that the age at which children learn to read does not appear to be a critical factor in eventual attainment. Neither experimental nor nonexperimental

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designs find support for a "critical period" in reading acquisition. Rather, it would appear that appropriate assistance and an ample supply of texts to read are more important to reading development.

Of course, the evidence reviewed in this chapter has its weaknesses, in that we cannot control for all of the variables present in the environment of children leaning to read outside of school, or be sure of the types of possible assistance they receive. In other words, it suffers from all of the shortcomings of naturalistic, longitudinal research noted above in discussing limitations of the evidence on the alphabetic principle.

3. Does access to text have a significant and substantial impact on literacy development among children even after controlling for the effects of meta-linguistic assistance?

4. Does access to text have a significant and substantial impact on literacy development among adolescents in assessments of academic reading proficiency?

Since these studies are closely related, I will discuss them under a single heading. In the analysis reported in Chapter 4 of state-level fourth grade reading scores, print access, and meta-linguistic instruction, it was found that access to print via the home, school and public library, and frequency of free reading accounted for a very large amount of variance in test scores, nearly 80%. Once access to print was controlled for, the effects of meta-linguistic assistance were small (Table 13, Order B). It may be, of course, that the order of entry in the

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regression analysis distorts the true importance of skills instruction; that is, if skills were entered first, the impact of print might be similarly small. But as seen in Order A, when skills and free reading measures are entered first and other print access measures second, access still manages to account for a high proportion of the variance. (Notice that Order A actually overestimates the impact of skills, since we have included free reading on the same step in the equation.)

Attempts to make the case statistically for the independent impact of skills instruction on test scores via alternative hierarchical regression models was not successful. The results are shown in Table 19.

Table 19
Alternative Models for Variance Explained in Path Model

Order A	
Variable	**R^2**
Skills	38%
Poverty	22%
Access	26%
Order B	
Poverty	59%
Skills	0%
Access	26%

When skill instruction is entered on step one, followed by poverty on step two and access variables on step three, skill instruction does account for about a third of the variance in test scores. However, when poverty is entered first into the equation, the skills variable adds absolutely no variance explained. Remember that

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when access is entered first (Table 13, Order B), neither poverty nor skills explains very much additional variance. It does not appear, then, that the failure of skills instruction to account for differences in test scores is due to order of entry in the regression analysis.

Measures of an alternative method of teaching reading, "whole language" or literature based instruction, were not included in the analysis because the correlation between the percentage of teachers reporting the use of whole language methods and state-level reading scores was close to zero ($r = .07$). Taking this fact together with the above analysis of the impact of skills instruction, one may conclude that instructional factors as measured by the NAEP assessment don't account for much of anything in explaining reading test score differences.

The path proposed to account of the relationship among the variables was supported. Poverty reduces the print environment at home, which leads to less pleasure reading and lower reading scores. Similarly, school and public library quality affects the amount of library use, which in turn influences the amount of free reading, and ultimately, reading test scores. These findings are consistent with other research on the strong influence of print access on reading achievement (Lance, Welborn, & Hamilton-Pennell, 1993; Krashen, 1995). The direct impact of meta-linguistic instruction was found to be significant but negative, resulting in lower test scores at the state level.

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The results are consistent with our model of literacy acquisition in Chapter 1, which predicts that access to input will be an important determinant of the amount of reading, which will in turn influence the level of acquisition. Meta-linguistic assistance may play a mediating role, but is not necessary. The relatively large proportion of the variance explained by the access variables versus the instructional ones (see also Appendix, footnote 1) suggests that, at least for fourth graders, print access in more critical than teaching.

There are several limitations of this analysis, as already noted in our discussion in Chapter 4. Path analyses can only claim that the data are consistent with the causal relationship proposed; other models may also be supported by the data. More importantly, state-level data may obscure other confounding influences on achievement. Finally, there is a low ratio of predictor variables to sample size, combined with a high degree of multicollinearity, making the analysis unreliable and requiring replication on another data set.

The analysis of state S.A.T. Verbal scores in Chapter 5 found that print access was significantly related to reading achievement via the public library ($p < .05$) and school library ($p < .10$), controlling for the effects of class size, spending on computers, and median income. It may be expected that older students rely more on public than school libraries for their free reading materials, explaining the stronger influence of the former on S.A.T. scores. Our measure of public library per capita circulation was for the entire population, however, not just for students,

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although the two may be related. Unlike the analysis of the fourth grade NAEP scores, there was only a small degree of multicollinearity among the variables used here, although as single measures of the constructs represented, their reliability is probably also greatly diminished.

The results confirm that access continues to exert a strong influence on reading proficiency through high school, a finding consistent with a study by Stanovich, West, and Harrison (1995), who found that differences in vocabulary and "cultural" knowledge between college students and older adults were a function of the amount of pleasure reading done by each, not age.

Further Research and Implications

Measuring Literacy Acquisition

There are still several methodological problems present in the literature on reading acquisition that may bias the picture we have of how children acquire and develop literacy. As was noted in our analysis of studies done on acquisition of the alphabetic principle, it is difficult to control for the type of assistance a child may receive when learning to read. Perhaps more importantly, it may be even more difficult to measure the precise point at which children are able to recode words in isolation. It may be, for example, that children incrementally acquire certain letter-sound correspondences or various aspects of phonological awareness from the text embedded in environmental print, leading to a cumulative effect that results in their ability to read (and recode). If this is true, then we should expect to see a bimodal

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distribution of children of the kind Masonheimer et al. and Stahl and Murray discovered in their samples--some children being able to read several words in isolation, others not at all. This compounds the specificity problem of using environmental print noted in Chapter 2.

The existence of a "threshold" for acquiring the alphabetic principle would explain the sudden increase in word reading among Lomax and McGee's five-year-old subjects noted in Chapter 2, Table 2. Similar evidence of this phenomenon is found in other studies. In Ferreiro's (1986) longitudinal study of two early readers, she gives several examples one of how her subjects, Max, gradually learns about print through exposure to text, including syllable boundaries, letter names, and phonemes. Although Ferreiro does not report on Max's reading ability, she does state that his writing went from proper correspondence of just the first letter to full-blown use of standard spelling very quickly, within a period of three months. (There is no evidence that he received any explicit instruction.)

In one of Byrne's (1992) training experiments meant to explicitly teach children phonemic awareness (Number 11), the children trained on one pair of letter/sound combinations were able to quickly use their insights in recoding other words containing phonemes not presented during the experiment. It may be, then, that aspects of this particular skill of recoding also come quite quickly after a certain amount of incremental acquisition from print exposure or minimum meta-

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linguistic training, and thus we may never see anything approximating a normal distribution of recoders and "partial recoders."

Further support for the incremental growth of some types of print knowledge reaching an apparent threshold resulting in recoding ability is reported in Bowey (1994). Bowey found that while novice readers (those children who could read at least one word in isolation on a screening test) scored significantly higher than prereaders in phonemic awareness, other types of phonological sensitivity varied more incrementally according to the level of letter knowledge among the prereaders. A confound in these results was that prereaders with a high level of letter knowledge also had higher verbal ability. Bowey speculates that "verbally advanced children come from homes that emphasize language and reading related activities," and that this exposure accounts for both verbal and phonological differences. None of the novice readers in her preschool sample had yet been exposed to formal reading or reading readiness instruction of any kind (p. 140).

Measurement issues also play a role in determining how print access may influence later literacy development. It is known, for example, that socio-economic status has a much more powerful impact on school performance when the unit of analysis is the school, the district, or the state (White, 1982). When we analyze at the individual level, the correlations between SES and achievement decrease (see also the Appendix for a discussion of this point). Unfortunately, we

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have very poor measures of print access at the individual level in most large, representative databases on student achievement. One of most ambitious of these, the National Educational Longitudinal Survey, 1988 conducted by the U.S. Department of Education, does not contain any measure of access to print in school, and only a few measures of the number of books at home and amount of free reading (NCES, 1994b). Other studies of reading achievement have similarly failed to take print exposure into account, with the exception of a few studies by Stanovich and his colleagues (Stanovich, West, & Harrison, 1995; Stanovich & Cunningham, 1992), Greaney (Greaney & Clarke, 1973), Krashen (1995), and Elley (1991, 1994, 1996). More reliable tests of the impact of access on literacy await more reliable measurements of print exposure.

The "Naturalness" of Reading

An obvious objection to the position that formal instruction is not necessary for literacy acquisition is the observation that relatively few children seem to acquire reading "spontaneously" before school in literate societies, whereas oral language acquisition is nearly universal. (The actual number of early readers might be larger than previous studies indicated, however, as noted in Chapter 3.) There are other possibilities for this situation, however. First, formal instruction often comes at the point when many children are beginning to acquire certain print concepts on their own, as evidenced by the number of children who

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come to kindergarten with letter knowledge and often the ability to read words already in isolation (Richgels, 1995).

Second, it may be that print, unlike oral language, is never presented to children in forms that they can understand easily. The context in which they encounter print may be less than comprehensible, especially if they are not given any elaborative assistance by parents or siblings. Oral language, in contrast, is typically the first communication system presented to the child and made comprehensible to them by others in a variety of ways over a number of years.

Is There Any Role for Meta-Linguistic Assistance?

A related question not considered directly in the dissertation, but important to practitioners, is whether explicitly teaching children about certain properties of print is helpful, even if it is not necessary. Goodman (1996) and Smith (1994) have stated that a little explicit meta-linguistic instruction may be of limited assistance to some children by helping them make texts more comprehensible, consistent with our model in Chapter 1. Still, classrooms which emphasize the acquisition of reading primarily through a rich exposure to texts can also accomplish this goal, and have other benefits, including giving students a more expansive knowledge of written language conventions, a more enjoyable experience with text, and a stronger disposition to continue reading (Dahl & Freppon, 1995; Freppon, 1991; Purcell-Gates, McIntyre, & Freppon, 1995).

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The amount of meta-linguistic assistance that would be helpful for children is thus still an open question. Some studies comparing the amount of phonics and phonemic awareness instruction have sometimes found no better results in classroom with extensive training and those with little or none at all (e.g. Torgeson & Hecht, 1996). Krashen's (1996a) analysis of the effects of "phonemic awareness" training on early readers found that while it has a substantial impact on measures of recoding, it has a considerably smaller influence on reading comprehension. More importantly, these training studies typically do not directly compare a print-rich classroom to one with meta-linguistic instruction, making claims about the superiority of one method versus the other very questionable.

Identifying Variables in Reading Achievement

Despite the diversification of U.S. public schools over the past 25 years, the level of reading achievement has remained remarkably stable (Berliner & Biddle, 1995). Still, there are many groups which perform relatively poorly compared to the national norm, and this includes children coming from low-income areas and those attending schools in poorly funded districts. The reading field's response to these disparities has been for the most part to center their attention on the "Great Debate" over what type of instruction is most useful in helping students learn how to read, as noted in Chapter 4. This dissertation has attempted to "refocus" the debate to include a logically antecedent and, as it turns out, very powerful correlate of reading achievement: the availability of reading materials.

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The position taken here is still clearly a minority one. Chall (1996), for example, recently attempted to explain historical changes in reading achievement in high school by looking at the type of early reading instruction that was prevalent among reading methods textbooks when the cohort in question was in elementary school. This analysis is based upon mostly unsubstantiated (and often improbable) assumptions about the relationships among numerous factors, including what appears in methods texts, what gets taught in method courses, what (new) teachers do in the classroom, what proportion of students are taught by new teachers, and what teachers say they do and what the actually do, among others. More seriously, it fails to consider in any way other variables which may affect reading achievement, such as the number of books available to students at home and in schools (see Appendix, note 1).

It might be more worthwhile to begin with the assumption that large differences in performance are attributable to large changes (or differences) in the basic conditions of the environment, rather than focus on the micro-level of instruction. All this is not to dismiss the importance of teaching, but to put it in proper perspective. Individual teachers may have a profound impact on individual students, but their students' success in reading may be more closely tied in the aggregate to the amount of books that are accessible to them. This is one plausible interpretation of the results of Chapter 4 on the minor impact of instruction on state reading scores and the very strong effects of print access.

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If access is critical to reading proficiency, then the implications for schools are straightforward: Greater access to books must be given to students. This includes increasing the number of books in school and classroom libraries, giving students more time to read books and a comfortable place to read them.

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APPENDIX

ACCESS AND INSTRUCTION: A CASE STUDY

In 1995, the nation's most populous state, California, took dramatic and highly publicized steps toward a renewed emphasis on phonics and meta-linguistic skills in early literacy instruction. The significance of California's policy decisions for the rest of the country cannot be underestimated, as the apparent "failure" of its literature-based program ("whole language") was cited as justification for changes in other states and indeed, for a new national policy on literacy instruction (e.g. Chen & Colvin, 1996). This Appendix focuses on the two central themes addressed in this dissertation, access and instruction, through a case study of California's reading policy toward both.

The reasons for California's dramatic shift in educational policy were nearly unanimously agreed upon by a government leaders and commissions (California Department of Education, 1995a; CRTFR, 1995), the media (e.g. Stewart, 1996), and many members of the research community (Fry, 1996; CRTFR, 1995). First, California's reading test scores were said to have "plummeted" (Stewart, 1996, p. 23) to record lows over the previous ten year period; and second, this sharp decline was said to be directly attributable to the adoption of a literature-based reading curriculum in the state in 1987 (CRTFR, 1995), which de-emphasized phonics and meta-linguistic skills instruction. As I will show, however, there are no empirical data to sustain either of these

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assertions. The shift in reading policy was based upon false information and faulty assumptions, and completely ignored the importance of access in reading acquisition.

Declining Test Scores

The move to reform reading instruction in California began with the appointment of a special Reading Task Force in May of 1995 by Superintendent of Public Instruction Delaine Eastin. The impetus for the task force was the release of two sets of test scores that have been widely cited as demonstrating that California's reading performance has dropped significantly since 1987. The first set is from the National Assessment of Educational Progress (NAEP), a federally-funded, standardized reading assessment administered every two years by the U.S. Department of Education to a representative sample of fourth grade students in 41 states. In both 1992 and 1994, California's fourth graders ranked among the worst of the participating states. The median score for California in 1992 was 202, the fourth lowest of the states and territories for which data were available, while the overall national average was 215 (on a scale of 0-500). In 1994, California dropped slightly to 197, tying for next to last, while the national average slipped slightly to 212 (Campbell, Donahue, Reese, & Phillips, 1996, p. 25). Rank scores are, of course, slightly misleading, since a difference of a few points can cause a state to rise or drop in rank if the states are clustered closely together. But even when this clustering is taken into account, California still did not fare well: in 1992,

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the state was in the bottom third, and in 1994, in the bottom quarter (Campbell et al., p. 59-60). Clearly, California was performing relatively poorly compared to the rest of the nation.

But performing poorly is not the same as declining. To show a decline, one must look at scores from both the beginning and the end of the time period in question. Herein lies the problem: state-level NAEP scores are unavailable before 1992, and the tests are not equivalent to any other standardized reading measure. As such, the NAEP data cannot tell us anything about whether scores went up or down after the implementation of the literature-based curriculum.

The second set of data cited to show California's supposed drop, the California Learning Assessment System (CLAS), suffers from the same lack of comparability. The CLAS tests were administered only twice, in the 1992-93 and 1993-94 school years. Like the NAEP scores, they are not comparable to previous test scores and tell us nothing about how California students read before and after the 1987 Framework adoption. (In fact, the two years are not even comparable to each other, due to changes made in the test after the first year of its administration). Ironically, the 1993-94 results indicated that more than three-fourths of California's students could read at a "basic" level, a rather strong showing in light of the dismal financial conditions of the state's schools (see below.)

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It is important to keep in mind when analyzing the NAEP and CLAS scores what categories such as "basic" or "proficient" level mean in terms of reading proficiency. Both examinations are "criterion-referenced" and have established cutoff points for each level of proficiency. These cutoff points were not made in reference to how schoolchildren performed in the past, but rather were determined based upon criteria created by a committee of teachers and researchers. These criteria are different for each test, and are necessarily arbitrary (Glass, 1978). On the NAEP test, for example, children who score above the basic level at the fourth grade (a score of 208 on a scale of 0 to 500) can "demonstrate an understanding of the overall meaning of what they read," can "make obvious connections between the text and their own experiences," and can "extend ideas in the text by making simple inferences" (Campbell et al., 1996, p. 42). For the CLAS examination, "basic" was defined as "literal understanding of a reading selection, both as a whole and in its parts" (California Department of Education, 1995b). Not surprisingly, the two definitions produce two different results. On the NAEP test, only 44% of California's children read at or above the basic level; on the CLAS test, more than 75% do. It should also be clear from these definitions that scoring at the "basic" level does not mean that children cannot recognize words or will stare blankly when confronted with a text.

A third set of data, commercial test score results, has also been cited by some journalists as evidence of a test score decline (Levine, 1996). The scores are

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taken from a report by the Policy Analysis for California Education group (Guthrie et al., 1988) which equated California's performance on the California Achievement Program (CAP) to national percentile ranks during the early and mid-1980's. At first look, these scores seem to make the case for whole language critics: as shown in Table 20, California scored near the middle throughout most of the previous decade in the PACE analysis, not near the bottom, as it was said to have done in the 1992 and 1994 NAEP assessments. Upon closer inspection, however, it becomes clear that these data do not show that California ranked around the middle of the states before 1987, nor that scores were rising relative to other states over that same period of time, nor even that more than half of our students were above the national average in the mid-1980's. Let's take each of these claims in turn.

Table 20
Comparison of California Achievement Program Scores to National Percentile Ranks

	81	82	83	84	85	86	87
CTBS 1973 norms	59	60	62	64	69	71	---
CTBS 1981 norms	--	41	45	46	54	55	55

(from Guthrie et al., 1988, Table 7.5)

First, commercial tests are not comparable in any way to the NAEP tests from which California's low national ranking is determined. NAEP scores can only be compared to NAEP scores because they are derived from a set of criteria

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and representative samples particular to that test, and scored according to a statistical procedure very different from that used by most commercial test givers.

Second, national percentile ranks are not the same as ranks among the states (such as those that have been used in the NAEP comparisons). In other words, a national percentile rank of 50 does not mean that California ranked in the middle of the states. National percentile ranks are derived from comparing the mean student scores in a state to the scores of all students collectively in the country, while state ranks are determined by comparing a state's mean score to the mean scores of other states. An example might clarify this difference. Consider the hypothetical distribution shown in Table 21.

Table 21
Hypothetical Distribution of State Test Scores, National Percentile Ranks, and State Ranks

State	Mean Raw Score	National Percentile Rank	State Rank
A	230	75	1
B	211	60	2
C	207	55	3
D	205	53	4
E	200	50	5
F	180	42	6

Although state B is separated from state A by 19 raw score points and 25 percentile points, the state rank--determined only in relation to where the state's

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score falls relative to the others--is 2. This illustrates that there is no necessary relationship between national percentile ranks and state ranks.

With large, normally distributed national samples such as those used in NAEP, students in most states will tend to fall around the 50th percentile--that is the nature of normal distributions. Yet only one state will rank in first place, and one in last, despite the fact that the students in those first- and last-ranking states may score about average. We can now see why distinguishing between national percentile ranks and state ranks is so important: California's low 1992 NAEP ranking was a state rank, not a national percentile rank. California's national percentile rank of 55 from the 1986-7 CTBS reading test means that the average California student scored better than 55% of all students in the country, not that California ranked 27th out of 50 states in the country in reading.

Another example will help illustrate this difference: In the 1994 NAEP 4th grade reading test, only 14 of the 42 states (33%) had average public school scores above the 50th percentile. This is because students are not evenly distributed among the states, not because only a third of American schoolchildren scored above average (a statitistical impossibility in norm-referenced comparisons). Minnesota, for example, had a state rank of 13 in the nation, but scored below the 50th percentile (Campbell et al., 1996).

Third, even the claim about California's mid-80s above-average national percentile rank is inaccurate. The percentile ranks shown in Table 20 were derived

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by comparing California's performance to 1981 and 1973 norm groups. But commercial test norms have been rising substantially over the past 50 years (see The Manufactured Crisis (1995) by Berliner and Biddle for details). This means that comparing test scores from a group of students to a previous norm group will likely overestimate the true percentile rank. It is easy to see that one can inflate percentile rank estimates simply by using an earlier (and lower) norming population. Notice, for example, that students in California had a percentile rank of 55 when calculated with the 1981 norms, but 71 when computed using the 1973 norms--a 15 point difference. If we assume a similar upward trend in the CTBS norms for 3rd grade reading resulting in a 15 point difference in percentile ranks over the 1981-87 period, then California's true 1987 percentile is not 55 or 71, but around 40.

Although the 1980s CAP assessments and 1992 NAEP tests are not comparable, it is interesting to note that when uninflated measures of the CAP scores are used, the national percentile ranks are in fact quite similar. The most reliable percentile rank from the 1980s CAP program is from 1981-82, the year closest to the 1981 re-norming of the test. The percentile rank for that year was 41 (Table 20). The state NAEP scores are not reported with a national percentile ranking, but from the information provided in the 1992 NAEP reports (Campbell et al., 1996, Table 2.1, p. 23; NCES, 1994), it appears to be in the high 30s, just a few points below the CAP rank. Given the measurement error in both tests, this

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small difference is unlikely to be statistically significant. In other words, when compared to students nationwide, the average California fourth grader in 1992 probably ranked about the same as fourth graders in the early 1980s, scoring at around the 40th percentile mark.

Table 22
California Achievement Program Raw Scores for 3rd, 6th, 8th, and 12th Grades 1984-1990

	1984	1985	1986	1987	1988	1989	1990
3rd	268	274	280	282	282	277	275
6th	249	253	260	260	265	262	261
8th	250	240	243	247	252	256	257
12th	236	241	240	246	250	248	251

(from Guthrie et al., 1993, p. 34)

The CAP scores do not show that California was on average any better in the 1980's than it was in 1992, nor do they show any serious declines after the implementation of the 1987 Framework. Table 22 shows the raw scores from the CAP until its discontinuation in 1990. There were slight increases and decreases across different grade levels, but overall the scores were very stable. California's third graders, for example, were performing at the same level in 1990 as they were in 1985, which would be unlikely if the 1987 Framework resulted in a dramatic decline in test scores. Of course, neither were there any marked increases in test scores, and this fact taken together with the rising trend in reading scores nationally on commercial tests over the past three decades (Berliner & Biddle, 1995) could mean, by comparison, that California's children are now somehow

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"falling behind." Even if this were true, however, it does not mean that things have gotten worse since the 1987 Language Arts Framework adoption, or that the state was any closer to an "average" performance nationally during the mid-1980's.

Despite repeated claims to the contrary, then, there is no evidence that California reading scores have declined markedly over the past ten years, and sufficient data to suggest that there has been little change in achievement since the 1987 Framework adoption. This stability of test scores is remarkable in light of the declining financial status of the California's schools discussed below, a decline that has been largely ignored in the debates over reading achievement in the state.

Print Access and Instructional Method in California

The second part of the argument used to promote a renewed emphasis on skills instruction was that whole language was the cause of California's (non-existent) decline and (very real) low national ranking. As noted earlier, it is true that California ranked relatively low among the states. Is a literature-based curriculum or whole language to blame? Another look at the 1992 NAEP data reveals that the answer appears to be "no." As part of the assessment, fourth grade teachers were asked to indicate their methodological approach to reading as "whole language," "literature-based," and/or "phonics." The average scores for each type of approach were then compared, and those children in classrooms with heavy emphasis on phonics clearly did the worst. Children in whole language-

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emphasis classrooms (reported by 40% of the teachers) had an average score of 220, those in literature-based classrooms had a score of 221 (reported by 49% of the teachers), and students in phonics classrooms (reported by 11% of the teachers) came in last with an average score of 208 (NCES, 1994, p. 284). Similar patterns were observed in the 1994 NAEP results (Campbell et al., 1996).[1]

If these teacher self-reports are accurate, then there is no evidence in the NAEP data that the use of whole language leads to lower reading scores. The cause of California's problems would seem to lie elsewhere. As it turns out, there are several likely sources for the state's low ranking, almost all of which were completely ignored by the state's political and educational leaders and by the media. Consider the following:

California has some of the worst school libraries in the country. There is now massive evidence to suggest that greater access to pleasure reading materials leads children to read more, and that more reading leads to better reading achievement (e.g. Krashen, 1993, 1996; Stanovich & Cunningham, 1992). Specifically, there is evidence of the critical role of school libraries in reading performance. Children get anywhere from 30 to 90% of their free reading materials from the school and public library (Krashen, 1993), and the impact of library quality on reading scores has been documented in a variety of studies. Lance and his colleagues (Lance, Welborn, & Hamilton-Pennell, 1993) found in a study of Colorado schools that the quality of the school library had a direct and

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powerful effect on reading achievement scores, even when controlling for the effects of teacher-pupil ratio, overall school spending, and socio-economic status of the students. On the national level, Krashen (1995) showed that school library quality was a significant predictor of a state's 1992 NAEP fourth grade reading score, even when considering median income, per-pupil spending, and the availability of computer software in a school. We have seen (Chapter 4) that public and school library quality were important indicators of a state's average S.A.T. score. Internationally, Warwick Elley (1992, 1996), in a study of over 200,000 students in 32 countries, found that school library quality had a significant impact on a country's reading performance, particularly on students who lived in less economically developed countries.

How does California rank in school library quality? According to the most recent data available (White, 1990), California places last or nearly last in almost every category, including books per pupil, per pupil spending, and librarians per pupil. Table 23 shows just how far California is behind the national averages in library quality, and the state's rankings are abysmal: 45th in per-pupil expenditures, 49th in books per pupil, and 50th in librarians per pupil.

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Table 23
School Library Quality in California and the United States

Books per Pupil:	Elementary	Middle	High School
U.S.	18:1	16:1	15:1
California	13:1	11:1	8:1
Per Pupil Spending			
U.S.	15.44	15.50	19.22
California	8.48	7.48	8.21
Librarians per Pupil	**Overall**		
U.S.	895:1		
California	5,496:1		

(from White, 1990; Snyder & Hoffman, 1995)

California has one of the worst public library systems in the United States. Public libraries also have an important impact on children's reading achievement. In Chapter 4 (Table 12), we found that there was a very strong correlation (r = .70) between a state's 1992 NAEP reading score and public library quality in a state. That means that nearly half of the variance in state NAEP scores can be accounted for merely by knowing the quality of a state's public library system. Mirroring its poor standing in school libraries, California also ranks near the bottom on several measures of public library quality. In 1990-91, Chute (1992) reports that California ranked 39th in books and serials held per capita (1.95 versus 2.53 nationally), 43rd in capital outlay per 1,000 residents ($666.00 versus $1,912.00), and 50th in hours open to the public per 1,000 residents (72.09 hours/week). Not only does California rank relatively poorly now, but the situation has become far worse since the late 1980's. As of 1993, Gibson noted

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that book budgets in the state had been cut 25% since 1989, the number of open hours had decreased 30% since 1987, and per capita spending had been reduced 36% from 1989. Children services had been the hardest hit, Gibson found, with 25% of public libraries reporting cutbacks in this area (Gibson, 1993).

California's children are poor and getting poorer. The only place children can find books outside of the school and public library is at home. But if you're poor, you're much less likely to be able to afford many books. This relationship between poverty, access to books at home, and reading achievement is again seen clearly in the NAEP data: In 1992, the correlation between a measure of poverty and a state's NAEP reading score was -.73; between books in the home and a state's average reading score, .87 (see Table 10). Similar results were found in the 1994 assessment (Campbell et al., 1996). A reasonable interpretation of these data is that children in relatively poor states have less access to books in the home, leading to lower reading test scores.

California ranked 9th in the country in the number of children 5-17 years old living in poverty (Bureau of the Census, 1995), with the poverty rate rising an incredible 25% between 1989 and 1993 (Schmittroth, 1994). According to the most recent figures, one out of every four California students is living in a family with income below the poverty line. Data gathered in the 1992 NAEP assessment confirm these figures: California ranked 10th highest among participating states in the number of children participating in free lunch and nutrition programs. Not

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surprisingly, the NAEP report also found that the state ranks near the bottom in the percentage of homes with more than 25 books in the home (NCES, 1994).[2]

The Verdict on Whole Language

Whole language did not fail in California. There is no evidence that state reading test scores declined after its implementation of the literature-based curriculum framework in the late 1980s. Furthermore, there is very little reliable data on just how widely literature-based reading instruction was actually implemented in the state. The 1992 NAEP reading assessment reported that 69% of fourth grade teachers in California said that they placed "heavy emphasis" on whole language practices in their classrooms, the highest percentage in the country. At the same time, 40% also said they gave "moderate emphasis" to phonics and 68% said they devoted at least some of their class time to decoding skills (NCES, 1994). Fisher and Hiebert (1990), in an analysis of teacher's self-reported labels concerning reading instruction and their observed reading practices, often found little correspondence between what teachers called themselves ("whole language," "phonics") and what went on in their classrooms. We should be cautious then in making any strong claims about just how seriously whole language took root in California based on teacher self-reports.

States looking to learn the "lessons of California" in reading instruction should avoid drawing the same faulty conclusions that the state's media and educational establishment have in regards to whole language. The evidence

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indicates that the most likely cause of California's low national ranking in reading achievement is not a literature-based curriculum but a lack of reading materials for California's students. Before abandoning whole language, policy makers and teachers would be better advised to look the state of their school and public libraries, making sure that children have books to read.

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Notes

1. Chall (1996) claims this interpretation of the NAEP scores is incorrect because "phonics is usually taught in grades 1 and 2, and possibly 3, [and] when it is taught in grade 4, it usually means that the students were already functioning below expectancy" (p. 305). In other words, low scoring students in phonics classrooms are there because they are poor students to begin with, but if we looked at the relationship between phonics and test scores in first and second grade, we would see higher scores for the skills-based classes.

This interpretation is plausible if we looked only at the results nationally by individual classroom, as they are reported in Campbell et al. (1996). It is less persuasive, however, when we calculate the correlation between a state's NAEP score and a state's use of phonics in grade four, which turns out to also be very negative ($r = -.59$; Chapter 3, Table 10). If Chall were correct, it would mean that there is no meaningful correlation between what teachers of a given state do in reading instruction in fourth grade and what they do in first three grades; in this case, that school districts with a strong emphasis on phonics in grade 4 don't necessarily use phonics in similar proportions in the lower grades.

That is possible, of course, but not very likely. It seems much more probable that, on the whole, states, districts, and schools that use a lot of phonics in grade four also use a lot of phonics in grades 1, 2, and 3. (Imagine if whole language backers used a similar argument in California--that the real problem was

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that the state's first, second, and third grade teachers were using phonics, and that things changed suddenly to whole language in grade 4.)

2. Some have argued (Fry, 1996) that socio-economic factors can't account for California's low ranking in reading, since the median income for the state's residents in 1992 was above the national average, and both the percentage of people living below the poverty line and the number of persons 25 or older with a college education were about the same as the rest of the country. These figures, however, are for the average Californian, not the average California parent, who, as the figures above indicate, are indeed poorer than their counterparts in other states.

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