Prediction of Early Reading Success in Multilingual Children

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ABSTRACT

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The focus of reading-related research has shifted in recent years towards the study of specific cognitive skills involved in reading achievement, such as phonological processing and listening comprehension. This trend is partly due to findings that deficits in visual-motor processes are relatively rare among children with reading problems and to growing dissatisfaction with operational definitions of reading disabilities based on discrepancies between IQ and achievement scores. The main purpose of this longitudinal study is to assess the validity of phonological processing and listening comprehension measures relative to more traditional tests of general cognitive ability and visual-motor coordination in the prediction of early reading skills. Furthermore, few researchers have examined these skills in multilingual children. The participants in the present study speak Italian, English or other languages in addition to learning French in school. Thus, a second purpose of this study is to evaluate the generalizability of previous findings to a sample of multilingual, ethnic minority children. Sixty-five children were tested in Kindergarten with measures of phonological processing, listening comprehension, visual-motor integration, and general cognitive ability. In Grade 1, they were administered reading measures of letter, word and non-word recognition. Consistent with other results reported in the literature, phonological processing was the best individual predictor of Grade 1 reading and had incremental validity beyond all

other measures. Although children's lingual status was not strongly predictive of reading skill, language(s) most frequently spoken in the home had incremental validity in the prediction of letter recognition. In group comparisons, poor versus average readers differed significantly in performance on the Kindergarten and Grade 1 phonological tasks and on the listening comprehension measure. The weak listening comprehension skills of the poor readers of this study suggest that these children may have had more global language deficits. These results imply that (1) Kindergarten children who have weak phonological skills are at-risk for developing reading problems; (2) measures of specific abilities, such as phonological processing, may be more relevant than traditional measures, like general cognitive ability, for the identification of reading disabilities; and (3) lessons on phonics should be incorporated into reading instruction.

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An increased understanding of the cognitive bases of reading-related problems among children has resulted in three significant changes in the focus of this research area. One includes a greater emphasis on language-based processes. This new focus is in part due to findings that deficits in visual processes and visual-motor integration, once believed to be the main cause of reading disabilities, are actually relatively rare (e.g., Stanovich, 1986). Accordingly, many investigators have begun to study other cognitive processes involved in reading. For example, some research evidence suggests that phonological processing, which refers to a cluster of abilities that involve the use of the phonological or sound structure of oral language to process written and oral information, is central to reading success (Wagner & Torgesen, 1987). Through longitudinal studies of variables related to the early acquisition of reading as well as through studies in which poor versus accomplished readers were compared, the significance of phonological skills has been corroborated. Other findings indicate that listening comprehension, the ability to understand spoken language, is also a moderate predictor of reading skill (e.g., Curtis, 1980). Moreover, phonological processing and listening comprehension together have been found to account for substantial percentages of the variance of children's reading abilities (e.g., Aaron, 1991).

The second change in the focus of the research concerns operational definitions of reading problems, especially of "dyslexia" or "reading disability." To date, these concepts have been based on discrepancies between IQ and achievement scores. The former is seen as an index of the potential to learn, the latter of a specific, applied skill. Many

researchers have expressed dissatisfaction with IQ tests as measures of potential scholastic ability. One reason is that IQ and reading achievement scores covary highly, suggesting that they measure common cognitive processes. Also, IQ tests measure very global cognitive skills, which provides limited information about the specific processes involved in reading. This dissatisfaction with the use of IQ/achievement discrepancies to define reading disabilities has led to the third change in the field, a search for an alternative assessment model. The suggestion that specific cognitive processes, like phonological processing and listening comprehension, could be diagnostically informative for reading problems is currently being evaluated.

The purpose of this study is to assess the predictive validity of phonological processing and listening comprehension skills measured during Kindergarten, in comparison to more traditional measures of general cognitive ability and visual-motor skills, in the prediction of reading skills in Grade 1. In addition, unlike most previous studies in which the subjects have been monolingual, English-speaking students, the subjects of this project are ethnic minority children from multilingual homes. Thus, this study is also an attempt to examine the generalizability of previous findings regarding the importance of phonological processing and listening comprehension in reading with a different type of sample. Relevant research from these areas and their relation to the current study are discussed in the following sections: (1) phonological processing; (2) listening comprehension; (3) the traditional IQ/achievement discrepancy model; (4) visual-motor processing; and (5) linguistic status.

Phonological Processing

Many researchers have conducted longitudinal studies to examine various processes in young children that may be linked to later reading achievement (e.g., Badian, 1982, 1986; Butler, Marsh, Sheppard, & Sheppard, 1985; Hurford, Schauf, Bunce, Blaich, & Moore, 1994b; Sawyer, 1992; Wagner, Torgesen, & Rashotte, 1994). Considerable evidence indicates that phonological processing plays an important role in reading development and has validity in predicting reading success (e.g., Bryant, MacLean, Bradley, & Crossland, 1990; Majsterek & Ellenwood, 1995; Mann & Brady, 1988; Mann & Liberman, 1984; Stanovich, Cunningham, & Feeman, 1984b). Indeed, performance on measures of phonological skills assessed as early as Kindergarten can predict with reasonable accuracy later reading performance. For instance, Mann (1993) found that two phoneme awareness tasks administered in Kindergarten accounted for 30-40% of variance in first-grade reading ability. Stanovich, Cunningham, and Cramer (1984a) reported that two of their phonological tasks accounted for over 65% of Grade 1 reading variance in their sample. Bradley and Bryant (1983) reported high correlations between the phonological scores of 4- and 5-year olds and reading measured 3 years later. Altogether, these results suggest that (1) phonological skills measured even prior to the onset of formal reading instruction are predictive of the early acquisition of reading; and that (2) young children who have difficulty with phonological processing may have problems learning to read. In support of this suggestion, some researchers have found that it is possible to accurately identify at a very young age children who are at-risk for reading disabilities with measures of phonological skills (e.g., Hurford et al., 1994a; Hurford,

Schauf, Bunce, Blaich, & Moore, 1994b). Furthermore, results of other studies also suggest that phonological measures are predictive of reading skills independent of general cognitive ability (e.g., Mann, 1993; Wagner & Torgesen, 1987).

Many researchers have also compared the phonological skills of successful and unsuccessful readers (e.g., Ackerman, Dykman, & Gardner, 1990; Fox, 1994; Hurford, Gilliland, & Ginivan, 1992; Rack, Snowling, & Olson, 1992; Watson & Willows, 1995). The general finding is that although poor readers are deficient in phonological processing, successful readers are efficient at tackling most phonological processing tasks. Moreover, some investigators have attempted to assess whether this phonological deficit is pervasive across poor readers of varying IQ levels, including reading disabled children (average IQ, low achievement) and so-called "garden-variety" poor readers (low IQ, low achievement; e.g., Hurford, Darrow, Edwards, Howerton, Mote, Schauf, & Coffey, 1993; Siegel, 1992; Stanovich, 1988). These results generally indicate that poor readers have difficulties with phonological processing regardless of their IQ levels (e.g., Felton & Wood, 1992; Hurford et al., 1993, 1994a; Siegel, 1988, 1992; Stanovich, 1988, 1993). Other researchers have concentrated on the deficits that may be specific to children with severe reading disabilities, and the findings have corroborated that low ability readers have phonological problems regardless of the severity of their reading problems (e.g., Ackerman, Dykman, & Gardner, 1990; Cornwall, 1992). For example, Cornwall (1992) found that even after controlling for age, socioeconomic status, behavior problems, and general cognitive ability, phonological processing added significantly to the prediction of reading ability in her sample of children with severe reading disabilities.

Given the apparent importance of phonological skills in the development of reading, the issue of whether such skills can be remediated has been raised. Some researchers have reported that young children can be successfully trained to improve their phonological processing skills (e.g., Fox & Routh, 1976; Treiman & Baron, 1983). Furthermore, such training is effective in increasing reading abilities (e.g., Bradley & Bryant, 1983; Felton, 1993; Fox & Routh, 1976; Hurford et al., 1994a; Treiman & Baron, 1983). More specifically, phonological instruction in Kindergarten may significantly improve early reading and spelling skills (e.g., Ball & Blachman, 1991; Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988). Also, Hurford et al. (1994a) reported evidence that children with reading problems can benefit from phonological-based training as a means of enhancing their word identification skills regardless of their IQ levels. Finally, direct instruction in phonics and the alphabetic code in Grades 1 and 2 may have a positive impact on the nonword reading skills of children who are identified as at risk for reading disability in Kindergarten (Felton, 1993).

Although phonological processing is believed to be a precursor of reading ability, some recent evidence suggests a reciprocal effect (Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner, Torgesen, & Rashotte, 1994). That is, phonological processing abilities influence subsequent reading which in turn affects the continued development of phonological skills, but the effects of the former seem stronger than the reverse (Wagner et al., 1994). Moreover, phonological processing, like other cognitive abilities, has been found to be a relatively stable and coherent individual difference attribute. For example, Wagner, Torgesen and Rashotte (1994) found that individual

differences in phonological processing abilities are consistent from Kindergarten through Grade 2. A possible implication of these findings that phonological skills are relatively stable is that deficits in phonological processing may persist throughout the lifespan. Indeed, Bruck (1992) reported that, in comparison to good readers of the same age and reading level, reading-disabled children ages 8 to 16 years show not only phonological deficits but also little phonological development with increases in their reading skills. Furthermore, even adults with childhood diagnoses of dyslexia performed below age-expected levels on phonological awareness tasks (Bruck, 1992).

Consistent with a presumed bidirectional relation between phonological abilities and reading, Hurford et al. (1993) compared the phonological processing and reading skills of children with and without reading problems over a period of one year. They found that although all children made improvements in both skills, the gap in the performance between the disabled and nondisabled children on the phonemic segmentation and reading tasks widened (Hurford, Darrow, Edwards, Howerton, Mote, Schauf, & Coffey, 1993). Their results are consistent with Stanovich's (1986) notion of the "Matthew effect," in which for good readers the successful practice of reading and reading-related processes in turn enhances their reading and phonological skills; children with reading problems, however, become incrementally less able to learn to read and fall further behind their non-disabled peers (Hurford et al., 1993; Stanovich, 1986). Altogether, these findings seem to reinforce the value of assessing young children's phonological skills in order to identify those children who are at risk for future reading problems.

Results of the studies reviewed above suggest the importance of phonological processing in reading, including that (1) phonological processing strongly predicts the acquisition of early reading skills; and that (2) performance on phonological measures can differentiate between poor and successful readers. Essentially all of these studies were conducted with English-speaking samples of adults and children.

Listening Comprehension

Although research results clearly indicate the critical role of phonological processing skills, other language-based abilities, particularly listening comprehension, may also be important for reading development. The skill of listening comprehension refers to a child's ability to understand spoken language, including unstructured, natural speech and more formal, organized oral language such as in a text read aloud. There are many alternative ways to measure listening comprehension skills, including by (1) recall of or answering questions about a text presented orally; (2) pointing to the picture that illustrates the content of a sentence read aloud (i.e., a multiple-choice format); and (3) supplying the missing word to a sentence read by the examiner.

Results of a number of studies have documented that listening comprehension is a moderate to a strong predictor of reading ability (e.g., Curtis, 1980; Stanovich, Cunningham, & Feeman, 1984; Wood, Buckhalt, & Tomlin, 1988). For example, Wood, Buckhalt and Tomlin (1988) reported that listening comprehension and reading performance correlated .73 for non-disabled children and .78 for learning disabled children ages 9 through 15. In addition, the relation between reading and listening comprehension appears to change as a function of age (Curtis, 1980; Stanovich et al., 1984). Stanovich et

al. (1984) found that the correlation between reading comprehension and listening comprehension increased from .37 in Grade 1 to .52 in Grade 3 to .59 in Grade 5. Moreover, at each grade level, listening comprehension proved to be a better predictor of reading than IQ scores. Like phonological processing, the increasing intercorrelation between listening comprehension and reading may reflect a reciprocal relation. Results of studies in which the performances of successful and unsuccessful readers were compared have indicated that high ability readers either score better on tasks of reading comprehension than on listening comprehension (e.g., Royer, Sinatra, & Schumer, 1990) or show no difference in scores (e.g., Hood & Dubert, 1983); the performance of low ability readers is more variable, with listening comprehension scores often exceeding reading comprehension, but not always (Royer et al., 1990; Spring & French, 1990).

Given the association of listening comprehension with reading, some researchers have proposed that this skill is one of the basic components of the reading process (e.g., Aaron, 1991; Juel, Griffith, & Gough, 1986; Tunmer & Hoover, 1993). Understanding written text also requires the ability to decode unfamiliar words. Therefore, both phonological processing, used to decode printed text, and listening comprehension are important for reading. Researchers have found that the combination of information about listening comprehension and phonological processing together account for about 50-75% of the variance of reading ability (Aaron, 1991; Stanovich, 1986). This substantial percentage of explained variance appears to be greater than the predictive power of either skill alone. With development, the relation between these specific cognitive skills and reading appears to shift. In the early stages of reading acquisition, children may rely more

heavily on phonological skills to decode printed words. Once they have mastered basic word recognition and have built up a sight vocabulary, children can allocate more of their attention to understanding the text and thus can apply their listening comprehension skills (Aaron, 1991; Tunmer & Hoover, 1993).

It has been suggested that discrepancies between listening comprehension and reading comprehension may prove to be informative for distinguishing among poor readers (e.g., Aaron, 1991; Hood & Dubert, 1983; Spring & French, 1990; Stanovich, 1991, 1993). All poor readers, by definition, have weak reading comprehension abilities. Stanovich (1991; 1993) reasons that poor readers with adequate listening comprehension possess a cognitive deficit specific to reading (i.e., a "vertical" phonological deficit); those who have equally poor reading and listening comprehension skills may have a more generalized language deficit (i.e., a "horizontal" deficit) that involves the ability to understand spoken speech. Thus, according to Stanovich (1988), the core deficit specific to reading is a phonological one. This argument is consistent with research findings indicating that phonological processing is predictive of reading success and that poor readers display deficiencies in this skill, as was discussed earlier.

In support of this assessment model, researchers have reported that listening comprehension can be a useful benchmark for identifying and diagnosing reading disabilities (e.g., Aaron, 1991; Hood & Dubert, 1983; Horowitz & Samuels, 1985; Royer et al., 1990; Spring & French, 1990; Wood, Buckhalt, & Tomlin, 1988). For example, Spring and French (1990) found that by minimizing the demands placed on working memory, it was possible to significantly discriminate children with specific reading

disabilities in Grades 4 through 6 from their non-disabled classmates using discrepancies between reading and listening comprehension scores. The proposed listening comprehension/reading comprehension discrepancy model also has implications for educational remediation. Poor readers with a discrete or "vertical" deficit in phonological processing may well profit from phonetic-based training. In comparison, low ability readers with more "horizontal" problems may require assistance in the development of additional skills, such as general language use.

Both theory and empirical evidence cited above corroborate the important role of listening comprehension in reading development, particularly in older subjects. This study addresses the predictive validity of listening comprehension in a younger sample than most previous studies.

The IQ/Achievement Discrepancy Model

There is considerable controversy over the role of IQ tests in the definition of a reading disability (e.g., Lyon, 1989; Naglieri & Reardon, 1993; Share, McGee, & Silva, 1989; Siegel, 1989b; Torgesen, 1989). A child is usually classified as reading disabled based on a discrepancy between general cognitive ability, as measured by IQ tests, and reading achievement. Because the guidelines as to what constitutes a significant discrepancy are typically unspecified, any change in the discrepancy formula results in different populations of children being classified as reading disabled (e.g., Dykman & Ackerman, 1992; Fletcher, Epsy, Francis, Davidson, Rourke, & Shaywitz, 1989; Shaywitz, Fletcher, Holahan, & Shaywitz, 1992; Berninger, Hart, Abbott, & Karovsky, 1992). Nevertheless, the current practice has been that a child so labeled is entitled to

remedial services, while a child with equally poor reading achievement who also has a low IQ score may not be eligible to receive such assistance. The latter child's achievement score is believed to be, according to the logic of the discrepancy model, in agreement with his limited ability, and is therefore not unexpected.

Empirical evidence supporting either the concept of "reading disability" or the validity of separating children with poor achievement based on IQ discrepancies is lacking. This may be attributed to the fact that the assumptions on which the discrepancy model is based are unfounded. For example, one assumption of the IQ/achievement discrepancy model is that IQ and reading achievement can be separately measured. However, research findings suggest that these skills covary given that (1) the correlation between IQ and reading increases with age (from .3-.5 in early elementary to .6-.75 by adulthood; Stanovich, 1986); and that (2) verbal IQ scores for poor readers appear to decline over time (e.g., Share & Silva, 1987). Thus, as cited earlier, with the reduced exposure to printed text, low ability readers may be in a "poor-get-poorer" situation in which they are less likely to develop the abilities assessed by IQ tests, such as vocabulary breadth (Stanovich 1986, 1989, 1993). An additional criticism of the model concerns its assumption that the degree of discrepancy between IQ level and reading is meaningful and has external validity (Stanovich, 1991). Indeed, researchers have reported that it can be quite difficult to demonstrate cognitive differences between poor readers of differing IQs (e.g., Glez & López, 1994; Pennington, Gilger, Olson, & DeFries, 1992; Siegel, 1992; Stanovich 1989, 1991). For example, Fletcher, Francis, Rourke, Shaywitz, and Shaywitz (1992) found that neuropsychological status accounted for little variability among low

ability readers with and without IQ/achievement discrepancies. Thus, the impetus for differential treatment of poor readers is questionable, particularly since there is little evidence that children of varying IQ levels benefit differently from remediation (Siegel, 1993; Stanovich, 1993). It seems, then, that the traditional IQ/ achievement model provides a very limited approach to the identification and understanding of reading disabilities.

The relation between IQ and reading does not preclude the notion that other cognitive processes, such as phonological processing and listening comprehension, are more relevant to reading achievement than IQ level. This study is an attempt to compare the predictive validity of traditional IQ to phonological processing and listening comprehension in predicting early reading skills. It is hypothesized that the latter two skills will be better predictors of Grade 1 reading than IQ.

Visual-Motor Processes

Studies of the relation between visual-motor integration and reading ability have yielded equivocal results. Some investigators have found that good perceptual-motor skills at a very young age are predictive of success with early reading skills (e.g., Solan & Mozlin, 1986; Solan, Mozlin, & Rumpf, 1985), thus implying that visual-motor difficulties predispose children for reading failure (Mantziepoulos & Morrison, 1990). For example, Solan and Mozlin (1986) found that perceptual-motor skills measured in Kindergarten predicted reading proficiency at the end of Grade 1. Other evidence, however, indicates that perceptual-motor abilities have minimal influence on reading beyond the first primary grades (e.g., Bruininks & Mayer, 1979; Silliphant, 1983). Thus, visual-motor skills may

be predictive of early reading skills until higher mental processes, such as language and cognitive abilities, become more important determinants of reading development (e.g., Klein, 1978; Silliphant, 1983; Solan & Mozlin, 1986). In particular, Silliphant (1983) found that although visual-motor integration was related to reading achievement at the end of Kindergarten, only reasoning ability was predictive of reading at the end of Grades 2 and 3. Nevertheless, there have also been studies supporting the predictive relation between Kindergarten visual-motor skills and later reading achievement (e.g., Fletcher & Satz, 1982). But, visual-motor coordination may only predict reading performance in somewhat older children to the extent that it reflects general cognitive ability (Goldstein & Britt, Jr., 1994). Furthermore, relative to language-based processes, perceptual-motor skills may be secondary from the start. Mann (1993) compared the predictive power of both phoneme awareness and visual-motor ability assessed in Kindergarten to Grade 1 reading and found that the latter showed a less substantial relation to reading than did the former. It has also been found that visual-motor ability and visual processing can distinguish between normal and disabled readers, where poor readers (1) committed more errors on visual-motor tasks (Malatesha, 1986); and (2) demonstrated visual processing deficits concurrently with language processing deficits (Slaghuis, Lovegrove, & Davidson, 1993). These results seem to suggest that perceptual-motor skills play a role in the early development of reading but beyond that, the relation seems less clear.

Results of the studies just discussed indicate that visual-motor processes are predictive of early reading achievement, but that this skill may be less important in comparison to other cognitive skills, such as phonological processing. It is, therefore,

hypothesized that listening comprehension and phonological processing will be more predictive of Grade 1 reading than visual-motor coordination.

Linguistic Status

Few research studies in the reading and reading disabilities fields have been conducted with linguistically-mixed, Canadian children. Rather, the subjects have tended to be monolingual, English-speaking children from the United States. The subjects of the present study are ethnic minority children from the province of Quebec. For many of these children, English is their second language. Moreover, as part of a bilingual society, these children are learning French in addition to English in school.

The consideration of the effects of linguistic background on second-language reading is important because of its implications. For the most part, the results of the studies reviewed thus far indicate clear relations between phonological processing, listening comprehension, general cognitive ability and visual-motor skills to reading acquisition in monolingual, English-speaking readers; the generalizability of these findings to multilingual children, however, is less apparent. This uncertainty is due to the possibility that language may be a variable that changes the relation between the predictors (mentioned above) and reading in English. Given that these children may speak one language at home and a second (and third) language at school, some may fail to develop sufficient mastery of either language; in this circumstance, learning may be more difficult. Thus, if language is a variable that influences English reading skills, there may be group differences in this study between the English-speaking children and the children who speak other languages in their performances on the measures of Kindergarten predictors and

Grade 1 reading. The effects of linguistic status on English reading skills may, however, depend on the child's ability to reflect on the components of the primary language. For example, in word recognition, children need to identify the phonological components of spoken words and understand how alphabetic symbols are mapped onto those phonological components. Once this skill is acquired, it may be readily applied to a second (or third) language, even though some additions must be learned (e.g., new phonemes, new matches between phonic segments and letter patterns). Hence, this ability may not be language-specific, suggesting that the linguistic backgrounds of the children in this study may not be all that relevant. In support of this argument, Durgunoğlu, Nagi and Hancin-Bhatt (1993) reported evidence of cross-language transfer in which the performances of Spanish-speaking children on English word and nonword recognition tasks was predicted by the levels of Spanish phonological awareness and Spanish word recognition. In short, this study is an attempt to extend previous research findings to a sample of multilingual children.

Statement of the Problem

The main purpose of the study is to compare the predictive power of measures of phonological processing and listening comprehension to that of IQ and visual-motor processes, assessed in Kindergarten, against reading levels measured one year later, shortly after the start of formal reading training. In accordance with the research reviewed, it is expected that visual-motor integration and IQ will correlate with reading success in Grade 1. It is believed, however, that listening comprehension and phonological skills will not only prove to be stronger predictors of reading achievement,

but will also have incremental validity even when IQ and visual-motor skills are partialled out. Thus, children with good listening comprehension and phonological processing skills are predicted to be successful readers in Grade 1. Regardless of IQ level and listening comprehension scores, children with poor phonological abilities are hypothesized to have some difficulties acquiring early reading skills. It is also hypothesized that individual differences in phonological skills will be consistent from Kindergarten to Grade 1. Finally, as mentioned above, this study is also an attempt to extend previous research findings concerning the prediction of early reading success to a more diverse sample of children.

Method

Subjects

Seventy-one Kindergarten children (36 boys, 35 girls; age M = 5.8 years, SD = .4, range = 5.2 to 6.4) participated in the study. Native languages of the children were mainly Italian (44%) or English (31%); others were less frequent and included a combination of Italian and English (3%), French (10%), Portuguese (4%), Ukrainian and English (3%), Greek (1%), Greek and Ukrainian (1%), or other languages (3%). At home, these children spoke both Italian and English (39%), English (32%), other individual languages (French, 7%; Portuguese, 1%) or combinations of languages (English and French, 6%; English, French and Italian, 6%; English with some other language, 9%). Two-thirds of the participants had some school experience prior to entering Kindergarten. Subjects attended one of two schools within the same English-language school board in Quebec. Parents of all Kindergarten children were sent the consent letter presented in Appendix A. A total of 95 letters were distributed; the parents of 11 children declined to participate in

the study, and responses were never received from the parents of 11 other children. One child was unable to understand test instructions and testing was discontinued; a second child who was extremely shy refused to participate. Thus, the overall participation rate was 75%. The children were enrolled in four different Kindergarten classrooms, three of which were in one school and the fourth was in the smaller, second school; three-quarters of the children attended the first school, the rest the second. Two Kindergarten teachers were involved in the project. One of the teachers taught the class at the smaller school plus a second class at the larger school (55% of the children). The English Kindergarten program in both schools consisted of half-day programs, but parents could register their child in a French Immersion program for the remaining half-day. A total of 29 children (41%) attended only the English half-day program and the other forty-two (59%) participated in the French Immersion program.

Of the 71 students, a total of 65 (92%; 31 boys, 34 girls; age $\underline{M}$ = 6.7 years, $\underline{SD}$ = .3; range = 6.2 to 7.3) were available for the Grade 1 testing. Sixty-four of the children were enrolled in the same schools as in Kindergarten; one child who had changed schools was retested. Results of t tests in which the performances of the six subjects who dropped out were compared to the remaining 65 across all Kindergarten measures were not significant, which suggests that these children did not differ from those who were retained in the study. The children attended four different classrooms, three in the larger school and the fourth in the smaller. Three Grade 1 English teachers were involved in the study; one taught two classes of children (59%) at the larger school, the second teacher taught 12 participants at the larger school (19%), and the third one taught 14 children

(22%) at the smaller school. A total of 39 children (60%) attended French Immersion classes, in which they spent half of each school day in French class and the other half in English; the remaining 26 (40%) were in an English school program. Parents reported that they read to their children either on a daily basis (46%), four to six times a week (23%), or not at all to three times a week (31%).

Measures

Tests administered during the Kindergarten year included one of phonological processing, another of listening comprehension, one of visual-motor integration skills, and a two-subtest, abbreviated measure of general cognitive ability. In Grade 1, three measures of reading ability and one of phonological processing were administered.

Phonological processing. The Test of Phonological Awareness-Kindergarten (TOPA-K; Torgesen & Bryant, 1994) is a 20-item, multiple-choice test that measures children's ability to identify words that begin with the same or different sounds. For example, the child is required to indicate which of three words has the same first sound as the target word. The examiner says the target word (e.g., *key*) followed by the three choices (e.g., *box*, *cake*, *foot*) and instructs the child to mark the one that begins with the same sound as the target word. All the stimuli are presented pictorially to minimize short-term memory demands. Raw scores are converted to deviation quotients ($M = 100$, $SD = 15$) based on age norms from the tests' standardization sample ($N = 857$). There is no time limit and the entire test takes about ten minutes to administer. The TOPA-K has internal consistency reliability coefficients of .90 for 5-year-olds and .91 for 6-year-old children (Torgesen & Bryant, 1994); for the sample of the present study, the internal

consistency coefficient was somewhat lower, .83. The 6-week test-retest reliability is .94 (Torgesen & Bryant, 1994). Summarized in the manual is evidence for the content, construct and criterion-related validity of the test. For example, TOPA-K scores correlate highly with those from different measures of phonological awareness given concurrently in Kindergarten and correlate .62 with an alphabetic reading measure given at the end of Grade 1 (Torgesen & Bryant, 1994). The Test of Phonological Awareness-Early Elementary (TOPA-E; Torgesen & Bryant, 1994) was administered to the subjects in Grade 1. The format of this version is the same as that of the TOPA-K, but the child is required to recognize words that have the same or different ending sound. Children's raw scores (out of twenty) are converted to deviation quotients (M = 100, SD = 15) based on the age norms of the standardization sample (N = 3,654). The TOPA-E has internal consistency reliability coefficients of .87 and .88 for 6- and 7-year olds, respectively and an 8-week test-retest reliability of .77 (Torgesen & Bryant, 1994). The internal consistency coefficient for the present sample was .81. Evidence for the validity of the TOPA-E is summarized in the manual (Torgesen & Bryant, 1994). For children of the present study who were administered both versions (N = 65), TOPA-K and TOPA-E scores were moderately correlated, r = .47 ($p < .05$).

Listening comprehension. The Test for Auditory Comprehension of Language-Revised (TACL-R; Carrow-Woolfolk, 1985) is designed to measure the listening comprehension skills of children 3 to 10 years old. The test consists of 120 items divided into three sections of 40 items each. The first section assesses the comprehension of word classes (e.g., nouns and verbs) and basic word relations (e.g., agent-action and

action-object); the second concerns the understanding of grammatical morphemes (e.g., prepositions, noun-verb agreement and verb number and tense); and the third measures the comprehension of more complex sentences (e.g., active and passive voice). Each item is comprised of a word or sentence read aloud by the examiner and three corresponding line drawings of objects or scenes, one of which correctly depicts the meaning of the item. The child is required to point to the picture that best represents the word or sentence spoken by the examiner. Raw scores for the overall test are converted to age-based deviation quotients ($\underline{M}$ = 100, $\underline{SD}$ = 15). The TACL-R is normed on 1,003 subjects, 153 of whom were in Kindergarten. The internal consistency reliability for Kindergarten children is .95 on the overall test score with reliabilities of .82, .92, and .94 on the respective test sections (Carrow-Woolfolk, 1985). Information about the content, criterion-related and construct validity of the TACL-R is presented in the test manual (Carrow-Woolfolk, 1985). For instance, the TACL-R scores are highly correlated with scores from other measures of language ability.

Visual-motor coordination. The Short Version of the Developmental Test of Visual-Motor Integration-Third Revision (VMI; Beery, 1989) is designed to assess the hand-eye coordination skills of children 3 to 8 years old. This version of the VMI consists of 15 geometric shapes presented in a booklet with three figures on each page. The child is required to copy each figure onto the page directly below the test stimulus with a pencil. Raw scores are converted to a standard score ($\underline{M}$ = 100, $\underline{SD}$ = 15); the test's normative sample includes 5,824 subjects with 828 and 769 children who were 5- or 6-years old, respectively. The internal consistency reliability coefficients are .87 for 5-year olds and

.81 for 6-year olds (Beery, 1989). Evidence for the VMI's concurrent and predictive ability against early reading and mathematics achievement is summarized in the manual (Beery, 1989); also, the VMI correlates moderately with scores from measures of general cognitive ability ($r = .56$).

General cognitive ability. Two subtests of the Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1983) were administered to estimate general cognitive ability. The K-ABC is one of several possible IQ tests with good psychometric characteristics that was appropriate for the age group of this sample and its concurrent validity with other measures is reasonably strong (Sattler, 1988). The more widely used Wechsler scales were not selected for this study because the ages of the children fell in between the Wechsler Preschool and Primary Scale of Intelligence-Revised (Wechsler, 1989) and the Wechsler Intelligence Scale for Children-Third Edition (Wechsler, 1991) and, hence, subtests from two scales would have been required.

One of the K-ABC subtests that was administered, Riddles, is a verbal reasoning task that requires children to guess the name of an object, animal or concept based on three descriptors (e.g., What has four legs, whiskers and meows?). The total raw score is converted to a standard score ($M = 100$, $SD = 15$). This subtest is normed for children ages 3 to 12 and its internal consistency reliability coefficients for 5- and 6-year olds are, respectively, .92 and .88; the test-retest reliability for an interval of 2- to 4-weeks is .70 (Kaufman & Kaufman, 1983). The second subtest, Triangles, is a task of visual-spatial reasoning. The child is required to assemble rubber triangles to match abstract designs shown in a booklet. The total score is converted to a standard score ($M = 10$, $SD = 3$).

Triangles has an internal consistency coefficient of .85 and a 2- to 4-week test-retest reliability of .87 for 5- and 6-year olds (Kaufman & Kaufman, 1983). Additional information on the validity of both subtests is provided in the manual (Kaufman & Kaufman, 1983). Based on the normative sample of 1,500 school-age children, Riddles and Triangles are correlated moderately (r = .49); the subtest scores were not related in the present sample (r = -.03), suggesting that the two subtests measured distinct abilities in these children. The low correlation may, in part, be attributed to a restricted range of scores (Riddles M = 92.4, SD = 13.1; Triangles M = 10.6, SD = 2.5). To calculate an estimate of each child's IQ in the present study, Riddles standard scores were converted to the same metric as Triangles and then summed. Next, a composite score with the metric M = 100 and SD = 15 was formed based on a procedure outlined by Sattler (1988, p.138) for combining standard scores from different subtests.

Reading. Three of six subtests from the Woodcock Reading Mastery Tests-Revised (WRMT-R; Woodcock, 1987) were administered to assess children's reading levels in Grade 1. The entire battery is normed for children aged 5 years to adults, and the subtests chosen were appropriate for the age group in this sample. The Letter Identification subtest (51 items) measures the child's ability to recognize letters presented in capital or lowercase print and cursive forms. The second test, Word Identification (106 items), requires the child to identify individual words that appear in large print. Word Attack (45 items), the third test, assesses the child's ability to apply phonic and decoding skills in order to pronounce unfamiliar words. Specifically, it requires the child to read either nonsense words (i.e., letter combinations that resemble words but are not actual

ones) or words with extremely low frequency occurrence in the English language. The raw scores of each subtest are converted to deviation quotients (M = 100, SD = 15). The normative sample for the WRMT-R consists of 6,089 subjects with 602 children who were in Grade 1. The internal consistency coefficients for Grade 1 students are .94, .98, and .94 for Letter Identification, Word Identification and Word Attack, respectively (Woodcock, 1987). Evidence for the content and concurrent validity of the WRMT-R is provided in the test manual; for instance, the whole test is highly correlated with other individually- and group-administered reading measures (Woodcock, 1987). At the Grade 1 level, the magnitudes of the subtest intercorrelations from the standardization sample range from .62 to .79, which suggests that they are measuring a common skill domain; for the present sample, the test correlations were somewhat lower, ranging from .44 to .76. The lower correlations may be due to the reduced variability in test scores of this more homogeneous sample as the standard deviations were around 10 instead of 15 (see Table 2).

Procedure

Similar procedures were followed for both Kindergarten and Grade 1 testing. Each child was tested individually outside of his or her classroom for approximately a half-hour. Two examiners were involved in the Kindergarten test administration (64% of children tested by one; 36% by the other); the first examiner administered all tests in Grade 1. In Kindergarten, the VMI drawing test was given first to help establish rapport. The Test of Phonological Awareness-Kindergarten, Test for Auditory Comprehension of Language-Revised, Triangles, and Riddles tests were then administered in a varied order. Following testing, parents were interviewed by telephone about their child's previous

school experience (i.e., attendance of Pre-Kindergarten), native language and the language(s) spoken at home. The Kindergarten children were tested during the English half of the school day over a period of 5 months, from January to May 1995. In Grade 1, the Test of Phonological Awareness-Early Elementary followed by the reading tests (i.e., Letter Identification, Word Identification, and Word Attack) were administered. Parents were again contacted by phone and were asked about the frequency with which they read to their child. The Grade 1 children were tested over a period of 6 weeks, from early January to mid-February, 1996. Once all the children had been retested, a letter was sent to each parent summarizing their child's performance on the reading tests; see Appendix B for an example.

Analysis

The data were analyzed in three stages. The first involved correlations and univariate analyses of variance to determine which of the school and language variables were significantly related to test scores. Any home/school variable that was significantly correlated with either a Kindergarten or a Grade 1 test score was retained for subsequent study. In the second stage, a canonical correlation and three hierarchical multiple regressions were conducted. The purpose of the canonical correlation was to evaluate the overall multivariate predictive validity of the Kindergarten variables against Grade 1 reading. Through three hierarchical multiple regressions, the incremental validity of the predictors for each of the individual reading tasks was examined. The order of entry of predictors was as follows: all background variables retained for further study were entered at step 1; the more conventional measures of visual-motor integration and general

cognitive ability were added at step 2; and the phonological and listening comprehension tasks were entered at step 3 to determine their incremental validity. In the third stage, through group comparisons, the performances of poor and average readers were compared across all Kindergarten measures and Grade 1 phonological task. These comparisons were conducted to assess whether young children who are at risk of having difficulty learning to read could be identified in Kindergarten.

Results

Home/School Variables

Reported in Table 1 are bivariate and multiple correlations between the home/school variables and the cognitive and reading measures. All relations involving the Grade 1 home and school variables and test scores were not significant. Although the magnitudes of the correlations between Kindergarten background variables and test scores were not large (about .30), several were statistically significant. Children in the classes of the Kindergarten teacher who taught at both schools performed somewhat better on the phonological task than the other children. Also, children who attended the full-day Kindergarten program scored significantly higher on the measures of phonological processing, visual-motor coordination, and listening comprehension. Kindergarten teacher covaried significantly with two of the reading measures. A one-way ANOVA of the Letter Identification subtest by children's language(s) most frequently spoken at home was significant (F (2, 62) = 3.40, $p < .05$); children who spoke English at home (M = 104.9, SD = 10.4) attained higher scores than children who spoke other languages (M = 96.1, SD = 15.5) but did not differ from the English/Italian group (M= 99.6, SD = 6.2).

Table 1

Correlations Between Home/School Variables and Test Scores.

	Test Scores							
	Kindergarten (N = 71)				Grade 1 (N = 65)			
Home/School Variables	VMI	IQ	TACL-R	TOPA-K	Letter Ident	Word Ident	Word Attack	TOPA-E
Kindergarten								
Gender	.08	-.01	.00	-.19	-.01	-.15	-.11	.03
Pre-K	.19	.03	.01	-.04	-.20	.02	.03	.00
Program-K	.28*	.02	.28*	.23*	.12	.04	-.03	-.01
Teacher-K	.18	.21	.12	.33**	.07	.26*	.29*	.13
Home L	.18[a]	.10[a]	.09[a]	.18[a]	.31[a]*	.22[a]	.10[a]	.14[a]
Native L	.08[a]	.24[a]	.14[a]	.19[a]	.25[a]	.18[a]	.12[a]	.27[a]
Grade 1								
Program-1					.08	.08	.10	-.14
Teacher-1					.09[a]	.11[a]	.16[a]	.16[a]
Read Fr					.13[a]	.27[a]	.23[a]	.17[a]

Note. VMI = Test of Visual-Motor Integration; IQ = estimated general cognitive ability; TACL-R = Test for Auditory Comprehension of Language-Revised; TOPA-K = Test of Phonological Awareness-Kindergarten; Letter Ident = Letter Identification; Word Ident = Word Identification; TOPA-E = Test of Phonological Awareness-Early Elementary; Pre-K = prior school experience; Program-K = half or full school day Kindergarten program; Teacher-K = Kindergarten teacher; Home L = home language; Native L = native language; Program-1 = Grade 1 French Immersion or English program; Read Fr = frequency with which parent(s) read to children.

[a]Multiple correlations.

* $p<.05$ ** $p<.01$

Because the background variables of Kindergarten teacher, program and home language were significantly correlated with one or more of the cognitive or reading measures, these variables were included as predictors in subsequent analyses.

Prediction of Reading

Test scores. Presented in the top half of Table 2 are the mean scores and standard deviations of the children's performance on the Kindergarten and Grade 1 measures; intercorrelations between all tests are reported in the bottom half. Overall, the children achieved average scores on the Kindergarten tests of visual-motor coordination, cognitive ability, and phonological processing but scored slightly below average on the listening comprehension task (M = 89.2, SD = 13.8). In Grade 1, the children performed at age-expectations on the reading measures; however, their average score on the phonological awareness task decreased from 97.4 (SD = 10.5) in Kindergarten to 88.9 (SD = 12.4) in Grade 1. The Kindergarten phonological test was the strongest individual predictor of reading, with correlations ranging from .40 with Letter Identification to .61 with Word Identification and Word Attack. General cognitive ability correlated significantly with Word Identification (r = .33) and Word Attack (r = .32). Similarly, listening comprehension was also significantly related to two of the Grade 1 reading measures. In contrast to the other Kindergarten measures, scores on the task of visual-motor coordination were not significantly related to Grade 1 reading.

Canonical correlation. A canonical variate analysis was conducted to evaluate the multivariate relation between the Kindergarten predictor variables (i.e., phonological

Table 2

Means and Intercorrelations of Kindergarten Predictor and Grade 1 Reading Measures.

Measures[a]	M	SD
Kindergarten (N = 71)		
VMI	105.2	8.7
IQ	97.4	10.4
TACL-R	89.2	13.8
TOPA-K	97.4	10.5
Grade 1 (N = 65)		
Letter Identification	100.5	11.1
Word Identification	102.6	10.4
Word Attack	99.5	10.6
TOPA-E	88.9	12.4

	Intercorrelations						
	IQ	TACL-R	TOPA-K	Letter Ident	Word Ident	Word Attack	TOPA-E
VMI	.12	.23*	.04	.00	.16	.09	.01
IQ		.52**	.40**	.16	.33**	.32**	.41**
TACL-R			.39**	.16	.29*	.28*	.26*
TOPA-K				.40**	.61**	.60**	.47**
Letter Ident.					.58**	.44**	.31*
Word Ident.						.76**	.45**
Word Attack							.46**

Note. VMI = Test of Visual-Motor Integration; IQ = estimated general cognitive ability; TACL-R = Test for Auditory Comprehension of Language-Revised; TOPA-K = Test of Phonological Awareness-Kindergarten; Letter Ident = Letter Identification; Word Ident = Word Identification; TOPA-E = Test of Phonological Awareness-Early Elementary.

[a] M = 100, SD = 15 for all measures.

* p<.05 ** p<.01

awareness, listening comprehension, cognitive ability, visual-motor coordination, Kindergarten teacher, program, and home language) and the Grade 1 reading measures. The overall relation was significant (Wilks's $\Lambda = .44$, $F\ (24, 157.22) = 2.11$, $p < .01$) and the index of redundancy equaled .32, which means that 32% of the variance of the criterion variables was explained by the predictors (Cohen & Cohen, 1983). Results of a dimension reduction analysis indicated that only the first pair (of three) of canonical variates was significant. Structure correlations between each variable and their respective canonical variates are presented in Table 3. For the predictor composite, phonological processing contributed the most weight to the canonical variate ($r = .94$) followed by general cognitive ability ($r = .51$), listening comprehension ($r = .44$), and Kindergarten teacher ($r = .43$). The criterion composite was represented primarily by the Word Identification ($r = .95$) and Word Attack ($r = .92$) subtests. Altogether, the structure correlations suggest that although several variables contributed to the prediction of Grade 1 reading, phonological processing was clearly the strongest contributor to the predictor composite.

Hierarchical multiple regressions. Results of three hierarchical regressions, which evaluate the incremental validity of the Kindergarten predictors, are summarized in Table 4. In the first regression, the home/school variables (step 1) accounted for 11% of the variance of Letter Identification, of which only home language (English versus other languages) was significant. The addition of children's visual-motor coordination and cognitive ability scores (step 2) did not result in a significant increase in the overall R^2. Once phonological processing and listening comprehension were entered at step 3, a

Table 3

Structure Correlations of Kindergarten Predictor and Grade 1 Reading Measures.

Predictor	r	Criterion	r
VMI	.20	Letter Identification	.54
IQ	.51	Word Identification	.95
TACL-R	.44	Word Attack	.92
TOPA-K	.94		
Teacher-K	.43		
Program-K	.01		
Home L1	.25		
Home L2	-.16		

Note. N = 65; VMI = Test of Visual-Motor Integration; IQ = estimated general cognitive ability; TACL-R = Test for Auditory Comprehension of Language-Revised; TOPA-K = Test of Phonological Awareness-Kindergarten; Teacher-K = Kindergarten teacher; Program-K = half or full school day Kindergarten program; Home L1= home language, English versus other; Home L2 = home language, English/Italian versus other.

Table 4

Hierarchical Multiple Regressions with Kindergarten Predictors and Grade 1 Reading Measures.

Predictors	R^2	Increase in R^2	Beta weights	
			Entry	Last Step
		Letter Identification		
Step 1	.11	.11		
Home L1			.37*	.31*
Home L2			.16	.14
Teacher-K			.05	-.01
Program-K			.11	.02
Step 2	.13	.02		
VMI			.00	.04
IQ			.14	.01
Step 3	.22	.09*		
TACL-R			.02	.02
TOPA-K			.37*	.37*
		Word Identification		
Step 1	.11	.11		
Home L1			.19	.11
Home L2			.00	-.03
Teacher-K			.24*	.01
Program-K			.04	-.15
Step 2	.19*	.08*		
VMI			.13	.19
IQ			.26*	.03
Step 3	.43**	.24**		
TACL-R			.03	.03
TOPA-K			.59**	.59**
		Word Attack		
Step 1	.09	09		
Home L1			.05	- 06
Home L2			-.04	-.09
Teacher-K			.28*	.07
Program-K			-.03	-.20
Step 2	.16	.07		
VMI			.13	.09
IQ			.26*	.01
Step 3	.41**	.25**		
TACL-R			.07	.07
TOPA-K			.59**	.59**

Note. N = 65; Home L1= home language, English versus Ot er; Home L2 = home language, Italian and English versus Other; Teacher-K = Kindergarten teacher; Program-K = half or full school day Kindergarten program; VMI = Test of Visual-Motor Integration; IQ = estimated general cognitive ability; TACL-R = Test for Auditory Comprehension of Language-Revised; TOPA-K = Test of Phonological Awareness -Kindergarten.
* p<.05 ** p<.01

total of 22% of the variance of Letter Identification was explained, which was just short of significance ($p < .07$). Tests of the standardized regression coefficients (β) indicated that the phonological task ($\beta = .37$, $t(58) = 2.53$, $p < .05$) and home language (English versus other; $\beta = .31$, $t(58) = 2.02$, $p < .05$) were the only significant individual predictors of Grade 1 letter recognition.

In the second regression, the home/school variables (i.e., home language, teacher, and half or full day Kindergarten program) accounted for a nonsignificant 11% of the variance of Word Identification. At step 2, visual-motor coordination and general cognitive ability together explained an additional and significant 8% of the variance; of the two, cognitive ability was the best individual predictor ($\beta = .26$, $t(58) = 2.12$, $p < .05$). Once listening comprehension and phonological processing were added to the equation at the third step, a total of 43% of the variance of Word Identification was explained, which was a significant increase in the R^2 from the previous step. At the final step, phonological processing was the only significant individual predictor of this reading measure ($\beta = .59$, $t(58) = 4.73$, $p < .01$). A similar pattern was evident in the final regression. The home/school variables accounted for a nonsignificant 9% of the variance of Word Attack; with visual-motor coordination and general cognitive ability entered in the analysis, a nonsignificant total of 16% of the variance was explained. Cognitive ability was again the most predictive of these variables. An increase in R^2 of 25% resulted when the phonological and listening comprehension tasks were entered in the regression. Altogether, the Kindergarten predictors accounted for 41% of the variance of the Word Attack subtest. As in the previous regression, phonological

processing was the best individual predictor ($\beta = .59$, $t(58) = 4.35$, $p < .01$).

Group Comparisons

Although the canonical and regression analyses concerned the predictive power of the Kindergarten skills in early reading development for the entire sample, these results did not yield information about the performance of discrete groups of children, such as poor and average readers. This type of distinction may be useful in identifying young children who are at risk for developing reading difficulties even prior to the beginning of formal reading instruction. Similar to other studies in the reading research literature, poor readers were classified as having a standard score of 90 or below (i.e., 25th percentile) on either the Word Identification or Word Attack subtests (Siegel, 1988). This definition is not comparable to the one used for children who qualify for remedial services. The limited sample size for group comparisons and homogeneity of reading test scores, however, precluded the use of a stricter definition. Given that this criterion for poor reading is not absolute, the results of the following analyses should be viewed with caution.

A total of 12 children (18%) met the definition for being a poor reader; 53 (82%) were reading at least average for their ages. Reported in Table 5 are group mean scores and the results of t test comparisons with Cohen's d statistic for each one. Cohen's d, an effect size index, equals the difference in group means divided by the pooled standard deviation. Cohen (1988) suggested that d values around .20 indicate a "small" effect, about .50 a "medium" one, and d values greater than .80 a "large" difference. As expected, poor readers scored significantly lower on the Kindergarten phonological test

Table 5

Group Comparisons of Poor and Average Readers across Kindergarten Measures and Grade 1 Phonological Processing.

Variable	Group	M (SD)	t(63)	Cohen's d
VMI	average[a]	105.4 (9.2)	0.91	0.29
	poor	102.8 (6.7)		
IQ	average	98.3 (10.9)	1.41	0.45
	poor	93.7 (4.3)		
TACL-R	average	91.2 (13.4)	2.09*	0.67
	poor	82.4 (12.2)		
TOPA-K	average	99.2 (10.0)	3.85**	1.23
	poor	87.3 (7.9)		
TOPA-E	average	90.7 (12.6)	2.57*	0.82
	poor	80.9 (8.3)		

Note. VMI = Test of Visual-Motor Integration; IQ = estimated general cognitive ability; TACL-R = Test for Auditory Comprehension of Language-Revised; TOPA-K = Test of Phonological Awareness-Kindergarten; TOPA-E = Test of Phonological Awareness-Early Elementary.

[a] n = 53 average readers; n = 12 poor readers

* p<.05 **p<.01

than average readers ($t(63) = 3.85, p < .01$), and the magnitude of this difference was large ($d = 1.23$). A comparable pattern was found for the Grade 1 phonological processing task with poor readers performing significantly poorer on this task than the other children ($t(63) = 2.57, p < .05$). Here too, the magnitude of the group difference was large ($d = .82$). On the listening comprehension task, poor readers attained significantly lower scores than did the readers functioning at age expectations. The magnitude of this last group difference ($d = .67$) was medium in size. Kindergarten cognitive ability and visual-motor coordination did not significantly differentiate poor from average readers. Taken together, the results of the group comparisons suggest that poor readers can be differentiated from average (and above average) readers based on their scores on the tests of phonological processing and listening comprehension.

Discussion

Some limitations of the present study are considered before the implications of its results. The size of the sample was relatively small, which posed some practical and conceptual limitations. In the group comparisons, the definition of poor reader was restricted, in part, by the sample size. In addition, the small number of poor readers precluded further differentiation within this group of children. For example, it was not possible to compare poor readers of different levels of intellectual functioning across Kindergarten measures as has been conducted in some previous studies (e.g., Glez & López, 1994; Siegel, 1989b). As mentioned before, however, there is little evidence that this distinction is substantively meaningful among poor readers, at least a[illegible]ng those within the normal range of general cognitive ability. Also, the children were drawn from

only two schools; thus, the sample may not be representative of immigrant, ethnic minority children. In order for these children to attend English schools, their parents had to have been educated in English. Nevertheless, this study involved a relatively unique sample of multilingual children and, as such, the influence of native language and home language(s) on the early acquisition of reading skills could be evaluated.

A second limitation of this study was that the Kindergarten children were tested over a period of five months. Although age at testing was taken into account because the tests are normed by age, any effects of the particular time during the school year in which testing occurred could not be controlled. For instance, the Kindergarten children's performance on the phonological task may have been different if they were all tested later in the school year, possibly after having received additional lessons on phonics. The same problem could also be true for the Grade 1 evaluations, although these were conducted in a shorter time span. A third limitation was that only a few select cognitive skills could be measured in this study, although clearly additional abilities such as the retention of verbal information in working memory are involved in reading. This restriction was especially true for the assessment of phonological processing, which is a multi-dimensional domain that can be measured with different types of tasks (e.g., Wagner & Torgesen, 1987; Wagner et al., 1993). A single measure was used in this study, a test of phoneme isolation (i.e., finding words with the same initial or ending sounds) that was suitable for pre-literate children. Also, as the focus of the study was on the development of very rudimentary reading skills, tests of word recognition were used; the children were too young for measures of reading

comprehension because tests for this age group have very limited floors, which (1) confines the overall range and (2) precludes discrimination at lower reading levels. Finally, additional and potentially relevant background variables may have inadvertently been omitted from the study, such as family history of reading or learning problems and speech delay (e.g., Badian, 1988; Scarborough, 1989).

With the aforementioned caveats in mind, the results of this study were generally consistent across all analyses. The Kindergarten predictors altogether accounted for 22% to 43% of the variance of the Grade 1 reading tasks. Although most of the predictors were significant when considered individually, phonological processing measured in Kindergarten was the best individual predictor of Grade 1 reading. This strong predictive relation between phonological skills and later reading success is consistent with results from previous studies (e.g., Bryant et al., 1990; Hurford et al., 1994). More specifically, the findings of this study suggest that children who can identify and isolate individual sounds of spoken words in Kindergarten are more likely to be reading at age expectations in Grade 1 regardless of their linguistic status. Furthermore, phonological processing was the only measure (with the exception of home language on letter recognition) that had incremental validity beyond all the others, including home/school variables, general cognitive ability, visual-spatial skills, and listening comprehension. This result is also in accordance with previous findings that phonological processing is a stronger predictor of early reading than more traditional measures of global cognitive ability and visual-motor coordination (e.g., Mann, 1993; Stanovich et al., 1984). In addition, the finding in the group comparisons

that poor readers scored significantly lower on the Kindergarten phonological task than did the average readers is similar to results from other studies (e.g., Mann & Liberman, 1984; Hurford et al., 1994).

Given the importance of phonological processing in early reading development, of interest in the present study is the unexpected finding that children's phonological scores decreased from Kindergarten to Grade 1. This result may be partially attributed to the test itself. The distribution of scores on the TOPA-Early Elementary is very negatively skewed; thus, the test is optimal for distinguishing among below average performances while poorer at differentiating average to above average skills. As such, a difference of a few raw score points produces a large difference in the standard score. Also, the Grade 1 task required the identification of ending sounds which may have been more difficult than finding first sounds of words as was measured in the Kindergarten task. Another possibility is that had testing occurred later in the school year, children's performance would have improved (i.e., age and not time of testing in the school year was controlled). Finally, it is equally possible that phonological lessons were less emphasized in Grade 1.

Other variables were predictive of reading although to a lesser extent than phonological processing. The school/home background variables of Kindergarten teacher, half- versus full-day program, and home language were related to Grade 1 reading. The teacher effect of children's performance on the Kindergarten phonological task and reading measures may be attributed to a selection factor, in which more skilled children may have happened to be placed in the same classes. Differing teaching

methods may also have influenced the performance on the phonological measure. The children attending the full-day Kindergarten program most likely scored higher on the Kindergarten measures because of the greater number of hours of schooling. Nonetheless, when Kindergarten teacher and program were entered as predictors along with others in the regression analyses, they had essentially no incremental validity, suggesting that their predictive power was minimal relative to the other Kindergarten measures. As for home language, English-speaking children performed significantly better on the Letter Identification task than children speaking 'other' languages; this result probably occurred because the former group had greater exposure to the English alphabet. For the most part, however, children's linguistic status did not significantly influence their Grade 1 reading test scores, at least not at this age. This finding suggests that the results of previous studies with monolingual English-speaking children may be generalized to multilingual children. Likewise, the results of the present study involving multilingual children may be extended to monolingual children. Given that only rudimentary reading skills were assessed in this study, lingual status could potentially make a greater difference with reading comprehension.

As anticipated, listening comprehension was significantly related to Grade 1 reading performance. In contrast to previous findings, however, this skill was not a better predictor of reading achievement than general cognitive ability (e.g., Stanovich et al., 1984). Specifically, listening comprehension did not explain additional reading variance after the traditional measures of cognitive ability and visual-motor coordination were added to the analyses. It should be noted, though, that other researchers who

examined the predictive validity of listening comprehension to reading have typically used measures of reading comprehension rather than word pronunciation (e.g., Aaron, 1991; Stanovich et al., 1984). Perhaps, then, listening comprehension is a more valuable predictor of reading comprehension, which would not be evident until later reading in higher elementary school. In support of this hypothesis, results from previous studies have indicated increasing correlations between reading performance and listening comprehension with age (e.g., Aaron, 1991; Stanovich et al., 1984). Moreover, in a longitudinal study conducted by Juel, Griffith, and Gough (1986), listening comprehension did not add unique variance to the prediction of reading comprehension in Grade 1 but did so in Grade 2. A follow-up of the reading comprehension skills of the children from the present study in Grade 2 and higher would be required to test these hypotheses.

The listening comprehension measure did differentiate the poor from average readers in the group comparisons; poor readers scored significantly lower on this task. Thus, the children who had reading difficulties in the present study were also weak in their listening comprehension skills. As has been mentioned in the literature, this result is consistent with a distinction of listening comprehension abilities among poor readers (e.g., Aaron, 1991; Royer, Sinatra, & Shumer, 1990; Stanovich, 1991). Those individuals with poorly developed listening and reading skills may have more global language deficits such that their ability to understand speech is affected. In contrast, poor readers with normal listening comprehension skills may have a more specific modular deficit in the phonological domain (e.g., Stanovich, 1991, 1993). In the present

study, it would seem that the poor readers may have been more similar to the former group with broader language deficits rather than to the one with isolated phonological difficulties.

Of the more traditional measures of general cognitive ability and visual-motor coordination, the former was significantly predictive of Grade 1 reading. In addition, general cognitive ability assessed in Kindergarten had incremental validity over the school/home variables for one reading measure (i.e., Word Identification). With phonological processing added to the analyses, however, cognitive ability no longer explained unique reading variance. These results support the suggestion that in order to assess reading problems, the focus should be changed from general cognitive ability to more educationally relevant components of the reading process, such as phonological processing (e.g., Siegel, 1993) and listening comprehension (e.g., Aaron, 1991; Stanovich, 1989). As for the other conventional measure of visual-motor integration, this skill was only minimally related to Grade 1 reading. This result is not consistent with previous research findings that early perceptual-motor skills are significantly predictive of early reading success (e.g., Solan & Mozlin, 1986; Solan, Mozlin, & Rumpf, 1985). As was found in the present study, language-related abilities are more predictive of the acquisition of elementary reading skills. In addition, contrary to the reports by other researchers of significant distinctions between normal and disabled readers in visual-motor ability (e.g., Malatesha, 1986), the poor and average readers in this sample did not differ in their performance on the visual-motor integration task. These results support the notion that deficits in visual processes and hand-eye

coordination may not be the primary cause of reading difficulties.

Three implications of the results of the present study are considered. The first concerns the finding that phonological processing is a strong predictor of Grade 1 reading success regardless of linguistic status. Young children who have difficulty acquiring phonological skills are at risk for developing reading problems; moreover, these children can be identified in Kindergarten, even prior to the beginning of formal reading instruction. Children with weak phonological skills may require additional attention and with early intervention, such as phonological-based training, it may be possible to prevent future reading problems. As mentioned earlier, there is evidence supporting the beneficial effects of such intervention (e.g., Bradley & Bryant, 1983; Felton, 1993; Hurford et al., 1994a). A related and second implication of the study concerns the search for an alternative assessment model to the "standard" IQ/achievement discrepancy definition of reading disabilities. The results of the present study indicate that the traditional measures of general cognitive ability and visual-motor coordination are weak predictors of Grade 1 reading, particularly in comparison to phonological processing. An assessment model that focuses on specific skills, such as phonological processing, rather than (or at least in addition to) general cognitive ability may be more relevant for the identification of reading disabilities (e.g., Kline, Snyder, & Castellanos, 1996). As was evident in this study, tests of phonological awareness can be used as screening measures for reading problems. Nevertheless, IQ tests could continue to be incorporated into assessment batteries of poorly achieving children for the purposes of ruling-out gross cognitive impairments or developmental disorders, such as

mental retardation (Kline et al., 1996). In such cases, the phonological skills of the child may be irrelevant.

A third implication of the findings of the present study relates to reading instruction. There has been considerable debate in both the literature and in the schools regarding the best method of teaching children how to read. Currently, two different approaches are followed in elementary schools, the "phonics" versus the "whole language" approach. The focus of the phonics approach is on learning words by reciting the sounds of each vowel and consonant through rote memorization; the whole language approach teaches reading through open-ended exercises that emphasize creative writing, inventive spelling and sight vocabulary. Thus, the main difference between approaches is that the phonics method is molecular, while the whole language approach is more integrative and holistic by teaching words in the context of stories. A recent alternative method, transactional strategies instruction, has also been proposed for teaching reading skills (Brown, Pressley, Van Meter, & Schuder, 1996; Pressley, El-Dinary, Gaskins, Schuder, Bergman, Almasi, & Brown, 1992). In this latter approach, children are taught effective strategies to enhance their reading comprehension, including multiple methods for dealing with difficult, unfamiliar words (Brown et al., 1996). Although it is beyond the scope of this study to evaluate the merits of each method, the results suggest that eliminating lessons on phonics from the educational program may be undesirable. In fact, as the results of this study and previous research indicate, phonics should be incorporated into reading instruction because it is an important skill to acquire for early reading success. Some children may learn to read

without difficulty regardless of which of the three routes is followed by their teachers; however, if phonological processing is not a focus of instruction, the weaknesses of poor readers may not be addressed. Therefore, the teaching of the basics (i.e., phonics) should be included in reading instruction, especially for disabled readers. Once children have attained the phonological skills required to decode new words, other techniques, such as the transactional strategies instruction, may help children improve their reading comprehension skills.

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Appendix A

Parental Consent Form

Consent Form

To the parents of: _____(child's name)_____

Dear Parents:

This letter is being sent to the parents of all children who are enrolled in the half-day Kindergarten program at (school name). We -- Dr. Rex Kline, an associate professor at Concordia University, and Stephanie Margolese, a psychology graduate student at Concordia University who works with Dr. Kline -- are writing to ask your permission for your child to participate in a research project about children's early skills that help them learn to read.

Kindergarten children who participate in this research will be given different types of measures of their abilities to do things like put puzzles together, draw, and name pictures of objects. Many of these tasks are similar to classroom activities. All testing takes place at (school name) and would require about 30 minutes of time altogether. Children will be seen either by Dr. Kline or Ms. Margolese. At the end of the session, each child will be given a small token of our appreciation in the form of something like a sticker or eraser. We would then like to see each child again next year in Grade 1 so that we can monitor their progress over the year. The testing time in Grade 1 would be about the same length of time or a bit longer, about 30-45 minutes.

Participation in this project is entirely voluntary. If you grant permission for your child to be included in this research, or if you wish that your child not participate in

this project, please sign this letter, check the appropriate box, and have your child bring the bottom part back to school. You would certainly be welcome to ask us questions about this research project before you make up your mind. Please call either Dr. Kline or Ms. Margolese at 848-7556, and we would be very happy to tell you more about this research. Also, keep in mind that you can later request that your child not participate in this study even if you grant permission now.

Thank you for your attention to this letter and for your response. Again, please contact us if you have any questions.

Cordially,

Rex B. Kline
Associate Professor

Stephanie Margolese, B.A.
Psychology Graduate Student

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I received this letter (please sign): _____ about my child _____ and I (please check):

_____ grant permission for my child to participate in this research project.

_____ decline to have my child participate in this research project.

Appendix B

Sample Feedback Letter

Feedback Letter

To the parent(s) of: (child's name)

This letter is to inform parents of the progress of the research project being conducted with the children attending Grade 1 at Dante and Tara Hall schools. At this time, the meetings with the children have been completed and individual feedback to parents has been provided over the telephone. The results of the entire study, however, will only be available at the end of the school year at which time parents will receive a summary of the results.

Beginning mid-January 1995, we -- Dr. Rex Kline, an associate professor at Concordia University, and Stephanie Margolese, a psychology graduate student at Concordia University -- met individually with the Kindergarten children. During that first meeting, we studied children's early skills that may help them learn to read in Grade 1. In particular, we looked at children's general language skills and hand-eye coordination.

From early January 1996, Ms. Margolese has met individually with the same children, now in Grade 1, for approximately half an hour per child. The focus of this second meeting was to assess each child's current reading skills. Specifically, Ms. Margolese examined your child's ability (1) to identify and name letters of the alphabet that were presented either in print or handwriting; (2) to read words ranging from single syllable words to more difficult two and three syllable words; and (3) to read non-words

(e.g., "tat") where phonic skills are required to sound out the correct pronunciation. In addition, Ms. Margolese looked at the your child's knowledge of phonics through a measure in which he/she had to find words that end with the same or different sound.

Ms. Margolese met with your child, (child's name), on (date), 1996. As was indicated by the test results, (child's name) appears to be progressing normally in his/her early reading development in comparison to other children of the same age. Relative to his/her age peers, your child was able to name letters, read single words and pronounce non-words without difficulty. In addition, (child's name) was very cooperative and friendly, and it was genuinely a pleasure to work with your child.

Thank you for allowing (child's name) to participate in this project. If you have any questions concerning the project, please contact either Dr. Kline at 848-7556 or Ms. Margolese at 848-4077 and we would be very happy to speak with you.

Cordially,

Rex B. Kline, Ph.D.
Associate Professor

Stephanie Margolese, B.A.
Psychology Graduate Student