









## ABSTRACT

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Learning to Read. Reciprocal Processes and Individual Pathways.

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Finnish summary

Diss.

The purpose of the present thesis was to investigate the critical factors in learning to read. The research questions were: (1) what are the antecedents for the development of skilled reading performance; (2) what are the prospective relationships between phonemic awareness and reading performance during the first grade; (3) what are the prospective relationships between reading performance and writing performance during the first grade; and (4) what kinds of developmental trajectories can be identified in children's reading performance during the first and the second grade. Four studies based on the same dataset were the outcome. The sample size was 114. First, initial reading-related skills were assessed. Word reading and reading comprehension were assessed four times during the first grade and twice during the second grade. Spelling and productive writing were also assessed four times and phonemic skills were assessed three times during the first grade. The results revealed that: (1) the development of reading performance was predicted by different antecedents depending on the phase of reading acquisition a child had reached; (2) letter knowledge, listening comprehension and visual-motor ability predicted word reading whereas initial reading skill and listening comprehension predicted reading comprehension; (3) a reciprocal relationship between phonemic awareness and reading performance existed during the first grade; (4) reciprocity between reading and spelling existed in the beginning phases of reading instruction whereas by the end of the first grade reading performance predicted spelling in a unidirectional manner; (5) productivity of writing predicted the development of reading performance during the first grade; (6) Competent, Technical and Poor Reader groups were identified; (7) Poor readers frequently moved to more skilled groups during the course of the first and second grades; (8) learning paths were individually constructed; and (9) progressive and regressive reading curves, in relative terms, existed among the seven typical learning paths. The findings suggest that the relationships between various literacy skills have to be taken into account when planning balanced reading instruction for school beginners.

Key words: reading acquisition, word reading, reading comprehension, spelling, writing, literacy

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- IV Lerkkanen, M.-K., Rasku-Puttonen, H., Aunola, K., & Nurmi, J.-E. (under revision). Reading Performance and its Developmental Trajectories during the First and the Second Grade.

# 1 INTRODUCTION

Recent preschool reform in Finland has led to a system where nearly all 6-year-old children are in preschool education one year before school entrance. The reform has influenced preschool curricula and practices all over the country. Firstly, there has been a focus on practical changes to pedagogical techniques, assessment and teaching material. Secondly, interest has focused on learning processes, especially the learning of reading, writing and mathematics. This interest has concerned not only the preschool year but also the following primary school year, which will through implication be influenced by preschool reform as well.

Teaching children to read is surely one of the most important aspects of education upon school entry. In Finnish schools reading skill is generally understood to be the accurate, rule-based ability to recognise words using alphabetic strategies. Therefore, fluent and accurate word recognition has been a primary concern within programs of first grade reading instruction, as well as for reading research focusing on the first school years. The purpose of the present thesis was to investigate critical factors in the initial stages of learning to read, in order to understand the consequences these factors might have for preschool and primary school literacy instruction. The focus of the present thesis is on reading and the trajectories of its acquisition.

Learning to read is a major event within a child's overall language development. Consequently, reading is probably one of the most studied areas of skill development. Research has been carried out from diverse perspectives, for example psychological, neuropsychological, linguistic, and educational. Current theories of reading skill development have focused mainly on word reading (Ehri & Wilce, 1983, 1985; Frith, 1985; Seymour & Evans, 1994, 1999; Seymour & MacGregor, 1984). Studies of initial reading have largely been carried out to examine the antecedents of reading acquisition (Adams, 1990; Badian, 1998; Bradley & Bryant, 1983; Stanovich, 1981; Stanovich et al., 1996; Tunmer & Hoover, 1992; Vellutino & Scanlon, 1991) and reading disability, or dyslexia (Badian, 1986, 1988; Catts et al., 1999; Ehri, 1989; Seymour & Evans, 1999; Seymour & MacGregor, 1984). The other main focus has been on the central role of phonological awareness in reading (Bradley & Bryant, 1991; Ehri

et al., 2001; Lundberg & Høien, 2001; Lundberg et al., 1988; Stahl & Murray, 1994; Stanovich et al., 1991; Wagner et al., 1994; Wagner et al., 1993).

Studies carried out in the context of the Finnish language have equally followed these trends. Finnish reading research has recently focused heavily on the possible factors predicting reading development and reading disabilities (e.g. Aunola, Nurmi et al., 2002; Holopainen, 2002; Korkman & Peltomaa, 1993; Lehtonen, 1993; Lepola et al., 2000; Lyytinen et al., 1995; Niemi et al., 1998; Poskiparta, 2002) as well as the role of phonological awareness in reading (e.g. Aro et al., 1999; Holopainen et al., 2000; Mäkinen, 2002; Poskiparta et al., 1999). As yet results have been slightly inconclusive; although there are some clear findings about risk factors, it still seems to be very difficult to predict future reading delay or disability.

Thus, despite the wealth of research evidence accruing, there is still more that needs to be understood. Previous research in the field also has certain limitations. Firstly, word reading and reading comprehension skills have been examined almost independently, although both are needed for competent reading ability. Most of the reading research on early readers has focused on the acquisition of word reading skill and its predictors. There is a relative lack of studies where word reading skill has been studied in parallel with reading comprehension, among the same children and following the development of both skills from the beginning phases of formal reading instruction.

Secondly, most of the previous studies from normal classrooms have measured reading on a yearly basis and even longitudinal studies in the field have seldom followed beginners' reading acquisition using more intensive measurement schedules during the first school year. However, such an approach is important, particularly in regular orthographies like Finnish where changes in word reading skill can happen very rapidly: a initial non-reader can become a well-skilled reader by the end of the first school year, or in an even shorter time. Therefore, assessments only at the end of the first and second grades are too far apart to adequately follow the learning process of reading. Moreover, reading performance across time may have individually constructed developmental trajectories and the optimal instructional grouping of children may thus change from one time point to another. Intensively administered assessments during the first grade, therefore, might be necessary in order to understand the dynamics of reading acquisition at the beginning of formal instruction in a Finnish language context.

Thirdly, a number of studies have focused on the predictive value of early phonological awareness for word reading development in the beginning phases of reading (Bradley & Bryant, 1983, 1991; Hatcher & Hulme, 1999; Lundberg et al., 1980; Stanovich et al., 1991; Vellutino & Scanlon, 1991; Wagner et al., 1997). There are also training studies where phonological intervention has been shown to facilitate reading (Korkman & Peltomaa, 1993; Lundberg et al., 1988; Schneider et al., 1997) and some studies which have shown that heavy exposure to phonics in reading instruction at school supports reading (Ehri et al., 2001; Juel & Minden-Cupp, 2000). In Finnish, the virtually perfect correspondence

between graphemes and phonemes has promoted heavy use of phonics in the reading instruction of the first grade. However, there is little research on the reciprocal relationship between phonemic skills and reading during the Finnish first grade. Moreover, recent research about the predictive value of phonemic skills for beginning reading has shown contradictory findings with regard to its importance in the Finnish language context (Aro et al., 1999; Poskiparta et al., 1999; Silvén, 2002). For example, in the training study of Aro et al. (1999) large inter-individual variation and a rather unclear link between phonological abilities and reading were found, whereas Poskiparta et al. (1999) found that a lack of phonological awareness alone was not sufficient cause for poor reading.

There is a further relatively small number of studies about the reciprocal relationship between reading and writing development, despite the awareness that these skills have a close relationship with each other during the beginning phases of literacy development (e.g. Boland, 1993; Ehri, 1987; Juel, 1988; Mäki, 2002). The recent study of writing skill development in Finnish carried out by Mäki (2002) showed that reading has an important role in writing skill development between grades 1 and 3.

Finally, most reading research reported in international journals has been carried out among English speakers. Less is published concerning reading within orthographically regular language contexts (e.g. Finnish, Spanish, Italian or Greek). The syllabic complexity and orthographic depth of the English language place many additional demands on children's word reading skills. By contrast, the majority of European children within more transparent language systems become accurate readers during their first school year (Seymour et al., 2003). Recent research has shown that a quarter of Finnish children can read fluently when they enter school, with the remainder attaining equivalent word reading skill very quickly during the first months of the first school year (Holopainen et al., 2001). Consequently, the aim of the present thesis is to focus on changes in reading performance, both word reading and reading comprehension, and the meaningful factors which relate to its progress in the early school years, within the highly regular Finnish language context.

## **1.1 Theories about literacy learning**

Basic word reading skill can be defined from two different approaches. In some theories reading is the visual recognition of words and in the others it is a process primarily relying on alphabetic knowledge and letter-sound correspondences (e.g. Ehri & Wilce, 1985). Recently, it has been shown that skilled readers use both these approaches flexibly and simultaneously in their reading: the quicker orthographic process for familiar words and use of phonemes to decode unknown words (Duncan & Seymour, 2000; Wagner & Barker, 1994).

The very beginning phases of learning to read and spell have also been explained using both visual and phonological explanations (Høien & Lundberg, 1989). The visual process is based on direct mapping of the visual image and the orthography of words. The beginning reader associates visual features located in or around the printed word and these visual cues are used in word recognition (Frith, 1980). In contrast, the phonological process of word recognition is based on phonological awareness of spoken words and the use of letter-sound correspondences in word recognition. Children have to learn the shapes and names of letters and resolve the code of correspondences between letters and phonemes in order to read and spell. Consequently, besides letter knowledge children need specific awareness of the phonemic structure of words in order to identify unfamiliar words using letter-sound correspondences (Ehri et al., 2001; Ehri & McCormick, 1998). This process is called sequential decoding.

Researchers have also introduced process-oriented theories of literacy development where both of these approaches are taken into account. The main focus in theoretical accounts has been on word recognition because of its central role in beginning reading. Process-oriented theories share the idea of a continuum: each phase of development builds upon earlier experiences and provides the foundation for later ones (e.g. Ehri, 1987, 1989; Ehri & McCormick, 1998; Ehri & Wilce, 1983, 1985; Frith, 1985; Seymour & Evans, 1994, 1999; Seymour & MacGregor, 1984). All readers will pass through these phases from prereading to skilled reading. A point of divergence, however, is in the importance attached to the involvement of letter-sound knowledge when children begin to read and spell.

Probably the most frequently used model is Frith's (1985) stage model, an example of a theory where reading and spelling are thought to begin from visual processing. The emphasis of this model is on the development of the strategy a child will use to recognise words. Development goes through partially overlapping stages, from logographic through alphabetic to the final orthographic stage. Word recognition in the *logographic stage* is based on visual features of the word, when the child can read words only in their typical contexts, on signs or labels, and not in isolation. In this way the child learns to read a limited 'sight vocabulary'. The second stage is the *alphabetic stage* when the child learns grapheme-phoneme correspondences and about segmentation of spoken language at the level of phonemes. Gradually word recognition becomes based on letter-sound knowledge and phonemic analysis of words. The highest stage is then the *orthographic stage* when the child uses both these skills adaptively and flexibly when reading new words, alongside further advanced strategies such as analogy. Frith (1980) has pointed out that spelling skills develop through similar stages as reading, although it is possible that a learner may be at different levels of strategy usage for reading and spelling at any one time.

Ehri's (1987, 1989) alternative view is that the acquisition of alphabetic knowledge and facility with letter-sound relationships are of pivotal

importance to beginning reading and spelling. When children see and hear spellings paired with pronunciations of specific words, they must pay attention to how at least some of the letters symbolize phonetic units detected in the pronunciation. Knowing letter names and shapes helps children to begin to process graphic cues in printed words and phonetic associations between word spellings and pronunciations.

In the model of Ehri (Ehri & McCormick, 1998), each of the five phases characterize the learners' understanding and use of the alphabetic system in word reading. During the first phase, the *pre-alphabetic phase*, children begin to participate in a literate environment, acquire oral language skills and identify printed signs from their environment, gradually learning the shapes and names of letters. However, this visual code learning does not equate to reading ability because alphabetic knowledge is not yet used. A reader focuses on letters while the prereader ignores the letters and instead 'reads' the environment, remembering or guessing words from context. Transition into the *partial-alphabetic phase* is thus signalled when children start attending to some letter-sound relationships, usually the initial or the final letters and sounds, to aid word recognition. In the *full-alphabetic phase* the child is able to fully use connections between the letters and sounds they encounter in words. For the first time they can also decode unfamiliar words and read stories. In the beginning of this phase, decoding is slow but fluency increases as a result of practice. In the *consolidated-alphabetic phase* children start to operate with multi-letter units in words like affixes, onsets, or syllables, and store the orthography and spelling patterns of words in memory. Their sight vocabulary grows and words are recognized automatically as a whole, without letter-sound processing being necessary. In the *automatic phase*, words are read proficiently with high automaticity and speed.

Ehri (1989) reported that reading and spelling develop together in a close relationship. Ehri's (1987, 1989) theory on learning to spell thus corresponds to her postulated reading phases. In the *pre-communicative stage*, the child generates spellings that resemble print using randomly selected letters or numbers. In the *semi-phonetic stage*, children learn the names or sounds of letters, select letters for words on the basis of letter names, and further, use this knowledge in spelling. However, most of the spellings are still incorrect and memory for correct spellings is unstable. In the *phonetic stage*, the child's spellings contain letters for all of the sounds in words and knowledge of grapheme-phoneme correspondence is demonstrated. When children's experience of words increases they reach the *transitional stage*. At this point, they become aware of the visual features of words and they begin to combine their understanding of how a word sounds with their knowledge of how the word looks. Their fluency in reading and spelling will thus increase.

Seymour and his co-workers have developed a process-orientated *dual foundation literacy* model for beginning reading and spelling (Duncan & Seymour, 2000; Seymour & Evans, 1994, 1999; Seymour et al., 2003). In this model letter-sound knowledge mediates the transition into the Phase 1

*foundation literacy process*, as in the model of Ehri and Wilce (1983, 1985). The foundation phase consists of two parallel processes: a logographic process, which consists of visual word-level recognition and storage of familiar words, and an alphabetic process, where word recognition occurs through decoding words on the basis of letter-sound correspondences. The subsequent phases are then developed according to the foundation processes. Phase 2, an *orthographic literacy process*, requires competence with the full complexity of the spelling system in an abstract generalisable format. Finally, in Phase 3, a *morphological literacy process*, understanding of meanings and semantic dimensions within the text is required.

Turning to reading comprehension, there are several diverse theories concerning the processes involved. In general, reading comprehension is seen as an interactive process between a reader and the text where the reader actively acquires information from the text using various cognitive skills and comprehension strategies (Pressley & Wharton-McDonald, 1997). The integration of information from the text depends on the ability to appreciate the main ideas presented, to understand the logical structure of the text, and the ability to make inferences (Oakhill & Garnham, 1988).

One example of a developmental theory is Adams' (1990) model of children's text comprehension development, which involves three phases. In the *first phase* the child concentrates on the meaning of individual words and uses context to determine the meanings. In the *second phase* the child will interrupt their reading flow to try to make sense of combinations of a few words, typically in one sentence. In the *third phase*, text comprehension requires active monitoring from the reader: the child integrates the content of new sentences with what has been read earlier and might return to earlier sections of text as part of this process. Kinnunen, Vauras, and Niemi (1998) have shown that comprehension monitoring is already present in Finnish first graders' reading, although decoding and listening comprehension skills affect its efficiency.

In addition, there are several classifications of the reading and thinking strategies or the levels of information processing used in text comprehension. One of the best known, focusing on thinking skills, is Barrett's (1968) *taxonomy of the cognitive and affective dimensions of reading comprehension* that has been provided as a guide for teaching reading comprehension at school. Barrett's main categories or levels of reading comprehension are hierarchically presented as (1) literal comprehension, (2) reorganization, (3) inferential comprehension, (4) evaluation, and (5) appreciation. The first three categories have been recommended for young readers. For example, initial literal comprehension tasks may focus on explicit information or single facts that can be recognised or recalled from the text, whereas inferential comprehension tasks may demand thinking that goes beyond the text. In the context of the Finnish language, the categories of reading comprehension used have been very similar, although the approach has differed (e.g. Vähäpassi, 1987).

Despite the number of models looking at distinct components of reading ability, reading is a holistic process - a successful reader must be able to read words in order to understand individual sentences, but also be able to combine their meanings in order to provide an interpretation of the text as a whole. Both of these components, word reading and reading comprehension, are given full consideration in *the simple view of reading* model (Gough & Tunmer, 1986). According to the simple view of reading, reading ability is seen as a product of two critical components: decoding and listening comprehension skills (Gough & Tunmer, 1986; Gough et al., 1996; Juel, 1994; Juel et al., 1986). Underpinning these two abilities are letter knowledge and phonological awareness, crucial skills for decoding ability (which leads to word recognition), whilst listening comprehension skills lead to subsequent reading comprehension ability (de Jong & van der Leij, 2002; Juel, 1988). If word reading, comprehension or both of these skills are poorly developed, it is obvious that the child will have problems in reading. Consequently, four differentially skilled reader groups can be identified according to word reading and comprehension abilities: readers who are good at both skills; readers who have difficulties in single word reading; readers who have difficulties in comprehending larger texts; and readers who have difficulties in both skills (Gough et al., 1996; Juel, 1988; Juel et al., 1986; Stothard & Hulme, 1996).

According to a number of writing models, the writing process of expert writers includes planning, translating, and reviewing, all of which are guided by self-regulation strategies or metacognitive knowledge (Berninger, Abbot et al., 2002; Berninger, Vaughan et al., 2002; Hayes & Flower, 1980; Mäki, 2002). Berninger and her co-workers' *simple view of writing* model focuses particularly on the translation process involved in beginning writing, i.e. how the planned ideas are mapped to the written form (Berninger, Abbot et al., 2002; Berninger, Vaughan et al., 2002). The model includes lower level transcriptional skills (i.e. handwriting and spelling) and a higher-level text generation component (i.e. generation of ideas in text production). Both skills are needed to transcribe oral language into orthographic symbols through handwriting and spelling: spelling skill to produce the words on paper in the appropriate form and ideas to drive the content of the text itself. In the initial phases of writing, acquisition of spelling skill is the key to progress. For example, Juel (1994) showed that spelling explained 29% of the variance in compositional writing in the first grade. This proportion subsequently decreased later on, whereas the contribution of ideas in the writing composition increased. The term 'productivity' in compositional writing encompasses fluency of language use within the written medium (Carlisle & Beeman, 2000).

It is well known that rapid progress occurs in reading and writing skill development during the first school years (Ellis & Large, 1988; de Jong & van der Leij, 2002; Juel, 1994; Näslund & Schneider, 1996; Vellutino & Scanlon, 1991). Previous studies have shown that individual differences between children's reading performances are generally quite stable during the primary grades (Juel, 1988; Smith, 1997). However, more recently Phillips et al. (2002)



have suggested that progress in literacy skills is perhaps more relative i.e. reading group membership might show continuing flux from the first through to the sixth grade. Their study showed that there was a high probability that children who were below average at the first grade would shift to an average level later on. There was also a significant probability that children at an average level would move to above average standards whilst for children of initially above average ability there was equal probability that they would either move down to an average level or remain above average in their relative reading achievement (i.e. decoding and comprehension).

A further recent development within literacy development theories has been a move away from the heavy focus on word reading and a move towards emphasising functional reading skill. Theories of functional reading skills thus explore and seek to encompass the combination of different reading skills, knowledge and strategies needed to participate in an information society, which relies on a huge amount of printed information (Elley, 1994; Linnakylä, 2000; Välijärvi & Linnakylä, 2002). The focus of functional reading skill is on text comprehension, interpretation and meaning-making from what is read. Moreover, reading and writing skills are seen as important tools for thinking and life-long learning. Consequently, the aim of functional reading is the understanding of a range of texts and the active use of reading skills to search, use and understand printed information independently and in diverse contexts.

In the present thesis the simple view of reading and the simple view of writing have been used as a framework for the study. Although the development of literacy is not simple, the simple view clearly encompasses the different components that are needed when learning to read and write at the beginning phases of school. In the present thesis word reading ability refers to the accurate ability to recognise words using alphabetic decoding strategies. Moreover, reading comprehension has been divided into two components: lower level literal text comprehension which involves recognition of single facts from the text, and higher level inferential text comprehension, where the full meaning of the text has to be understood even when this involves going beyond what is explicitly stated in the text. Inference making is also a good index of text comprehension skills in general. Previous studies have shown that poor comprehenders have difficulties answering questions that require inference making from the text (Oakhill & Yuill, 1996; Stothard & Hulme, 1996; Yuill & Oakhill, 1991).

Writing performance is also divided in the present thesis into accurate spelling skill and productivity of writing words in compositional writing tasks. Finally, the simple view has the same aims for literacy skills as does the primary school curriculum in the first and the second grade: a fluent reader who will understand what has been read, and a productive writer who can spell accurately and express thoughts in a written form.

## 1.2 Antecedents for reading ability

Reading ability is affected by a number of factors exerting an influence long before school entrance. Previous studies have well documented the language basis of reading development (Catts et al., 1999; de Jong & van der Leij, 2002; Stanovich, 1986; Wagner et al., 1997). The common finding is that reading skills are strongly linked to language development and verbal abilities. Mediating factors in this regard originate both from within the child's environment (e.g. parent-child interaction and printed environment) and also from within the child (e.g. cognitive skills and motivation).

The role of environmental factors can be explored by analysing various aspects of early parent-child interaction and the child's experiences of print in their environment. Babies begin to communicate with sounds that imitate the tones and rhythms of adult talk. They like to listen to familiar rhymes and play-along games. In this way they learn to use language to communicate. Later on, through repeated and diverse experiences with reading, children will learn the connection between spoken and written language, speech and reading. A number of studies have found that a child's pre-linguistic skills, early joint attention, interest in books and shared reading have predicted their later language development (Laakso, 1999; Scarborough et al., 1991; Silvén et al., 2002; Stanovich et al., 1996).

Children learn through interaction with others and a literate environment, that specific symbols can represent meanings. In the beginning, children will use context, pictures or visual cues to understand or recognize written messages. Little by little children's understanding of alphabetic principles and the spelling system then grows and they begin to engage with letters and sounds and connect these with meaning. The amount of written language experience differs between children depending on parents' interest, the child's own interest and the printed environment within which the child lives. Scarborough et al. (1991) showed that early literacy-related experiences such as parents' reading habits, parent-child reading or children's interest in books were associated with later success in reading at the second grade. Further, Stanovich et al. (1996) have shown that children's print exposure enhances their vocabulary, metalinguistic knowledge and general word knowledge, with knock-on effects for later reading comprehension ability.

The present study began when children entered school. The role of the environment and the language or reading development of the children before school entry has not been investigated here. However, it is important to recognize the impact of early language experiences on the later development of various literacy skills and bear this in mind in any interpretation of development pathways.

## Predictors for Word Reading

A large body of research has shown that a wide range of specific cognitive abilities predict word reading skill (Catts et al., 1999; de Jong & van der Leij, 2002; Stanovich, 1981; Vellutino & Scanlon, 1991; Wagner et al., 1997). Examples include letter knowledge (Adams, 1990; Ehri, 1987; Ellis & Large, 1988), phonological awareness (Bradley & Bryant, 1983; Wagner et al., 1993; Wagner et al., 1994), oral language abilities or vocabulary (Catts et al., 1999; de Jong & van der Leij, 2002; Vellutino & Scanlon, 1991), as well as visual perception (Badian 1998; Stanovich, 1992).

A number of studies have demonstrated that preschoolers' letter knowledge predicts initial progress in learning to read words (Adams, 1990; Ehri, 1987; Ellis & Large, 1988; Holopainen et al., 2001; Stahl & Murray, 1994). Letter knowledge reflects positive written language experiences and experience of print exposure within the child's early environment. A child's interest in the letter names and shapes in printed words around them helps the child to begin to process letters within words (Ehri, 1987, 1989). In regular languages, like German and Finnish, letter knowledge has been a particularly strong predictor of word reading skill. For example, Näslund and Schneider (1996) found that although both letter knowledge and phonological awareness predicted word reading, high letter knowledge in kindergarten was the strongest predictor of literacy skills at school age for a group of German children. Also in the Finnish language context, Holopainen et al. (2001) showed that letter knowledge and visual analogical reasoning were significant preschool predictors, predicting the differences between precocious decoders and late decoders at the end of the second grade.

In addition, there is also a lot of evidence for an association between phonological awareness and word reading skill (Bradley & Bryant, 1983; Lundberg & Høien, 2001; Stanovich et al., 1991; Torgesen & Wagner, 1994; Wagner et al., 1993; Wagner et al., 1994). Phonological awareness is sensitivity to the phonological structure of spoken language and the ability to understand the connection between oral and written language. According to many theories, for young children phonological awareness starts at the level of larger spoken units such as syllables, and sensitivity to rhymes and alliteration in words (Ehri et al., 2001). Later on phonological awareness develops into the ability to focus on and manipulate smaller units such as phonemes (Adams, 1990; Bradley & Bryant, 1991; Seymour & Evans, 1999; Torgesen & Wagner, 1994).

Phonemic awareness is distinct from phonological awareness. Phonemic awareness consists of the ability to explicitly and accurately analyse, synthesize, manipulate and separate phoneme size sound units within words (Ehri et al., 2001). Letter knowledge helps the child to operate with the phonemes of the oral language. However, children need to learn letter-sound correspondences in order to read and spell (Ehri, 1987, 1989).

There are three different hypotheses concerning the relationship between phonemic awareness and word reading skills: phonemic skills predict learning to read; reading skill enables phonemic awareness; or the relationship is

reciprocal. The difficulty determining causality between these skills is also made harder by the sheer range of investigative approaches adopted. If the question is which skill will develop first and enable the other, samples using pre-literate children should logically be the focus. Therefore, studies involving adults (e.g. Morais, 1991) are not comparable. However, if the question is rather how one skill, and progress in it, will support progress in the other, limiting samples to preliterate children is of less importance. Although this kind of procedure will not provide information about which skill enables the other, i.e. which one comes 'first', it does provide information about the supportive role of one skill for the other and the extent to which the influence of one skill is perhaps more dominant.

In most studies reported to date, phonemic awareness before school has been shown to precede and so enable the beginning phases of reading (Bradley & Bryant, 1983, 1991; Lundberg et al., 1980; Stanovich et al., 1991; Wagner et al., 1997; Vellutino & Scanlon, 1991). For example, in a longitudinal study by Lundberg, Olofsson, and Wall (1980), it was demonstrated that phonemic awareness in kindergarten predicted children's later success in reading and spelling in the first school year. Also phonological intervention studies have shown that phonological training supports subsequent reading ability (Lundberg et al., 1988; Peltomaa & Korkman, 1995; Poskiparta et al., 1999) although large inter-individual differences have also been found (Aro et al., 1999; Torgesen & Wagner, 1994).

The opposite scenario, that learning to read and spell will in fact induce explicit phonemic awareness for words, also has some empirical support (Ehri, 1989; Stahl & Murray, 1994). The studies reported centre around the idea that letter knowledge will lead towards greater sensitivity to the phonemic structure of words and that specific awareness of letter-sound correspondences through reading practice will then enable word reading development. Also Silvén (2002) showed that Finnish children who could already read at preschool age had a strong history of oral language development, and the early readers' growth in phonemic awareness at age of six, was more as a consequence of reading skill than a precursor. Moreover, Morais (1991) has argued that illiterate adults have poor phonemic awareness because there has been no need to learn individual letters or letter-sound correspondences before reading skill has been acquired. As soon as illiterate adults learnt to read, phonemic awareness also emerged.

Finally, studies about the reciprocal relationship between phonemic skills and reading ability have shown that awareness of phonemes facilitates word reading, which in turn improves phonemic awareness (Ellis & Large, 1988; Lundberg, 1998; Stanovich, 1986; Wagner et al., 1994). Previous studies have also shown that phonemic awareness might have an indirect influence on reading comprehension ability through its effects on word reading skill (Samuelsson et al., 1996; Tunmer & Hoover, 1992; Vellutino & Scanlon, 1991).

Oral language abilities, vocabulary, concept knowledge and comprehension, are at least as important predictors for later word reading performance as phonological awareness (Catts et al., 1999; Ellis & Large, 1988;

de Jong & van der Leij, 2002; Silvén, 2002; Stanovich, 1986; Vellutino & Scanlon, 1991; Wagner et al., 1997). According to Catts et al. (1999) most of the poor readers in the second grade had a history of language deficits from kindergarten, either in phonological awareness, oral language skills or both. The predictive strength of oral language abilities was even greater when reading comprehension tasks were considered within the reading achievement measure. Moreover, Ellis and Large (1988) as well as Vellutino and Scanlon (1991) demonstrated that besides phonological awareness, language knowledge and vocabulary also predicted reading even after the very initial phases of word reading. Wagner et al. (1997) showed that individual differences in vocabulary at kindergarten were related to subsequent word reading ability but the relationship decreased as children developed as skilled readers.

In earlier studies of reading and, more specifically, reading difficulties, visual perception impairments have been cited as one of the central reasons for reading and writing disability. Only more recently have studies shown that visual perception has a specific influence on the very initial phases of normal word reading development when reading direction and letter shapes are learnt (Stanovich, 1992). In Badian's (1994, 1995, 1998) longitudinal studies visual matching was highly associated with word reading in the first school year. She argued that the importance of visual skills was greater in the beginning phases of word reading than later on. Moreover, Vellutino and Scanlon's (1991) study with poor readers and Ellis and Large's (1988) study also demonstrated that visually-based skills carried some weight in normal word reading development, though not to the same degree as phonological awareness.

### **Predictors for Reading Comprehension**

Existing studies have indicated that partially different antecedents underlie word reading and reading comprehension abilities. Although some factors have an indirect influence on reading comprehension via word reading, there are clearly other cognitive and language abilities that influence reading comprehension more specifically. According to the simple view of reading two major determinants make an independent contribution to reading comprehension: word reading and listening comprehension (Tunmer & Hoover, 1992). Word reading skill is necessary for basic reading but more general language skills like listening comprehension are clearly implicated in the understanding of text (Yuill & Oakhill, 1991).

Reading fluency is a product of automaticity in word reading at the word and text level. A number of studies have shown that fluency and speed in reading predict subsequent reading comprehension (Adams, 1990; Gough & Tunmer, 1986; Gunn et al., 2000; Juel, 1994; Juel et al., 1986; Perfetti, 1985; Stanovich, 1986). The longitudinal study of Juel, Griffith, and Gough (1986), for example, showed that reading comprehension was heavily influenced by word reading skill at both the first and the second school year. In addition, the study of de Jong and van der Leij (2002) found that word reading speed had an influence on the development of reading comprehension after the first school

year. Thus, it is widely agreed that when word reading becomes more fluent, more attention can then be devoted to text comprehension (e.g. Perfetti, 1985).

Among general language skills vocabulary and listening comprehension have been important determinants for reading comprehension in many studies (de Jong & van der Leij, 2002; Juel et al., 1986; Oakhill & Yuill, 1996; Stothard & Hulme, 1996; Vellutino & Scanlon, 1991). The child's early language experiences enable the development of vocabulary. Therefore, children's vocabulary profits most from a rich language environment (Stanovich et al., 1996). At school age a study by Torgesen et al. (1997) strongly supported causality between vocabulary and the development of reading comprehension from the second to fifth grade. In addition, the study of de Jong and van der Leij (2002) found that both vocabulary and listening comprehension affected the development of reading comprehension ability from the first through to the third grade. Juel (1994) as well as Vellutino and Scanlon (1991) have also reported a relationship between listening and reading comprehension. However, Stanovich (1986) has highlighted the reciprocal aspect between vocabulary and reading comprehension development at school age: a child's vocabulary influences reading comprehension whereas reading itself precipitates an increase in vocabulary.

It is clear that learning to read is a combination of many sub-skills. It is also a complex process that is influenced by environmental factors, the development of language skills and other cognitive skills, both before formal reading instruction begins and during the process of reading instruction itself. Figure 1 illustrates the factors and pathways that are considered in the development of reading acquisition in the present thesis.

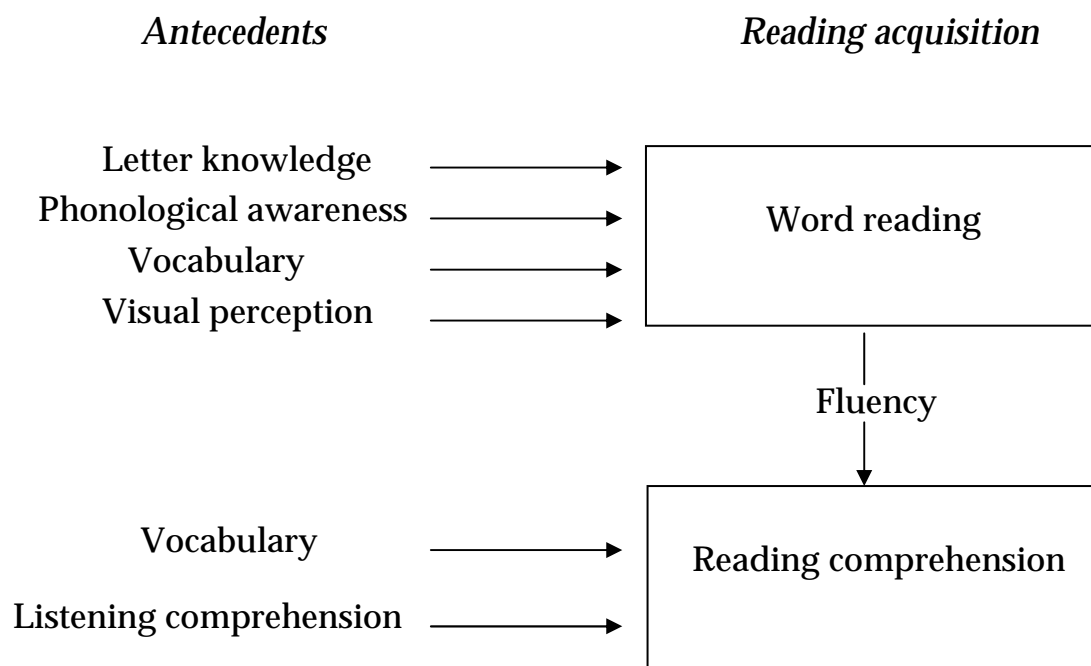


FIGURE 1 The crucial antecedents and pathways of reading acquisition in the present thesis.

## The Role of Spelling and Productive Writing

Previous research has shown the connections between reading and writing skill development (e.g. Adams, 1990; Boland, 1993; Ehri, 1980, 1989; Francis, 1994; Juel, 1988; Juel et al., 1986; Shanahan, 1984). As a whole it seems to suggest that reading and writing skills may share some of the same component skills or depend upon similar cognitive processes. For example, Juel (1988) showed that letter-sound knowledge was a basic component of both word recognition and spelling skill. It is still uncertain, however, in which direction influences occur: does reading support spelling and productive writing or is the reverse true.

There are three resultant hypotheses concerning the relationship between reading and writing. In the first, reading predicts the development of writing, in the second, writing predicts the development of reading and in the third, their developmental interaction is reciprocal. The first hypothesis, that reading predicts writing, has received support from longitudinal studies which have shown that success in reading is associated with writing success (Juel, 1988; Stahl et al., 1996) and that earlier reading skills have predicted later spelling or productive writing skills (Boland, 1993; Francis, 1994; Mäki et al., 2001).

The second hypothesis, that writing predicts reading ability, is based on the idea that a child's early experiences with written words may facilitate writing long before reading competence has been acquired. Ehri (1980, 1989) showed that alphabetic and phonological awareness of language supports the development of spelling, which consequently promotes decoding. Intervention studies have also shown that early spelling and writing activities will promote later reading skills (Ehri, 1989; Hagtvet, 1993; McMahan et al., 1998; Shatil et al., 2000; Straw & Schreiner, 1982).

The third hypothesis, that the developmental interaction between reading and writing is fundamentally reciprocal has been tested in only a few studies. Shanahan and Lomax (1986) tested three different models of reading (including decoding, vocabulary and reading comprehension) and writing (including spelling, vocabulary diversity, syntax and story structure) relationships. These were an interactive model between reading and writing, a reading-to-writing model and a writing-to-reading model. The results strongly supported the interactive model between reading and writing in the second grade and again in the fifth grade. This demonstrated that reading knowledge could be used in writing and writing knowledge could be used in reading. Recent intervention studies with at-risk children have also suggested that children's literacy skills benefited most from interactive programs that combined reading and writing practices (Santa & Høien, 1999; Shanahan & Barr, 1995).

### 1.3 Literacy learning in the Finnish language context

#### The Role of Finnish Language Orthography in Literacy Learning

The early phases of learning to read are considerably influenced by the orthography of the language the child is exposed to (Frith et al., 1998; Seymour et al., 2003; Wimmer & Goswami, 1994). Seymour, Aro, and Erskine (2003) have recently shown that syllabic complexity and the orthographic depth of a language will have strong effects on word reading skill during the phase of foundation literacy processes: word reading is much easier to learn in shallow orthographies. Among thirteen European orthographies Finnish has the most shallow orthography and simplest syllabic structure, whereas the most complex orthography is found in English. This likely explains the high probability that Finnish children will achieve accurate and relatively fluent word reading skill before the end of the first school year.

In the highly regular Finnish language word reading and spelling skills are based upon the high correspondence between letters and sounds. One letter always indicates only one phoneme and vice versa although there are some difficulties in the phonetic presentation of some letters (Kyöstiö, 1980). Grapheme-phoneme correspondences are perfect with just one exception, the combination of 'ng'. Because of such consistent letter-sound rules there is no need for a specific spelling vocabulary. Consequently, once children have learnt the letters and grasped the idea of systematic letter-sound rules they can easily read and spell all Finnish words (Lyytinen et al., 1995). This was also demonstrated in the Holopainen et al. (2000) study where readers at the end of the preschool year read words and non-words equally well ( $r = .93, p < .01$ ).

Finnish words generally consist of multiple, simple consonant-vowel (CV) syllables, the main stress is always on the first syllable of the word, and the number of monosyllabic words is limited to about 50 (Kyöstiö, 1980). This reflects the morphological complexity and the agglutinating nature of the Finnish language, with words containing a lot of semantic information. The highly agglutinative nature of the Finnish language also lends itself to the phonetic reading of words, rather than high dependence upon visual code. It is interesting to note, however, that according to the international IEA Study of Reading Literacy, orthography does not explain the differences in reading comprehension skills between languages (Elley, 1992).

#### Antecedents for Reading Acquisition in the Finnish Language

Recent Finnish studies have focused on the early prediction of children at-risk for later reading disability (Holopainen, 2002; Lyytinen et al., 2001; Lyytinen et al., 2003; Niemi et al., 1998). Moreover, phonological interventions have been devised with the aim of pre-empting such problems in learning to read (Aro et al., 1999; Korkman & Peltomaa, 1993; Mäkinen, 2002; Poskiparta et al., 1999).



There are a number of longitudinal research projects that have investigated these issues specifically. A particularly relevant example is the Jyväskylä Longitudinal study of Dyslexia (Lyytinen et al., 1994; Lyytinen et al., 1995; Lyytinen et al., 2001; Lyytinen et al., 2003) which has followed 200 children from birth until the age of ten, half of them with familial risk for dyslexia, in order to identify early predictors for dyslexia. One strong predictor, which may slow down the later automatization process of word recognition, has been early weaknesses in language development, especially imprecise perception of speech and temporal speech cues (Lyytinen et al., 2003).

Researchers at the Centre for Learning Research at the University of Turku have also carried out a number of longitudinal studies spanning from preschool until the end of comprehensive school, which have examined predictors of reading disability and different intervention strategies for children at-risk of reading failure (e.g. Kinnunen et al., 1998; Lepola et al., 2000; Lepola et al., 2002; Niemi et al., 1998; Poskiparta et al., 1999; Salonen et al., 1998). They have found that letter knowledge, phonological awareness, working memory, metacognitive skills and listening comprehension are important factors in Finnish children's reading acquisition. However, they have also recognised that problems in reading are not easy to predict reliably at preschool age. For example, Lepola and his colleagues (2002) showed that there were no significant differences at preschool age on phonological awareness or intelligence that distinguished poor, average or good readers at the second grade. Early word reading ability at preschool age also did not predict later levels of reading comprehension. Lepola et al. (2000) have further shown that children with good language skills at preschool age can go on to have a regressive reading career at school whilst conversely, preschool children with limited phonological skills can learn to read successfully during the first grade.

The Turku group also strongly emphasise the importance of motivational and emotional factors for learning paths (Lepola et al., 2000; Niemi et al., 1998; Salonen et al., 1998). Salonen et al., (1998) as well as Lepola et al. (2000) have shown that motivational orientation affects the pace of reading progress: task-focused behaviour predicts a progressive reading career whereas task-avoidance predicts a regressive reading pathway. Moreover, Lepola et al. (2000) have demonstrated that children with progressive reading careers show a higher level of reading comprehension over time than children with regressive reading careers.

Holopainen, Ahonen, and Lyytinen (2001) encountered the same difficulties as the Turku group in using preschool performance to predict later reading delay. They followed 91 children from preschool until the end of the second grade to examine cognitive and language skills associated with later reading problems. They found that preschoolers' phonological awareness and letter knowledge predicted the very beginning phases of ordinary readers' word reading development, whereas naming speed predicted reading fluency at the end of the second grade. The delay in word reading ability was predicted by pseudoword repetition and poor visual analogical reasoning. Interestingly,

deficits in phonological awareness alone were not enough to cause poor reading in this study. Children learnt to read words within a short time even with limited initial phonemic awareness.

Aro et al. (1999) as well as Poskiparta et al. (1999) have also found similar results in phonological training studies they carried out with 7 year olds: although children benefited from phonological training, some children learnt to read even with limited phonological skills. Korkman and Peltomaa (1993), however, showed that boys at risk of reading failure definitely benefited from phonological intervention and direct training of reading at the preschool level. Also, Mäkinen (2002) showed that two unselected groups of preschoolers benefited from phonological intervention, though the greatest gains were observed for the children at-risk of reading disability.

### **Learning to Read in Finnish**

In every language many children acquire reading skills on their own without being formally taught. In Finland the proportion of preschoolers to which this applies differs depending on the criteria used to define reading skill: 25% (Holopainen, 2002); 21% (Julkunen, 1984); 38% (Kananaja, 1999); 17% (Lepola et al., 2000) or 30% (Silvén, 2002). Studies of Finnish children's reading development during the first and second grade have shown fast and progressive development especially in word reading ability. Holopainen (2002) reported that after a few months of formal instruction 30% of non-readers had learnt to read and by the end of the first grade 77% of children could read accurately, even when presented with pseudo-words. Previous studies of first graders' reading skills have shown that on average children can read whole sentences by their first Christmas at school but the differences between children remain high (Julkunen, 1984, 1986; Kananaja, 1999). However, all children reach at least sentence level reading by the end of the first grade and they can answer questions from the text when the questions require specific, concrete answers (Julkunen, 1984, 1986; Merisuo-Storm, 2002).

Aunola, Leskinen et al., (2002) found that with 205 first graders, the 'Matthew effect' where good readers become continually better and poor readers relatively worse (Stanovich, 1986), did not actually occur in the Finnish language context during the first grade. More obvious was that initially poor readers in fact caught up with the others in terms of their reading performance (i.e. word reading and comprehension) during the first grade.

Thus, the consistent finding in all Finnish studies is that because basic word decoding is so easy to acquire, the differences between children's reading skills are mainly seen in the speed of word recognition and text comprehension (Julkunen, 1984, 1986; Lehtonen, 1993; Lepola et al., 2000; Lyytinen et al., 1995). Finnish children's initial limitations in reading comprehension skill are restricted to inference-making and higher level skills which will develop later, such as adapting their reading to other contexts, making evaluations and drawing conclusions (Julkunen, 1986, 1994; Karjalainen, 2000; Lepola et al., 2002; Linnakylä, 1993, 2000).

It is well known that Finnish children have achieved excellent results in the cross-national reading survey by the IEA in 1991 examining 9- and 14-year-olds (Elley, 1992; Linnakylä, 1993) as well as in the OECD PISA survey in 2000 of 15-year-olds (Väljjarvi & Linnakylä, 2002). In both surveys Finnish children in general were among the best readers in the world and the variation between children's reading skills were small. These results have clearly heightened interest in our literacy curriculum and methods of reading instruction.

### **Reading Instruction during the First Grade**

In Finland formal instruction in reading typically starts at school, but most children have a year in preschool before this. In Finnish preschools children's language skills and literacy involvement are promoted by various play-related methods such as using rhymes, language games, stories and drama, before more formal reading instruction begins at school.

At the first grade reading is the most important skill for children to learn. In Finland it has been a tradition to screen school beginners' skills before school or during the 'smooth transition' during the first five school weeks, to identify children in need of extra support or at risk of learning disability, and for teachers to plan further instruction accordingly. Screening includes assessments of different cognitive skills, for example, concept knowledge, visual and auditory perception, listening comprehension, vocabulary, mathematical skills and foundation reading skills such as letter knowledge, phonological awareness and word reading (Huolila et al., 1999; Liikanen, 1994; Müller & Kokko, 1999). Usually the special needs teacher selects the tests to be used in the screening battery of their school or in some cases a whole municipality will use the same battery.

Although these tests are widely used in schools there are only a few studies showing evidence that such screening tests will accurately predict risk for learning or reading disability. One example is that of Liikanen (1994), who tested every school beginner in one municipality ( $n = 132$ ). She showed that reading skill was best accounted for by the auditory discrimination, phoneme categorization and concept knowledge tests. Müller and Kokko (1999) also demonstrated the usefulness of the collection of screening tests used in Vantaa city (including letter knowledge, visual-motor skills, concept knowledge, initial phoneme identification, kinaesthetic differentiation, serial memory, auditory discrimination and naming speed of pictures and numbers) to recognise individual needs for special education. In their study of 125 school entrants, the best predictors for reading skill at the end of the first grade were letter knowledge, initial phoneme identification and naming speed of numbers.

In pedagogical contexts two different approaches to first graders' reading instruction have been discussed: the skill-based approach and the meaning-based approach. The skill-based approach to reading emphasises the systematic use of phonics. Therefore, the main focus of reading instruction is on the letter-sound relationship. Reading instruction advances stepwise from letter names to the correspondences between letters and sounds through to reading and

spelling. This then progresses onto phonological decoding and spelling of syllables and words. Phonics-based instruction offer stories or texts with controlled vocabulary made up of the letter-sound relationships and words which children are already familiar with. In writing instruction the same approach follows, with children only expected to write having achieved mastery of basic spelling skills. All Finnish ABC-books are authored from this perspective. Many studies have shown that systematic use of phonics with beginning readers is effective in the Finnish language context because of the nearly perfect letter-sound correspondence (Holopainen, 2002; Julkunen, 1984, 1986; Kananoja, 1999). It helps children in accurate reading and spelling, although limitations have been found in terms of achievement on reading comprehension tasks (Julkunen, 1987).

The meaning-based approach or whole-language approach to emergent literacy development more closely parallels language development and goes from the premise that from the outset readers rely on both the structure and meaning of language in their reading. While the skill-based approach emphasises phonics, meaning-based instruction focuses on the semantic content in reading and text comprehension. Word reading skills are taught in the context of various 'real' texts, for example children's literature. Children also produce their own texts and are encouraged to write from the earliest stages of literacy instruction. Children who have been taught using a whole-language approach are usually enthusiastic about reading and writing, they understand texts at a high level and they are not afraid of using their reading and writing skills in different contexts (Julkunen, 1984, 1986, 1987; Korkeamäki, 1996). However, Finnish children who have been taught this way are slower and more error-prone in their reading and spelling than children taught through the phonics-method (Julkunen, 1984).

These two approaches are usually seen as mutually exclusive (Adams, 1990; Goodman, 1982). However, in practice there are many similarities and usually Finnish teachers mix the best features of both methods in their teaching (Lerkkanen, 1994). The common misunderstanding is that in whole-language classes with a rich literacy environment the child learns to read and write naturally without direct instruction. Phonics, grammar and spelling are also taught in the whole-language approach. The key point is that they are taught in text contexts and specific skill teaching arises from children's needs and interests. Also, phonics-based instruction uses a lot of different kinds of reading material once all the letters have been introduced. Despite many studies on the effect or superiority of either of these teaching approaches, the results indicate that at least in the Finnish language context, the most important factor is the teacher's ability to get the children motivated, rather than the particular form of instruction (Korkeamäki 1996; Lehtonen, 1993; Lepola et al., 2002).

At present, formal reading instruction is relatively uniform across the country: heavy use of phonics is common in decoding and spelling instruction as well as stories, nursery rhymes, language games, drama, story telling, and writing activities (Lerkkanen, 1994). A meaning-based approach has also

recently emerged in some preschools and schools (Korkeamäki, 1996; Korkeamäki & Goman, 2002). In both approaches the orthographic structure of the Finnish language has been reflected in the reading and spelling instruction. Moreover, with the regularity of the Finnish language, word reading and spelling can be taught simultaneously to first graders in the knowledge that each skill will complement the development of the other. For example, Mäki et al. (2001) followed 154 preschoolers until the third grade and found that word recognition predicted later writing ability and compositional coherence after the second grade. Moreover, Lehtonen and Bryant (2001) have shown that the active use of syllables in reading instruction from the first to the third grade strongly supports Finnish children's spelling.

## 1.4 The aims of the present thesis

The aim of the present thesis was to increase understanding of the critical components of learning to read. The research questions were as follows:

- 1 *What are the antecedents of the development of reading performance? (Article I)*
  - 1.1 *To what extent do a variety of antecedents, such as letter knowledge, initial word reading skill, visual-motor ability, concept knowledge and listening comprehension skill, predict the development of reading performance from the beginning of the first school year to the end of the second school year?*
  - 1.2 *Are the different components of reading performance, i.e. word reading and reading comprehension, predicted by different antecedents?*
- 2 *What are the prospective relationships between phonemic awareness and reading performance during the first grade? (Article II)*
  - 2.1 *To what extent does phonemic awareness predict children's reading performance during the first school year?*
  - 2.2 *To what extent does reading performance predict subsequent phonemic awareness during the first school year?*
  - 2.3 *To what extent does the relationship between phonemic awareness and reading performance form a reciprocal cycle during the first school year?*
- 3 *What are the prospective relationships between reading performance (a combination of word reading and reading comprehension) and writing performance (basic spelling skills and productive writing separately) during the first grade? (Article III)*
  - 3.1 *To what extent does reading performance predict subsequent writing performance?*
  - 3.2 *To what extent does writing performance predict the development of reading performance?*
  - 3.3 *To what extent do the relationships between reading performance and writing performance form a reciprocal cycle?*

- 4 *What kinds of developmental trajectories in children's reading performance can be identified during the first and the second grade? (Article IV)*
  - 4.1 *Can we identify groups of children that differ systematically in terms of their word reading and reading comprehension skills?*
  - 4.2 *What kinds of trajectories can be identified in children's transition from one particular sub-group to another across the different measurement points?*

## 2 METHOD

### 2.1 Participants

A total of 114 children (61 boys, 53 girls) from six primary classes and from four schools participated in the study. Because of absenteeism from one or more measurement points, 29 participants in Article II, 31 participants in Article III, and 24 participants in Article IV, were removed from the data analysis. The final samples in the respective articles are shown in Table 1.

TABLE 1 Participants in articles I - IV

Article	Participants					
	Male		Female		Total	
	n	%	n	%	n	%
Article I	61	54	53	46	114	100
Article II	43	51	42	49	85	100
Article III	42	51	41	49	83	100
Article IV	46	51	44	49	90	100

The schools were situated in an urban district within Central Finland. All the children in the study were native Finnish speakers. At the beginning of the first grade, participating children were on average 7 years and 3 months old ( $SD = 0.32$ ). A total of 30% of their mothers and 35% of their fathers had a degree from an institute of university standing, 64% of mothers and 59% of fathers had a degree from an institution of professional or vocational education and 6% of parents had no occupational education. When compared to data derived from Statistics and Indicators (2003), the parents were found to be representative with respect to the educational level of all Finns aged 25 - 49 years in 1997. All the parents had given informed consent for their children to take part in the study.

Children's formal instruction in reading was started at school, but most children had had a year in pre-school before this. Participating schools reported systematic and heavy use of phonemes in beginning reading instruction in the

first grade and common use of the same ABC-book. Initial reading instruction started with the correspondences between letters and sounds. This then progressed onto phonological decoding and spelling of syllables and words; compositional writing followed shortly after, as did reading comprehension tasks. During the second grade, reading instruction focused on reading fluency and text comprehension. At the very beginning of school, 52% of these children correctly identified all 21 Finnish letters excluding b, c, f, q, w, x, z, and à ( $M = 18.29$ ,  $SD = 4.37$ ). Moreover, 27% of children accurately read a word list of 20 words and 2 sentences (Airo et al., 1985) with no more than one mistake ( $M = 9.39$ ,  $SD = 9.77$ ), 34% read one to twenty words and 39% were non-readers when they entered school.

## 2.2 Procedure and measurements

The children were tested seven times during their first and second school year (Figure 2). Initially, all children were assessed with an extensive test battery of pre-measurements during their first school week (Time 0, August 1998). The tests in the battery were designed for school entrants, and these were normally used in the participating schools as the screening tool for school beginners. All the tests were carried out as group tests, in the classroom and within a single day. The one exception was initial reading skill test, which was tested individually.

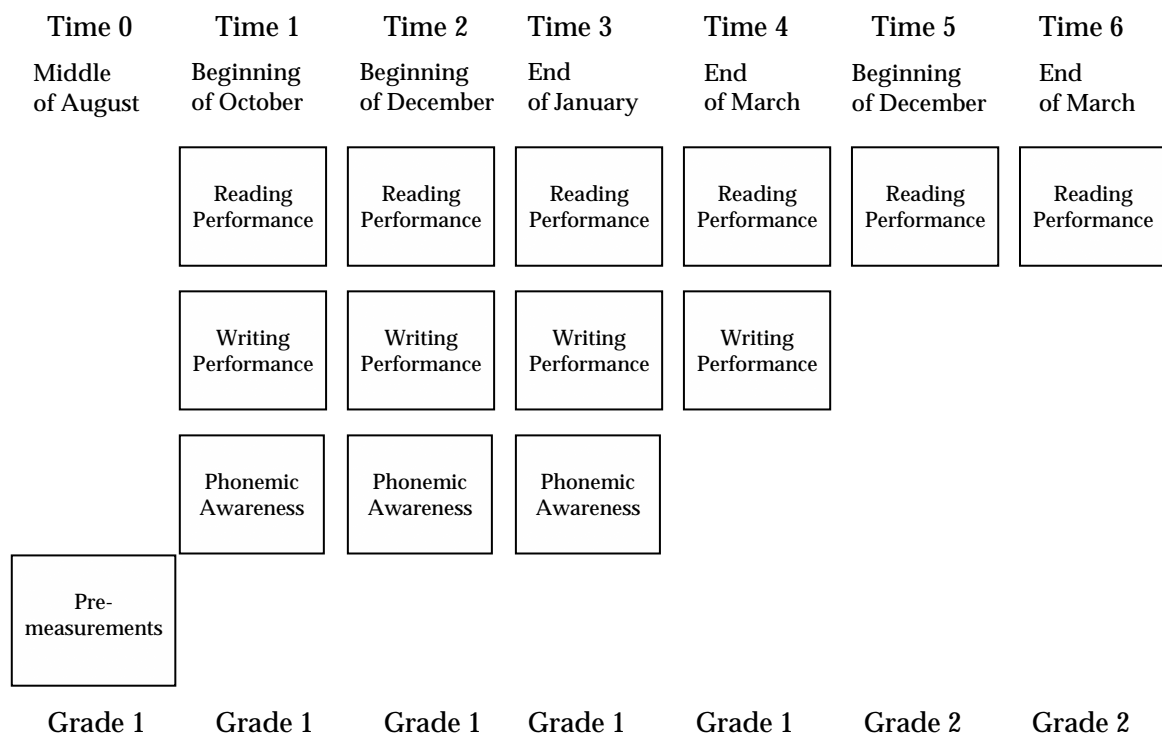


FIGURE 2 Schematic presentation of the entire research process.



Because of the absence of tests measuring the subsequent progress of reading during the first year, teachers were invited to collaborate with the researcher in the process of developing performance-based assessments and a timetable to assess the children's skill development. After several meetings with the teachers the decision was made to follow the existing assessment schedule of reading and writing performance at the participating schools, in order to avoid extra testing of the children. During the data collecting teachers had meetings, first, with the researcher before each measurement point to make the instructions uniform, and second, after each year with the whole research group, to discuss perceived experiences and performance trends. Teachers could also contact the researcher with feedback at any point during the running of the study.

During the first grade children were tested three times on phonemic awareness (Time 1, 2, and 3), and four times on reading and writing performance (Time 1, 2, 3, and 4). These measurements were at seven-week intervals (at the beginning of October 1998, at the beginning of December 1998, at the end of January 1999, and March 1999). During the second grade they were tested on reading performance just before Christmas (Time 5, December 1999), and towards the end of the second school year (Time 6, March 2000). Each reading assessment with phonemic tests lasted approximately one regular school hour. When testing writing performance as well as reading, the resultant two-hour testing schedule included one 15-minute break. The children's own teachers carried out the assessments within the classroom according to standard written instructions. The methods used in the present study are summarized in Table 2. More detailed descriptions of the methods and measurements can be found in the original articles I - IV.

TABLE 2 Summary of the methods and measurements used in the articles I - IV

Article	Statistical methods	Measurements
Article I Predicting reading performance during the first and the second year of primary school	Path modelling	<p><i>Pre-measurements</i></p> <ul style="list-style-type: none"> <li>- Letter knowledge (Poskiparta et al., 1994)</li> <li>- Initial reading skill (Airo et al., 1985)</li> <li>- Visual-motor ability (Liikanen, 1994)</li> <li>- Concept knowledge (Liikanen, 1994)</li> <li>- Listening comprehension (Liikanen, 1994)</li> </ul> <p><i>Reading Performance</i> (Grade 1 Aunola, Nurmi et al., 2002; Lerkkanen, 1998a; Grade 2 Lindeman, 1998)</p> <ul style="list-style-type: none"> <li>- Word reading</li> <li>- Literal text comprehension</li> <li>- Inferential text comprehension</li> </ul>
Article II Developmental dynamics of phonemic awareness and reading performance during the first year of primary school	Path modelling with categorical outcome variables	<p><i>Pre-measurements</i></p> <ul style="list-style-type: none"> <li>- Initial reading skill (Airo et al., 1985)</li> </ul> <p><i>Phonemic awareness</i></p> <ul style="list-style-type: none"> <li>- Sum score of initial phoneme and final phoneme isolation (Poskiparta et al., 1994)</li> </ul> <p><i>Reading Performance</i></p> <ul style="list-style-type: none"> <li>- Sum score of word reading, literal and inferential text comprehension (Aunola, Nurmi et al., 2002; Lerkkanen, 1998a)</li> </ul>
Article III The developmental dynamics of literacy skills during the first grade	Structural equation modelling	<p><i>Pre-measurements</i></p> <ul style="list-style-type: none"> <li>- Initial reading skill (Airo et al., 1985)</li> </ul> <p><i>Reading Performance</i></p> <ul style="list-style-type: none"> <li>- Sum score of word reading, literal and inferential text comprehension (Aunola, Nurmi et al., 2002; Lerkkanen, 1998a)</li> </ul> <p><i>Writing Performance</i></p> <ul style="list-style-type: none"> <li>- Spelling (Poskiparta et al., 1994)</li> <li>- Productive writing (Lerkkanen, 1998b)</li> </ul>
Article IV Reading performance and its developmental trajectories during the first and the second grade	<p>Cluster analysis (ISOA procedure)</p> <p>Univariate analysis of variance (ANOVA)</p> <p>Log-linear models</p>	<p><i>Reading Performance</i> (Grade 1 Aunola, Nurmi et al., 2002; Lerkkanen, 1998a; Grade 2 Lindeman, 1998)</p> <ul style="list-style-type: none"> <li>- Word reading</li> <li>- Literal text comprehension</li> <li>- Inferential text comprehension</li> </ul>

### **3 SUMMARY OF THE RESULTS**

#### **3.1 Article I: Predicting reading performance during the first and the second year of primary school**

The aims of Article I were to investigate, first, to what extent a variety of antecedents predicted the development of reading performance from the beginning of the first school year to the end of the second school year, and second, if the different components of reading performance, i.e. word reading and reading comprehension, would be predicted by different antecedents.

First, the results showed that antecedents for reading predicted the development of reading performance differentially, depending on the phase of reading acquisition a child had reached. Letter knowledge and initial reading skill predicted the beginning phases of reading performance in the first grade. Initial concept knowledge predicted children's reading performance at the end of the second school year. However, listening comprehension predicted reading performance at nearly every measurement point during the first year (Time 1, Time 2, and Time 4) and also at the beginning of the second year (Time 5). In other words, children with high listening comprehension skills showed a high level of reading performance across the first and second grade.

Second, partially different antecedents predicted the two main components of reading performance, i.e. word reading and reading comprehension. Word reading was influenced by letter knowledge, listening comprehension and visual-motor ability during the autumn term of the first grade. Listening comprehension skills also predicted word reading in the spring term (Time 3). In addition, initial reading skill and listening comprehension both predicted reading fluency at the beginning of the second grade (Time 5).

Concerning reading comprehension, the results showed that initial reading skill predicted literal text comprehension during the autumn term (Times 1 and 2) while letter knowledge predicted literal text comprehension in January (Time 3). Moreover, listening comprehension skills again proved predictive, in this case predicting the development of literal text comprehension

throughout the first school year: those who had good listening comprehension skills at the beginning of school were also likely to show strong literal comprehension performance at the beginning and at the end of the first school year.

Finally, initial reading skill also predicted inferential text comprehension at the first grade: early readers were better at the inferential tasks than other children until the end of January due to the strength of their basic word reading skill. Moreover, listening comprehension skills predicted inferential text comprehension across the first and the second school year. The level of inferential text comprehension performance at Time 1 (October) also predicted the development of inferential text comprehension one year later at Time 5: children who already had high inferential text comprehension skills at the beginning of the first grade maintained this strength in the second grade.

Overall, the results clearly highlight the importance of listening comprehension skills, which seem to play an important role in both word reading and reading comprehension development. Because the data were collected more intensively than in most previous studies, the results also revealed that the predictive power of some determinants diminished as reading development progressed. Therefore, although listening comprehension skills predicted reading performance during the first and second school year, letter knowledge, for example, predicted it only in the very early phases of reading development at school.

### **3.2 Article II: Developmental dynamics of phonemic awareness and reading performance during the first year of primary school**

The aim of Article II was to examine the prospective relationships between phonemic awareness and reading performance during the first year of primary school. The results revealed that there was a bi-directional relationship between phonemic awareness and reading performance: reading skills predicted the change in the level of phonemic awareness during the autumn term after controlling for the previous level of letter knowledge and reading, whereas phonemic awareness predicted the change in the level of reading at the end of the first school year. Consequently, if phonemic skills developed to a high level during the first grade, they predicted a child's transition to a higher level of reading performance group at the end of the first grade.

The results also shed more light on the dynamic relationship between these two skills' development: the direction of the support changed as children moved through the first school year. Reading performance at Time 1 predicted phonemic awareness at Time 2: children who did well at reading in October were more likely to move to a higher level of phonemic awareness in December than other children. Conversely, phonemic awareness at Time 3 predicted the

probability of belonging to a group with high reading performance at Time 4: children with high phonemic skills in January were more likely to progress to a good readers group at the end of the first year, and conversely, children with low phonemic skills in January were likely to show a low level of reading performance at the end of the first school year. Consequently, whilst success in phonemic skills was predicted by reading skills in the beginning phases of reading instruction, by the end of the first year, when all the children in the sample could read sentences, success in reading performance was influenced by the level of phonemic awareness.

Overall, the results revealed a strong association between reading performance and phonemic skills development. Reading and phonemic skills formed a reciprocal relationship during the first grade, however, the direction of the relationship between reading and phonemic skills changed as reading development proceeded.

### **3.3 Article III: The developmental dynamics of literacy skills during the first grade**

The aim of Article III was to examine the prospective relationships between reading performance (a combination of word reading and reading comprehension) and writing performance (spelling skills and productive writing respectively) during the first grade.

The results revealed that, first, the reciprocity between reading and spelling was strong in the beginning phases of reading instruction whereas by the end of the first grade reading performance only predicted spelling skill development. Reading performance at Time 1 predicted spelling at Time 2: the higher the level of reading children showed in October, the higher the level of spelling they showed in December. Moreover, both reading performance at Times 2 and 3 predicted subsequent spelling at Time 4: the higher the level of reading children showed in December and January, the higher the level of spelling they showed at the end of the first grade. What is more, spelling at Time 1 predicted the development of reading performance at Time 2: the higher the level of spelling children showed in October, the higher the level of reading they showed in December. Further, spelling at Time 2 predicted reading performance at Time 3: the higher the level of spelling children showed in December, the higher the level of reading they showed in January.

The results showed further that productivity of compositional writing predicted an improving reading performance during the first grade, whereas the reverse was not the case: the higher the level of productive writing children showed in October, the higher the level of reading performance they exhibited in December. Moreover, the higher the level of productive writing children showed in January, the higher the level of reading performance they demonstrated at the end of the first grade. Conversely, a low level of productive

writing in January predicted a low level of reading performance at the end of the first grade.

Overall, the results revealed a strong association between reading and writing development. Reading and writing performance formed a reciprocal relationship during the first grade, however, the direction of the relationship between reading and writing seemed to vary depending on the component of writing performance being assessed.

### **3.4 Article IV: Reading performance and its developmental trajectories during the first and the second grade**

The aim of Article IV was to investigate the nature of the developmental trajectories seen for children's reading performance during the first and the second grade. This was done, firstly, by identifying groups of children that differed systematically in terms of their word reading and reading comprehension skills, and secondly, by examining what kind of trajectories could be identified in children's transitions from one particular sub-group to another across the different measurement points.

First, in order to identify homogenous groups of children according to certain criteria variables, a clustering by cases analysis was run, as well as an ISOA procedure (Bergman, 1998; Bergman & El-Khoury, 1999), to yield similar groupings for the five measurement points. Three different reading performance groups were identified: Poor, Technical, and Competent Readers. Participants in the *Poor Reader* group (number of I-states was 59) were characterized by a low level of word reading, a low level of literal text comprehension and a low level of inferential text comprehension skill. The *Technical Reader* group (number of I-states was 144) was typified by a high level of word reading but low levels of both literal text comprehension and inferential text comprehension. The Technical Readers' text comprehension was actually as low as that of the Poor Readers. The third group, labelled the *Competent Reader* group (number of I-states was 247), was characterized by a high level of word reading, literal text comprehension and inferential text comprehension.

Second, in order to identify developmental trajectories defined according to the three reading groups through time periods 1 to 5, cluster group membership information for each individual across the different time points was assembled. Change and stability of group membership was examined by analysing frequency tables for pairs of consecutive measurement points by use of log-linear models. The results showed that there was substantial stability in the Competent and Technical Reader groups across time, whilst Poor readers frequently moved up to the Technical or Competent Reader groups during the first or second school year.

Finally, a frequency table for all possible combinations of transition between the reading groups and across the five measurement points was run to examine the most typical developmental patterns. Seven typical reading trajectories across the first and the second grade were identified: Stable, Consistent Elevation, First Grade Transitory Lapse, Cyclic Improvement, Second Grade Regression, Patterned Alternation, and Consistent Regression. The three last-mentioned groups evidenced relatively regressive trajectories.

Overall, the results showed that reading performance was an outcome of diverse developmental trajectories that were individually constructed. Although group membership was quite stable in the Competent and Technical Reader groups, there were significant transitions between the groups during the grades. Also, an overall diminution of the Poor Reader group was evident. This suggests that reading development is a dynamic process that includes a lot of relative changes. The results also showed the importance of taking into account both word reading and reading comprehension from the very beginning phases of reading.

## **4 DISCUSSION**

### **4.1 Antecedents for learning to read**

The first research question of the present thesis examined the antecedents of reading skill development. The results revealed, first, that different antecedents predicted different phases of a child's reading skill development. Second, subcomponents of reading performance, i.e. word reading and reading comprehension, were partially predicted by different antecedents.

The results from Article I revealed that during the first half of the first school year overall reading performance, including both word reading and reading comprehension skills, was predicted by letter knowledge, initial word reading skills and listening comprehension skills. After the first term of schooling it was listening comprehension and concept knowledge that predicted the level of later reading performance. This result suggests that in regular languages where word reading skills are learnt rapidly, important determinants for success in reading might be found within more general language skills such as listening comprehension.

Also of note was the fact that early readers had an advantage in their initial reading skill over non-readers only during the first months of the first school year. After this time reading instruction reduced individual differences and thus the predictive value of such elementary reading skills diminished: most of the non-readers caught up with the early readers very quickly. There is no conclusive evidence as to whether this occurred more due to regular nature of the Finnish orthography or because of effective reading instruction. Perhaps both factors had a role to some degree. However, in the longer term, early readers were likely to be more fluent readers in the second grade than those who learnt to read at school.

A more careful look at the components of reading performance showed that different antecedents predicted word reading and reading comprehension respectively. Whereas word reading was influenced by letter knowledge, listening comprehension and visual-motor ability, initial reading skill and



listening comprehension predicted fluency; both initial reading skill and listening comprehension predicted the development of reading comprehension.

The results revealed, first, that letter knowledge and visual-motor ability predicted word reading development particularly during the beginning phases of reading instruction, although they did not predict later levels of word reading. This may be due to the fact that the letter names and sounds are introduced during the first months of schooling and so they directly help children to master basic word reading skill in a regular language like Finnish. After this point the effect of letter knowledge is in fact conveyed by subsequent word reading skills and so its own unique predictive value is lost. Similarly, later on, other determinants had stronger predictive power for word reading than visual-motor ability. This result is in accordance with recent Finnish studies showing that visual perception does not effectively predict the reading development of ordinary readers (Holopainen et al., 2001; Merisuo-Storm, 2002). Instead, Holopainen et al. (2001) showed that preschoolers' limitations in visual analogical reasoning predicted delay in reading at the second grade. Also in earlier studies of reading difficulties, visual perception impairments have been cited as one of the central reasons for reading disability (Badian, 1994; 1995, 1998; Ellis & Large, 1988; Stanovich, 1992; Vellutino & Scanlon, 1991).

Second, the results showed that listening comprehension predicted word reading development in the first grade and also predicted fluency in the second grade. This finding contributes to our understanding of word reading development by suggesting that listening comprehension is already a strong determinant of word reading skill at the earliest stages of reading development. Previous studies have shown that listening comprehension is an important determinant of later, more automatic word reading (e.g. Ellis & Large, 1988; Vellutino & Scanlon, 1991). The results of the present study showed that listening comprehension does not only predict later automaticity of reading during the second year but also predicts basic word reading development in the first grade. This result may be due to the fact that high levels of listening comprehension require the development of higher level cognition and language, which further impact upon word reading skill and its development. In addition, the rapidity of word reading due to the regular orthography of Finnish might create contrastive pathways of acquisition as compared to other languages. Finnish children reach a basic level of reading skill much more quickly than happens in other languages, where it might take longer to reach an equivalent level of fluency (Seymour et al., 2003). Different factors may therefore be important at different times.

Previous studies have shown that word reading strongly predicts reading comprehension (Adams, 1990; Gunn et al., 2000; Juel, 1994; Juel et al., 1986; Perfetti, 1985). However, the results of this study demonstrated that initial word reading skill only predicted the beginning phases of reading acquisition during the first school year. As soon as non-readers were able to reach a basic level of word reading skill they could use this to read words and texts in comprehension tasks just as efficiently as their earlier reading peers. An even

more important finding was that reading comprehension did not depend solely upon word reading skill. Reading comprehension was also predicted by listening comprehension. Consequently, comprehension skills are probably a latent skill already in place before reading instruction begins. Listening comprehension predicted reading comprehension skills across the first and the second school year especially when inference making was demanded. This result accords with the findings of some previous studies: after word reading is learnt, the variability in children's comprehension ability arises from other cognitive and language factors (de Jong & van der Leij, 2002; Oakhill & Yuill, 1996; Stothart & Hulme, 1996). There will be some common factors such as vocabulary knowledge, working memory and syntax knowledge which might have a substantial effect on both listening comprehension and reading comprehension skills. However, whilst these will explain almost all of the variance in listening comprehension, reading comprehension is possible only with the additional involvement of word reading ability. Our results, however, differ from Vellutino and Scanlon (1991), and Juel (1994), who reported that listening comprehension skills predicted only much later and more skilled readers' reading comprehension after the beginning phases of reading development had passed.

Overall, the results of the present study were mainly in accordance with previous studies concerning the determinants of reading development (Adams, 1990; Badian 1998; Bradley & Bryant, 1983; Catts et al., 1999; Ehri, 1987; Ellis & Large, 1988; de Jong & van der Leij, 2002; Stanovich, 1992; Wagner et al., 1994; Vellutino & Scanlon, 1991). However, because of the longitudinal design and frequently made follow-up assessments, the present study followed children's learning processes in the beginning phases of formal reading instruction more comprehensively than previous studies have done. The results of Article I showed that path models were an appropriate statistical method to test the relationships among pre-measurements and later reading performance variables, particularly in light of the longitudinal design and intensive measurement schedule. It thus gives new information about the predictive value of antecedents during the entire period of initial reading instruction, when the most rapid changes in reading behaviour are occurring. Some previous studies (Badian, 1998; Ellis & Large, 1988; Vellutino & Scanlon, 1991) have assumed that predictors of reading performance might change according to the developmental phase of reading a child has reached. The results of the present study showed that at least in the Finnish language context this is certainly the case.

However, there is still the lack of an evidence-based model mapping out literacy development in the regular Finnish language, to help identify which phase of reading development children are in at a certain point in time and which phase of reading one is predicting. Information about the developmental phases of reading would help teachers to determine how to support and scaffold children to the next phase of literacy development. For example, Ehri's model of literacy development (Ehri & McCormick, 1998) demonstrates that

pre-alphabetic knowledge of letter names and shapes is a base for the initial reading of the partial- and full-alphabetic phases, where letter-sound relationships are used. However, Ehri herself has been sceptical about the suitability of the phases of her model for regular languages. She suggests that children who are taught to read words in regular languages, where the letter-sound correspondences are perfect and who receive systematic phonics instruction at school, spend little if any time in the pre- and partial-alphabetic phases once they learn the letter-sound relationship. Instead, they might move very quickly to the full-alphabetic phase of reading (also Wimmer & Goswami, 1994).

This conclusion got some support from the results of the present study. The results highlighted the fact that children differed in their literacy skills when they entered school. However, it was clearly shown that after a couple of months of formal instruction the situation had totally changed and by October 87% of children could accurately read all words made up of familiar letters. The results of the present study are consistent with previous Finnish studies which have also shown rapid acquisition of word reading skills, although the criteria for reading ability has differed considerably between studies (Holopainen, 2002; Julkunen, 1984, 1986; Kananoja, 1999; Lehtonen, 1993; Lepola et al., 2000). Consequently, the assumption that Finnish children move from the pre-alphabetic phase to the full-alphabetic phase of word reading 'in one shot' might be valid.

The results also gave more information about the predictive value of the screening battery for Finnish school beginners. The results revealed that the screening battery indeed identified the children with very low-level initial skills at school entrance, but that this did not automatically lead to reading disability. Rather, it predicted the time when a child would reach sentence level word reading skill: non-readers with good initial skills were able to reach sentence level reading before Christmas whereas non-readers with low initial skills achieved this goal during the remainder of grade 1. In actuality, the screening test seemed to predict better children's progress in reading comprehension development, a much more stable skill during the first two school years than the rapidly learnt word reading skill.

Thus, further consideration is clearly needed with regard to the school beginners' assessment overall. First, the primary reason for screening must be re-evaluated. If the original purpose for screening is considered, to find children at-risk for learning disability and provide them with special education as early as possible, then the screening battery must be changed so that the skills which will predict learning over a longer time scale than a couple of months, will have their place. In the present study the crucial factor was listening comprehension, which predicted overall reading performance and also its separate components from the beginning phases of reading instruction right through to the end of the second grade.

Second, other cognitive and language abilities not focused upon in the present screening battery are also likely to add crucial information. Important

factors such as phonological awareness (Badian, 1998; Holopainen, 2002; Torgesen & Wagner, 1994; Wagner et al., 1994; Wagner et al., 1993; Wagner et al., 1997), naming speed (de Jong & van der Leij, 2002; Korhonen, 1995; Lehtonen, 1993; Wagner et al., 1997; Wimmer & Mayringer, 2002; Wolf & O'Brien, 2001), or working memory (Wagner et al., 1993; Wagner et al., 1994) have been predictors of word reading accuracy or word-decoding speed in previous studies.

Third, the timing of assessment requires review. Due to preschool reform in Finland, nearly all 6 years old have a preschool year before school entrance. If the original purpose of screening is to recognise children at risk of learning difficulties, a preferential time for the screening might be at the beginning of the preschool period. This way children could much more easily get access to individual support for their cognitive and language development due to the number of adults available and the more flexible curriculum existing in preschools as compared to schools. On the contrary, if the purpose of the screening is instructional planning for the first grade then the optimal timing might be after the five weeks 'smooth transition' or even later. This is because the most radical changes in children's letter knowledge, phonemic skills and reading are still occurring during the first weeks of school and so this period may not give a realistic picture of the child's true long-term potential.

Finally, alternative methods of evaluation to the screening tests should be considered. At present the screening battery only includes tests that show competencies already acquired. The dynamic nature of learning process is thus lost. In the present study teachers' ratings of children's skill development at four times during the first grade had high correlations with follow-up test results. Because of the rapid changes in children's word reading during the first grade and teachers' accompanying sensitivity and skill in observing this process, serious consideration should be given to the use of observation schedules, as opposed to the more 'snapshot' profile given by the screening test. Systematic observation of language skills at the preschool level instead of formal testing may be adequate for most children.

## **4.2 Reciprocal relationships between literacy skills**

### **The Relationship between Phonemic Skills and Reading Performance**

The second research question sought to examine the prospective relationships between phonemic awareness and reading performance during the first grade. The results (Article II) revealed that the relationships between phonemic awareness and reading performance form a reciprocal cycle: reading skills predicted the change in the level of phonemic skills at the beginning of school, whereas phonemic skills predicted the change in the level of reading at the end of the first school year. The result is in accordance with studies that have shown

that phonemic awareness and reading facilitate each other in a bi-directional way (Ellis & Large, 1988; Wagner et al., 1994). The results further support the idea that phonemic skills will develop rapidly and strongly once reading instruction has begun, the amount of practice in letter-sound correspondences increasing subsequent sensitivity to the sounds of words (Cunningham, 1990; Ehri, 1989; Morais, 1991; Seymour & Evans, 1999; Stahl & Murray, 1994; Torgesen & Wagner, 1994). Through reading practice children become more aware of the phonemic structure of oral and written language and they can benefit from this in their reading.

Despite the suggestion that phonemic skills are a major contributor to early reading skills, studies in regular orthographies have questioned the central role of phonemic awareness (Frith et al., 1998; Wimmer & Goswami, 1994; Wimmer & Mayringer, 2002). Previous studies in the Finnish language have also shown that phonemic skills might not be an essential pre-condition for word reading skill (Aro et al., 1999; Holopainen, 2002; Poskiparta et al., 1999; Silvén, 2002) although its supportive role for learning to decode cannot be denied (Holopainen, 2002; Korkman & Peltomaa, 1993; Mäkinen, 2002). For example, Silvén (2002) showed that preschool readers' growth in phonemic awareness was more as a consequence of reading skill than a precursor to reading ability.

The reason for these results might be two-dimensional, influenced both by the regular orthography of Finnish and the heavy use of phonics in reading instruction in Finnish schools. It is essential to note that orthographic knowledge of words in regular languages helps significantly in phonemic tasks, because in the Finnish language the letter-sound correspondence is virtually perfect. Thus, Finnish children tend to manipulate words orthographically rather than relying completely on phonemic processing, especially precocious readers who learn to read before school entrance. Holopainen et al. (2000) asked preschoolers, for example, to identify the initial sound of a word. Children recounted afterwards that they visualised the given words in the air, recognised the letters in the 'written' form and then answered by the name of the letter instead of the sound. In the present study also, when asked to identify the initial or last sound of a word, first graders answered with letter names instead of sounds. The importance of letter knowledge for the early development of phonemic awareness and early reading ability in orthographically regular languages clearly requires further study.

Ehri (1989) has shown that phonemic awareness begins to develop as knowledge of the alphabetic system and word spellings emerges. She has also shown that after letter knowledge, phonemic awareness begins to develop as a result of reading and spelling practice. In Finland, school beginners have daily practice of letter names, letter sounds, letter-sound correspondences and decoding right from the beginning of formal reading instruction. Consequently, Poskiparta, Niemi, and Vauras (1999) assumed that a lack of phonological awareness does not necessarily cause problems in learning to read words, because the use of phonics in reading instruction in Finnish schools might in

this instance be enough to effectively support students' phonemic skills during the first grade. The present study gave support for this suggestion.

Overall, the results revealed that phonics provide a basis for reading performance during the first grade even when basic word reading skill is learnt rapidly. Consequently, it is necessary to take into account the support phonemic skills still offer to the process of reading development during the first school year when children are still very much consolidating their newly acquired literacy skills. It is obvious that high letter knowledge and initial reading skills support the improvement of phonemic skills but controversially, it also appears that strong phonemic skills support high level reading performance later on as well. It might be that after basic decoding skill has been mastered, subsequent repeated use of phonics in reading has effects on the level of automaticity achieved. Consequently, it might be that phonemic awareness is more likely to predict fluency in later reading than the beginning phases of rapidly acquired decoding skill in the Finnish language. Holopainen (2002) has also shown this with older children: phonological awareness at the preschool age predicted fourth graders' fluency. This is an important finding because previous studies have shown that the differences between Finnish children's word reading skills are mainly seen in automaticity and speed of word recognition rather than in reading accuracy (Julkunen, 1984, 1986; Lehtonen, 1993; Lepola et al., 2000; Lyytinen et al., 1995).

### **The Relationship between Reading Performance and Writing Performance**

The third research question examined the prospective relationships between reading performance and writing performance during the first grade. The results (Article III) revealed, first, that a strong association exists between reading and spelling, as well as between reading and productive writing. This is in accordance with previous studies investigating the association existing between reading and writing performance (Ehri, 1980, 1989; Juel, 1988; Juel et al., 1986; Shanahan, 1984; Shanahan & Lomax, 1986). However, there are only a few previous cross-lagged longitudinal studies that have investigated the directionality of the relationship between reading and writing performance.

In the present study, reading and spelling seemed to form a reciprocal cycle during the first months of the first grade: spelling advanced the development of reading skills and reading skills advanced the accuracy of spelling. Later on however, as reading development progressed further, reading skills supported spelling although the reverse was no longer true. In contrast, productivity of writing seemed to predict increases in reading performance during the first grade. Overall, the results of the present study suggest that the relationship between reading and writing performance is not at all simple. The direction of the relationship appears to vary depending on the component of writing performance being assessed.

The explanation for the bi-directional result between reading performance and spelling may lie again in the regular nature of the Finnish orthography and the perfect consistency between graphemes and phonemes in word reading and

spelling. For example, there is no need to adopt separate strategic approaches to reading and spelling or have a separate spelling vocabulary, as in the English language. The result also suggests that lower level literacy skills, i.e. word reading and spelling, are parallel skills in the literacy development of the Finnish language, at least in the beginning phases. In the present study the spelling measure focused largely on accuracy of writing whereas for reading performance there was more emphasis on reading comprehension ability. This suggests that lower level writing skill, i.e. spelling, supported higher level reading knowledge, i.e. reading comprehension, at the beginning of literacy instruction.

However, after the initial months of schooling the situation changed: reading performance predicted subsequent spelling during the spring term of the first grade. This might be because of the rapid learning of word reading during the first grade. In the present study children might thus make spelling mistakes whilst their word reading could be accurate. Despite the support given for a theory of literacy development that places reading and spelling reciprocity at its core, the development of spelling skills in the present study was much slower than word reading skill development. Although 37% of children could accurately spell all the given syllables and words in October, about half of the children continued to make spelling mistakes during the entire first grade. Therefore, it seems to take a longer time to learn to spell accurately than to read accurately in the Finnish language. These findings are in accordance with previous studies (Boland, 1993; Francis, 1994; Juel, 1988; Mäki et al., 2001). For example, Mäki et al. (2001) reported with older Finnish children that word reading skills at the end of the second grade predicted spelling at the end of the third grade.

Moreover, the results revealed, surprisingly, that it was productivity of writing which predicted reading performance during the first grade rather than vice versa. There has been a general lack of studies concerning the relationship between higher-level literacy skills with young children, i.e. productive writing and reading comprehension. These kinds of studies are clearly needed, especially in regular languages where differences in reading skills are mainly seen through higher level literacy abilities like reading comprehension (Julkunen, 1984, 1986, 1994; Lepola et al., 2002; Linnakylä, 1993, 2000). In the present study, productive writing demonstrated children's fluency in producing the written forms of words when generating compositions from pictures. From this perspective children's language fluency and vocabulary knowledge, i.e. productivity of writing, seemed to support the development of reading performance, particularly comprehension skills, which also differentiated children's reading ability during the first grade. This showed that higher-level writing skills promote higher level reading skill, i.e. comprehension. This might also suggest that compositional writing influences language in a way that supports reading comprehension. Furthermore, when producing a text, children will perhaps use language in a way that is beneficial to their overall reading development as well.

The results revealed that reading performance and writing performance formed a reciprocal relationship during the first grade: both spelling and productive writing seemed to contribute towards reading performance, and reading skills increased children's spelling competence. The path models used to investigate the prospective relationships between reading performance and spelling, and reading performance and productive writing enabled the study of reciprocity between these variables. Path models have seldom been used in previous studies and hence the present study gave new information in terms of the directionality of prospective relationships of these variables.

### **4.3 Individually constructed learning processes**

The fourth research question was to examine what kinds of developmental trajectories in children's reading performance could be identified during the first and the second grade. This was done, first, by identifying groups of children that differed systematically in terms of their word reading and reading comprehension skills, and second, by examining what kind of trajectories could be identified in children's transitions from one particular sub-group to another across the different measurement points.

First, the results (Article IV) showed that three qualitatively different reader groups were identified in the data: the Competent Readers (high word reading and high reading comprehension), the Technical Readers (high word reading but low comprehension) and the Poor Readers (low word reading and low comprehension). According to the simple view of reading, reading performance can be described in four qualitatively different ways (Cornoldi & Oakhill, 1996; Gough & Tunmer, 1986; Stanovich, 1986; Stanovich et al., 1996; Tunmer & Hoover, 1992). The present study, however, was able to identify only three of these groups. At these early phases of reading development there was no evidence of a fourth group of children who would show relatively low word reading but high comprehension, which is in fact typical of dyslexic children. These results suggest that adequate word reading skills must be learnt before a high level of reading comprehension can be attained (Gough & Tunmer, 1986; Juel et al., 1986). This obviously did not happen at a group level until the end of the second grade. Therefore a fourth group was difficult to identify in the first grade according to word reading and reading comprehension skills.

Notably, there were a large number of children in the Technical Reader group. This may be due to the fact that in the first grade the focus of instruction and learning is typically on word reading skills and reading comprehension is seldom explicitly practiced. According to the simple view of reading and in previous studies (de Jong & van der Leij, 2002; Stothard & Hulme, 1996), the limitations for Technical readers might be in their language comprehension abilities. Although Technical readers had as good word reading skills as the Competent readers, this was not yet reflected in their reading comprehension.



This was in contrast with previous studies that have shown that word reading fluency associates with subsequent reading comprehension (Adams, 1990; Gough & Tunmer, 1986; Gunn et al., 2000; Juel, 1994; Juel et al., 1986; Perfetti, 1985; Stanovich, 1986). Instead, the result was in accordance with studies that have shown that general language comprehension, and especially listening comprehension, might be more relevant for text comprehension than automaticity in word reading at the text level (Cain & Oakhill, 1999; de Jong & van der Leij, 2002; Juel et al., 1986; Oakhill & Yuill, 1996; Stothard & Hulme, 1996; Vellutino & Scanlon, 1991). However, the risk for Technical readers is that they may give an impression to the teacher of being a skilled reader. If Technical readers as well as Poor readers do not get special support for their language and reading comprehension, it may pose a serious risk to effective school learning later on when they are expected to use reading for learning and to acquire functional literacy skills.

Second, the results revealed that there was substantial stability in reading group membership across time except for children of the Poor Reader group, who frequently moved up to more skilled groups. There are only a few previous studies that have examined relative reading achievement. Juel (1988) demonstrated the constancy of relative reading achievement within a group of 54 children from the first through to the fourth grade: poor readers were likely to stay poor and good readers were likely to stay good. Smith (1997) reported similar results with 57 children from preschool to the third grade. In the present study twice as many children were examined, across several schools and at more points in time during the grades than in either of the aforementioned studies. The results revealed that Competent and Technical readers typically stayed in the same group of readers across time. In contrast, the Poor Reader group diminished, and encouragingly, Poor readers tended to progress to the Technical and Competent Reader groups. It is also worth noting, however, that in the Finnish language context poor readers can in fact read accurately (Holopainen, 2002; Julkunen, 1984; Kananoja, 1999). In the present study, children in the Poor Reader group learnt to read sentences during the first grade but they were slower readers in the second grade than the Technical group.

Third, a detailed investigation of the developmental trajectories of relative reading performance demonstrated that learning paths were very individually constructed. On an individual level, changes in relative reading performance and transitions between groups were common. During the first and second grade children from the Technical and Poor Reader groups had every possibility of becoming Competent Readers. This is in accordance with the recent study of Phillips and colleagues (2002). They also showed continuing flux in 187 children's relative reading performance, changes in reading group membership and a high likelihood that initially poor readers would become average readers during the primary grades. Moreover, Lepola et al. (2000) found with 48 Finnish children that pre-reading skills at preschool did not necessarily predict future poor, average or good reader status in the second

grade. The present study thus gives valuable additional information concerning the transitions and directions of change in reading development to be considered when planning reading instruction to meet individual needs.

In addition, and more worryingly, three of the seven reading development paths evidenced regressive trajectories. Reasons for these unexpected transitions might be, firstly, relatively slow development of word reading skill in some children, secondly, relatively low comprehension skills from the beginning, thirdly, a generally slow developmental rate of reading, or finally, the increasing demands of reading performance in class. Recent studies have also drawn more attention to motivational problems and task avoidant behaviour as reasons for regressive or slow learning paths (e.g. Aunola, Nurmi et al., 2002; Lepola et al., 2000; Lundberg, 1998; Niemi et al., 1998; Salonen et al., 1998). In the context of this research project the role of motivation for the present children has also been investigated. The results showed that strong motivation and task-orientation predicted high level of reading performance during the first grade whereas low motivation predicted slower progress in reading (Aunola, Nurmi et al., 2002). Consequently, children with regressive learning paths are obviously in need of individualised support; such support could be started as early as the pre-school stage, to strengthen pre-reading skills, especially general language skills. Further on, the focus could then change to pro-active prevention of a deceleration in progress. Teachers need to be alert to possible signs of risk or obstacles to a child's learning and motivation, in order to avoid future learning problems.

Overall, the results revealed that reading performance is a product of diverse developmental trajectories that are individually constructed. Thus, although group membership was quite stable with the Competent and Technical Reader groups, the significant transitions between groups during the grades and the reduction in number of the Poor readers suggests that reading development is a more dynamic process on an individual level than earlier studies have suggested.

#### **4.4 Pedagogical implications**

The present study differs from most previous studies of reading development in certain important ways. Firstly, the participants were an unselected group of first grade children from different schools. This situation thus more realistically represents the normal situation a teacher will experience, in comparison to studies with a greater degree of subject selectivity. Secondly, the present study tried to capture the dynamic nature of reading skill development at the time of most rapid change, when formal reading instruction begins. The longitudinal design and frequency of the follow-up assessments thus reveal the degree of classroom diversity in learning processes to which the teacher has to be alert.

Therefore, the results from the present study also have several implications for educational practice.

Children come to school with a different amount of knowledge about literacy. Furthermore, Article I showed that the importance of various antecedents for reading development at school also differs a lot. The present study showed that general language elements like listening comprehension seem to play an important role in both word reading and reading comprehension development whereas, for example, letter knowledge was predictive of only the very early phases of reading development. The findings of the present study highlight the importance of general language elements at the preschool stage as well as the need for supporting them during the primary grades. As a consequence, serious consideration has to be given to the increased integration of preschool and primary school literacy programs and to the current division between preschool and first grade reading instruction.

Article II showed the reciprocal relationship between phonics and reading skills. Previous studies have shown that phonics-based reading instruction is an effective way to learn reading at school (Adams, 1990; Cunningham, 1990; Juel & Minden-Cupp, 2000; Schneider et al., 1997) and encourage the progress of phonemic awareness, word reading and spelling skills (Ehri et al., 2001). Moreover, Juel and Minden-Cupp (2000) have shown that children with low pre-reading skills particularly, benefited from high exposure to phonics in reading instruction whereas others profit more from text-based instruction. The results of the present study thus confirmed the usefulness of phonics skills for reading: phonemic awareness was useful for the child especially in the context of learning to read whereas reading skill itself also supported the development of phonemic awareness further on. The present study showed that even if children learnt to read very quickly in the beginning of the first grade, the promotion of phonemic awareness still supported the development of more advanced reading performance. This suggests continuing to promote phonemic skills even though basic reading skill is rapidly acquired during the first grade.

Article III showed that reading and spelling formed a reciprocal cycle during the beginning phases of reading instruction. After half a year of schooling reading predicted the development of spelling whilst productive writing predicted the development of reading for the entire first grade. The findings suggest that literacy instruction should include both reading and writing activities from the very beginning of school because they support each other's development. Earlier studies have shown that teaching reading in combination with writing is an effective way to learn both skills (Adams, 1990; Bear & Templeton, 1998; Ehri, 1980, 1989; McMahan et al., 1998; Santa & Høien, 1999; Shanahan, 1988, 1997; Shanahan & Barr, 1995; Shanahan & Lomax, 1986). This is because of common cognitive and linguistic knowledge that supports the development of both skills (Shanahan, 1984; Shatil et al., 2000). The present practice of Finnish school literacy instruction typically integrates decoding and spelling exercises during the first grade because of the nearly perfect letter-sound rules in the Finnish language. The results of this study suggest that this is

a beneficial strategy in a regular language context. However, it is perhaps also necessary to provide more compositional writing opportunities during the first grade because such writing practices may also benefit reading development.

Finally, Article IV showed that reading development is an individually constructed learning process where the differences between children might be even greater and more complex than previously thought. The results challenge teachers to meet the needs of the individual child: reading instruction has to put differential weight on particular reading practices at different moments in time depending on the child's phase of reading development and so that the child is challenged but not overwhelmed. Children at-risk for reading failure and those who need a high degree of challenge to stay motivated should also be planned for in advance, to avoid potentially regressive learning paths. This study has also shown the importance of taking into account both word reading and reading comprehension right from the earliest phases of reading instruction. In the present study it was reading comprehension in particular which distinguished Competent readers from Technical and Poor readers. Moreover, the number of Technical and Poor readers with limited comprehension skills by the end of the second grade poses a serious risk to effective school learning in the third grade, when they are expected to use reading for learning. The ability to comprehend text is a significant determinant of overall school adjustment during the primary school years (Julkunen, 1987).

Overall, the simple view of reading seems to be too narrow a model to develop reading instruction. The results of the present study showed that the development of the two components of this model, word reading and reading comprehension, seem to be influenced by a number of skills exerting an influence both before reading begins as well as alongside it as it develops. The results support the idea that there has to be a *balance between various literacy skills* in reading instruction. According to the present results, balance should be found first, between general language elements and the systematic teaching of phonics in the context of reading, second, between the practice of decoding and text comprehension, and finally, between reading and writing practices. Moreover, the teaching implications of children's unique developmental patterns and motivation (Aunola, Nurmi et al., 2002) require careful consideration. Previous studies have shown further that meaningful contexts (Ehri & Wilce, 1985) and emotional, social and cultural factors (Kamil et al., 2000) are also central pedagogical components to take into account when planning reading instruction. For example, Taylor et al. (1999) have shown that in schools, with competent readers, teachers spend much time in small group reading situations, they coach children's development of active reading strategies to work out unknown words as an integral part of the class phonics instruction, they use higher level comprehension questions, and they collaborate with other teachers and with parents. The results of the present thesis support these kinds of practices.

## 4.5 Limitations of the present study

There are several limitations that should be taken into consideration when making generalizations concerning this study. First, the results may be influenced by the fact that the study is carried out in the context of the highly transparent Finnish language; letter-sound correspondences are perfect in both directions and this certainly supports children's rapid learning of phonemes and decoding. Consequently, the results may be different in orthographically more opaque languages such as English and so one must be careful in making any comparisons with first graders' in different countries.

Second, the use of non-standardized reading tests and the fact that the tests changed as reading instruction progressed, although the structure of the tests stayed similar, reduces the reliability of the assessments. The lack of standardized reading and spelling tests is common in Finnish literacy studies. Only one standardized test currently exists for group assessment of young children's reading skill, the ALLU-test (Lindeman, 1998) that was published one year into the present study. As a result, in the first year of the study reading was assessed by tests developed specifically for the present purposes, with the ALLU-test then used in the second grade. However, the correlation between the test scores and teachers' ratings of their pupils' reading and spelling skills was high at each measurement point in the first grade. Because the tests developed for this study were very similar to those normally used by teachers, the results they yielded may in fact have revealed more accurately the situation and ongoing practices that exist in ordinary classrooms, although teachers' reading instruction method was not carefully controlled. This information is necessary to improve the literacy assessment and instruction during the first grade. These are also challenges to be met through the further development of standardized follow-up tests at the group level, for researchers to get more comparable results.

Third, this study was started when children's literacy development had already begun, with many children able to read upon school entry. This problem was seen particularly in the high degree of skewness in reading and phonemic awareness scores, due to children's rapid mastery of word reading skill. This has also been the case in other Finnish language reading research carried out in the first grade (Holopainen, 2002; Lepola et al., 2000). Such problems with distribution are also unfortunately common to many studies within regular language contexts (Seymour et al., 2003). It seems to be that when Finnish-speaking children learn the idea of perfect letter-sound correspondence they can read every word. Therefore, reading skill is more of a dichotomous 'on-off' skill not resembling a normal distribution during the first grade. The rapid change from non-reader to skilled reader in the first grade also sets high demands for the creation of sensitive reading tests, amenable to rigorous statistical analysis.

The solution for this problem in Article I was the conversion of the continuous scores of the word reading, literal text comprehension and inferential text comprehension variable into dichotomous sets for the first grade (Times 1 to 4). Therefore, the results actually showed how each pre-measurement predicted a child's ability to exceed the threshold of entry for the higher-level performance groups in each skill at the first grade. In Article II the use of a categorical data model also allowed us to study the probability that a child would exceed certain performance thresholds for phonemic skills and reading performance. These procedures thus offered a viable solution for dealing with the dichotomous and categorical data at hand. Consequently, it will be important in future to collect data before formal reading instruction has begun and use multiple tests of phonemic awareness, as well as time-limited tests of word reading. This might allow for individual differences in reading acquisition to be more carefully tracked.

The goal of following individual learning paths also proved demanding in terms of the statistical methods available. The ISOA method fitted the longitudinal data well when the focus was on the identification of clusters and developmental trajectories of learning to read between the clusters. The alternative, to use growth models, was ruled out on the grounds of its inability to deal with changes in tests from one measurement point to another. However, the ISOA method is new and still under development (see also Bergman, 1998).

In the present study, the reading performance variable was a combination of word reading and reading comprehension at some time points. With word reading quickly approaching ceiling, children's reading performance will have actually been already differentiated largely on the basis of comprehension skills during the first grade. Although word reading skills have an influence on reading comprehension there are clearly other abilities which influence reading comprehension specifically and so the distinct effects of these factors may have been obscured by the methodology employed here. In the present study, however, an alternative strategy which separated word reading and reading comprehension would have been difficult due to the small number of children who actually made any mistakes in the word reading tasks after only a couple of months of schooling. This also meant that even children in the Poor Reader group (Article IV) could read words, a typical finding in the Finnish language context.

Other cognitive and language abilities not focused upon in the present study are also likely to have an influence on reading. The predictive battery could have included, for example, more rigorous tests of phonological awareness, naming speed or working memory, which are clearly additional determinants of reading ability. These skills were not underestimated but the reason for their omission was primarily 'real-world' research considerations: it was decided that using the pre-existing screening battery of participating schools would give a more realistic picture of the initial information teachers were actually presented with when making their teaching decisions. Moreover,

motivation and task-focus was assessed in the present research project and the predictive power of these factors for reading development has previously been reported (Aunola, Nurmi et al., 2002).

Finally, the overall sample size may have influenced the power of detecting statistical effects. Although the sample was relatively small and collected from Jyväskylä area only, however, in the light of the educational levels of the parents, it would appear to be relatively representative of the general Finnish population.

## **4.6 Conclusion**

The present thesis investigated learning to read during the first and the second grades of primary school. Overall, the results suggested that reading acquisition is a rapid learning process that is characterized by a variety of individual pathways. Moreover, the development of reading performance was predicted by different antecedents depending on the phase of reading acquisition a child had reached: letter knowledge, initial reading skill and listening comprehension predicted the beginning phases of reading performance in the first grade whereas listening comprehension skills and concept knowledge predicted reading performance in the second grade. Different antecedents predicted word reading and reading comprehension as well: letter knowledge, listening comprehension and visual-motor ability predicted word reading, whereas both initial reading skill and listening comprehension predicted the development of reading comprehension. Further, certain reciprocal relationships between the development of literacy related components were very apparent during the first grade: the reciprocal relationship between reading performance and phonemic awareness, and the reciprocal relationship between reading performance and spelling. The results revealed that reading performance predicted spelling after half a year of schooling, whilst productivity of writing predicted the development of reading performance during the first grade. Finally, Competent, Technical and Poor Reader groups were identified. Although group membership was relative stable with the Competent and Technical readers, the significant transitions between groups during the grades and the reduction in number of the Poor readers suggests that learning to read is a dynamic process. The findings of the present thesis suggest that the relationships between various literacy components and individually determined learning pathways of reading acquisition must be taken into account when planning balanced literacy instruction for both preschool and primary school children.

## YHTEENVETO

### Lukemaan oppiminen: vastavuoroiset prosessit ja yksilölliset oppimispolut

Lukemaan oppiminen on yksi tärkeimmistä ensimmäisellä luokalla opittavista taidoista. Tässä tutkimuksessa lukutaidosta käytetään tavanomaista laajempaa määritelmää, jonka mukaan lukutaito koostuu sekä alfabeettisesta sanojen dekodauksen taidosta että luetun ymmärtämisen taidoista lukutaidon yksinkertaisen mallin (*the simple view of reading*) mukaisesti (Gough & Tunmer 1986; Gough ym. 1996). Jos molemmissa tai vain toisessa taidossa on ongelmia, lukutaidon katsotaan olevan puutteellista. Vaikka lukutaidon oppiminen ja sen kehittyminen on pitkä prosessi, säännöllisten ortografioiden kuten suomen kielen sanojen lukemisen perustaidon oppiminen tapahtuu suhteellisen nopeasti ja kirjoitustaito opitaan rinnan lukutaidon kanssa.

Tämän tutkimuksen tarkoituksena oli löytää lukemaan oppimisen kannalta kriittisiä tekijöitä ensimmäisellä ja toisella luokalla. Tavoitteena oli tutkia: (1) mitkä koulutulokkaan taidot ennustavat lukutaidon kehitystä ensimmäisellä ja toisella luokalla, (2) millainen on foneemisen tietoisuuden ja lukutaidon kehityksen välinen suhde ensimmäisen luokan aikana, (3) millainen on lukutaidon ja kirjoitustaidon kehityksen välinen suhde ensimmäisen luokan aikana ja (4) millaisia lukutaidon oppimisen polkuja voidaan havaita ensimmäisen ja toisen luokan aikana.

Tutkimus koostuu neljästä artikkelista, jotka kaikki pohjautuvat ”Oppimisen ohjaaminen ja oppimisprosessit 1.–2. luokalla” -tutkimusprojektin aineistoon (Lerikkanen & Rasku-Puttonen 2003). Tutkimukseen osallistui 114 ensimmäisen luokan oppilasta (61 poikaa ja 53 tyttöä) neljästä keskisuomalaisesta koulusta kuudelta eri luokalta. Koska oppilaita oli poissa yhdestä tai useammasta mittauskerrasta, heidän määränsä vaihteli 83:sta 114:ään riippuen tutkitavasta ongelmasta. Koulun alkaessa oppilaiden ikä oli keskimäärin 7 vuotta 3 kuukautta ( $SD = 0.32$ ). Kaikki puhuivat äidinkielenään suomea ja lähes kaikki olivat saaneet vuoden esiopetusta ennen koulun alkua. Vanhempien koulutus-taso vastasi 25–49 -vuotiaiden suomalaisten keskimääräistä koulutustasoa.

Oppilaat testattiin heti koulun alkaessa ja sen jälkeen kuusi kertaa ensimmäisen ja toisen luokan aikana. Koulun aloitusviikolla elokuussa arvioitiin oppilaiden kirjaintuntemus (Poskiparta ym. 1994), lukutaito (Airo ym. 1985), visuaalis-motoriset taidot, käsitietoisuus ja kuullun ymmärtäminen (Liikanen 1994). Koulun alkaessa oppilaat tunnistivat keskimäärin 18 kirjainta 21:stä. Koulutulokkaiden lukutaitotestin (Airo ym. 1985) perusteella oppilaista 27 % luki sujuvasti, 34 % luki sanoja ja 39 % ei vielä lukenut lainkaan.

Luku- ja kirjoitustaidon kehitystä arvioitiin ensimmäisellä luokalla seitsemän viikon välein: lokakuun alussa, joulukuun alussa, tammikuun lopussa ja maaliskuussa. Tämän lisäksi testattiin foneemiset taidot kolme kertaa: loka-, joului- ja tammikuussa. Toisella luokalla lukutaitoa arvioitiin kaksi kertaa: joulukuussa ja maaliskuussa. Arviointiin käytettiin kahta oppituntia ensimmäisellä



luokalla. Ensimmäisellä tunnilla arvioitiin foneemisia taitoja sekä lukutaitoa ja toisella oppitunnilla arvioitiin kirjoitustaitoa. Toisella luokalla testit suoritettiin yhden oppitunnin aikana. Kunkin ryhmän luokanopettaja testasi omat oppilaansa.

Ensimmäisen luokan seurantatestit suunniteltiin yhteistyössä opettajien kanssa. Arviointitehtävät noudattivat opettajien käyttämää kirjainten ja äänteiden opettamisen järjestystä, joka oli kaikissa luokissa yhdenmukainen. Kaikki opettajat käyttivät lukemaan opettamisessa samaa kirjain-äänneperustaa lukemaan opettamisen menetelmää ja samaa aapistusta. Näin rakennetut testit osoittautuivat jälkikäteen luotettaviksi.

Lukutaitoa arvioitiin ensimmäisellä luokalla sanojen ja lauseiden lukemisen sekä luetun ymmärtämisen testeillä (Lerkkanen 1998a). Toisella luokalla käytettiin lauseiden lukemisen ja luetun ymmärtämisen ALLU-testejä (Lindeman 1998). Kirjoitustaitoa mitattiin saneluun pohjautuvan oikeinkirjoituksen (Poskiparta ym. 1994) ja kuvasta kirjoittamisen (tuottava kirjoittaminen) testeillä (Lerkkanen 1998b). Foneemien osaamista testattiin alkuäänteen ja loppuäänteen tunnistamisella (vrt. Poskiparta ym. 1994).

Aluksi selvitettiin, mitkä koulutulokkaiden taidoista ennustivat lukutaidon ja sen osataitojen kehitystä ensimmäisen ja toisen luokan aikana. Tulokset osoittivat, että osittain eri taidot ennustivat lukutaidon kehityksen eri vaihetta. Lukutaidon (sekä sanojen lukemisen että luetun ymmärtämisen) kehitystä ensimmäisen luokan syyslukukaudella ennustivat kirjaintuntemus, varhainen lukutaito ja kuullun ymmärtäminen. Tästä eteenpäin lukutaidon kehitystä ennustivat kuullun ymmärtäminen ja tietoisuus käsitteistä. Tulos tukee aikaisempien tutkimusten tuloksia, joiden mukaan koulutulokkaan kielellinen kehitys on pitkäaikainen lukutaidon kehityksen ennustaja (ks. Catts ym. 1999; de Jong & van der Leij 2002; Wagner ym. 1997).

Eri taidot ennustivat myös sanojen lukemisen ja luetun ymmärtämisen taitoja. Ensimmäisellä luokalla *sanojen lukemisen* kehitystä ennustivat kirjaintuntemus, kuullun ymmärtäminen ja visuaalis-motoriset taidot. Toisella luokalla sanojen *lukemisen sujuvuutta* ennustivat varhainen lukutaito ja kuullun ymmärtäminen. Lisäksi varhainen lukutaito ja kuullun ymmärtäminen ennustivat *luetun ymmärtämistä* ensimmäisellä ja toisella luokalla. Tulokset osoittivat, että kuullun ymmärtämisen taidot ovat keskeisiä myös sanojen lukemisen taidon kehittymisen kannalta eivätkä ainoastaan luetun ymmärtämisen ennustajina.

Lisäksi tulokset osoittivat, että sanojen lukemisen taito opitaan suomen kielessä hyvin nopeasti johtuen suomen kielen lähes täydellisestä kirjain-äännevastaavuudesta. Täysin lukutaidoton voi siirtyä hyvien lukijoiden ryhmään ensimmäisen kouluvuoden aikana. Toisaalta tulokset osoittivat, että luetun ymmärtämisen taidot, jotka muuttuivat vähemmän ensimmäisen ja toisen luokan aikana, olivat todennäköisesti latentteina taitoina olemassa jo ennen sanojen lukemisen taidon oppimista. Kun sanojen lukemisen taito opittiin, luetun ymmärtämisen taidot pääsivät myös esille. Tästä syystä varhaiset lukijat olivat lukutaidossaan muita edellä vain siihen saakka, kunnes lukutaidottomat oppi-

vat sanojen lukemisen taidon. Toisaalta varhainen lukutaito ennusti parempaa lukemisen sujuvuutta toisella luokalla.

Toiseksi selvitettiin, millainen on foneemisten taitojen ja lukutaidon kehityksen välinen suhde ensimmäisen luokan aikana. Tulosten perusteella voidaan todeta, että suomen kielessä foneeminen tietoisuus ja lukutaito edistävät toistensa kehittymistä ensimmäisen lukuvuoden aikana. Todennäköisesti suomen kielen säännönmukaisuus, hyvä kirjaintuntemus ja lasten nopea dekooodaustaidon oppiminen ovat yhteydessä siihen, että ensimmäisen luokan syksyn aikana pikemminkin lukutaito ennusti siirtymistä äänteiden erottelun taidossa hyvien ryhmään kuin päinvastoin. Toisaalta taas äänteiden erottelutaidon kehittyminen ensimmäisen luokan aikana tuki lasten siirtymistä hyvien lukijoiden ryhmään vuoden lopussa. Sen sijaan heikot foneemiset taidot ennustivat sijoittumista heikkojen lukijoiden ryhmään. Tulokset ovat yhtäpitäviä aikaisempien tutkimustulosten kanssa sekä foneemisten taitojen kehittymisestä lukutaidon harjoittelun myötä (Ehri 1989) että foneemisten taitojen ja lukutaidon vastavuoroisesta kehityksestä lukemaan opettamisen alettua (Ellis & Large 1988; Wagner ym. 1994) varsinkin silloin, kun lukemaan opettamisessa käytetään foneemeja.

Kolmanneksi selvitettiin lukutaidon ja kirjoitustaidon kehityksen välistä suhdetta ensimmäisen luokan aikana. Tulokset osoittivat, että lukutaito ja sanojen oikeinkirjoitustaito tukivat vastavuoroisesti toistensa kehitystä ensimmäisen luokan syyslukukauden ajan. Sen jälkeen lukutaito ennusti sanojen ja lauseiden oikeinkirjoituksen kehitystä. Jälkimmäinen tulos on yhtäpitävä aikaisempien tutkimustulosten kanssa: lukutaito edistää myöhempää oikeinkirjoitustaitoa (Boland 1993; Francis 1994; Juel 1988; Mäki ym. 2001). Sen sijaan suomalaisiin lukemaan opetusmenetelmiin sisältyvää oletusta lukutaidon ja kirjoitustaidon vastavuoroisesta kehityksestä opettelun alkuvaiheessa ei ole aikaisemmin todennettu. Todennäköisesti suomen kielen lähes täydellinen kirjainäännevastaavuus molempiin suuntiin edesauttaa luku- ja kirjoitustaidon alkuvaiheen vastavuoroista kehittymistä. Mielenkiintoinen tulos oli myös se, että tuottavan kirjoittamisen taito ennusti lukutaitoa koko ensimmäisen luokan ajan. Koska lukutaidon summamuuttuja painottui luetun ymmärtämiseen, voidaan todeta, että tuottava kirjoittaminen tuki erityisesti luetun ymmärtämisen kehittymistä. Näiden taitojen välisestä kehityksellisestä vuorovaikutuksesta ei ole juurikaan aikaisempaa tutkimusta. Kuitenkin tämän tutkimuksen tulosten pohjalta voidaan todeta, että kuvasta kirjoittamisen tehtävät mittasivat oppilaiden kirjallisesti tuottamaa kielellistä sujuvuutta ja sanavarastoa, joilla näyttäisi olevan yhteyttä lasten lukutaidon, erityisesti luetun ymmärtämisen taitojen, kehitykseen ensimmäisen luokan aikana.

Neljänneksi selvitettiin lukutaidon kehityksen yksilöllisiä polkuja. Ensiksi löydettiin kolme laadullisesti erilaista lukutaidon ryhmää, jotka erosivat sanojen lukemisen ja luetun ymmärtämisen taitojen suhteen selvästi toisistaan: kompetentit lukijat, tekniset lukijat ja heikot lukijat. Kompetentit lukijat lukivat sanoja hyvin ja ymmärsivät lukemaansa. Tekniset lukijat lukivat sanoja yhtä hyvin kuin kompetentit lukijat, mutta heillä oli ongelmia luetun ymmärtämisessä. Heikot lukijat olivat edellisiä heikompia sanojen lukemisessa ja yhtä

heikkoja kuin tekniset lukijat luetun ymmärtämisessä. Lisäksi tulokset osoittivat, että ryhmän jäsenyys oli suhteellisen pysyvää muissa paitsi heikkojen lukijoiden ryhmässä, joka pieneni selvästi mittausten edetessä. Simple view of reading -mallin mukaista neljättä lukutaidon ryhmää, heikot sanan lukemisen taidot ja hyvät luetun ymmärtämisen taidot (dyslektikot), ei tunnistettu. Tämän ryhmän varhainen tunnistaminen pelkästään lukutaitomuuttujien (sanojen lukeminen ja luetun ymmärtäminen) avulla on vielä ensimmäisellä luokalla vaikeaa, koska tämän ryhmän löytäminen vaatisi jonkinlaista perustaitoa sanojen lukemisessa, jotta hyvät luetun ymmärtämisen taidot pääsisivät esille.

Oppilaskohtainen tarkastelu osoitti, että oppimispolut olivat yksilöllisesti muotoutuneita ja oppilaiden lukutaidon suhteellisessa kehityksessä tapahtui jatkuvaa liikettä ryhmien välillä. Yksilöllisiä oppimispolkuja tarkasteltaessa voitiin erottaa seitsemän tyypillistä oppimispolkua: vakaa, hyppäyksenomainen, notkahtava, jaksoittain edistyvä, toiselle luokalle siirtymisen heikentämä, sahaava ja regressiivinen. Vaikka yleisellä tasolla lukutaitoryhmän jäsenyys oli suhteellisen pysyvää, niin yksilötasolla oli todennäköistä, että ryhmästä toiseen siirtymistä tapahtui joko parempaan tai heikompaan ryhmään jossakin kehityksen vaiheessa. Oppimisen etenemisen suhteellista regressiota voitiin selittää hitaalla sanojen lukemisen taidon oppimisella, heikoilla ymmärtämisen taidoilla jo koulun alkaessa, lukutaidon hitaalla kehitysvauhdilla tai lukutaidon tason kohonneilla vaatimuksilla. Näiden lisäksi ainakin motivaatiolla ja työskentelytavoilla oli yhteyttä lukutaidon etenemiseen. Tämän tutkimusprojektin yhteydessä kerätty aineisto on jo aikaisemmin osoittanut, että hyvä motivaatio ja tehtäväsuuntautunut käyttäytyminen olivat näillä lapsilla yhteydessä progressiiviseen lukutaidon kehitykseen, kun taas heikko motivaatio ja tehtävää välttävä käyttäytyminen ennustivat hidasta lukutaidon kehitystä (Aunola, Nurmi ym. 2002).

Tämän tutkimuksen tulokset antoivat viitteitä siitä, miten lukutaidon opetusta tulisi jatkossa kehittää. Ensinnä tulee pohtia mitä lukutaitoa ennustavia taitoja, missä vaiheessa ja millä tavoin niitä arvioidaan. Esimerkiksi kuullun ymmärtämisen taidot ennustivat lukutaidon kehitystä toisen luokan loppuun asti, kun taas kirjaintuntemus ennusti vain lukutaidon alkuvaihetta. Tämän tutkimuksen perusteella kielellisen kehityksen tukemiseen on syytä kiinnittää enemmän huomiota mahdollisimman varhain. Tästä syystä esi- ja alkuopetuksen tulee muodostaa jatkumo, jossa kielellisen kehityksen tukeminen ja lukutaidon opetus etenee lasten yksilöllisten tarpeiden mukaan luokkatasosta riippumatta.

Tulokset osoittivat myös sen, että foneemien käyttö lukemaan opettamisen yhteydessä edistää hyvän lukutaidon saavuttamista ensimmäisellä luokalla. Tästä syystä foneemisen tietoisuuden harjoittelua lukutaidon opetuksen yhteydessä tulisi jatkaa läpi ensimmäisen luokan, vaikka dekodeaustaito saavutettiin jo ensimmäisten koulukuukausien aikana. Samoin osoitettiin, että kirjoitustaidon opettelu lukemaan opettelun yhteydessä edistää molempien taitojen kehitystä. Erityisesti tulee lisätä tuottavan kirjoittamisen tehtäviä ensiluokkalaisten lukutaidon, erityisesti luetun ymmärtämisen, tukemiseksi.

Opettajan on syytä tunnistaa lukutaidon oppimisen yksilöllisiä oppimispolkuja, niihin liittyviä riskitekijöitä ja motivaation merkitystä oppimisen etenemiselle. On myös hyvä tiedostaa, että heikoilla aloittelijoilla on kaikki mahdollisuudet saada toisten lukutaidon taso kiinni kahden ensimmäisen luokan aikana. Kaiken kaikkiaan lukemaan opettaminen tulisi rakentaa enemmän yksilöllisiä tarpeita vastaavaksi esi- ja alkuopetuksen aikana.

Tulokset tukevat *tasapainoisen lukemaan opettamisen mallia*, jossa eri tekijöiden merkitys ja vastavuoroiset suhteet huomioidaan lukemaan opettamisen alusta lähtien. Tasapaino tulisi löytää kielellisen kehityksen tukemisen ja fonemien harjoittelun välillä lukemaan opetteluun yhteydessä, sanojen lukemisen ja luetun ymmärtämisen harjoittelun välillä sekä lukemisen ja kirjoittamisen harjoittelun välillä. Lukemaan opettamisen pedagogiikan kehittämiseksi tutkimusta on tarpeen suunnata erityisesti luku- ja kirjoitustaidon vastavuoroisten oppimisprosessien varhaisiin vaiheisiin. Jatkotutkimusten haasteena on lisäksi laajentaa tutkimusjoukkoa alueellisesti sekä kehittää edelleen arviointivälineitä luku- ja kirjoitustaidon oppimisen seurantaan.

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