Scandinavian Journal of Educational Research

ISSN: 0031-3831 (Print) 1470-1170 (Online) Journal homepage: https://www.tandfonline.com/loi/csje20

Screening for Slow Reading Acquisition in Norway and Finland – a Quest for Context Specific Predictors

Oddny Judith Solheim, Minna Torppa, Per Henning Uppstad & Marja-Kristiina Lerkkanen

To cite this article: Oddny Judith Solheim, Minna Torppa, Per Henning Uppstad & Marja-Kristiina Lerkkanen (2020): Screening for Slow Reading Acquisition in Norway and Finland – a Quest for Context Specific Predictors, Scandinavian Journal of Educational Research, DOI: 10.1080/00313831.2020.1739130

To link to this article: https://doi.org/10.1080/00313831.2020.1739130

Published online: 12 Mar 2020.

https://doi.org/10.1080/00313831.2020.1739130

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Screening for Slow Reading Acquisition in Norway and Finland – a Quest for Context Specific Predictors

Oddny Judith Solheim [a], Minna Torppa [b], Per Henning Uppstad [a] and Marja-Kristiina Lerkkanen [b]

[a]Norwegian Reading Centre, University of Stavanger, Stavanger, Norway; [b]Department of Teacher Education, University of Jyväskylä, Jyväskylä, Finland

ABSTRACT
Early identification of children at risk of developing reading difficulties is crucial for effective interventions. While orthographies and educational contexts differ, predictors included in early at-risk screening tend to remain rather homogeneous across countries. In this study, we compared longitudinal prediction patterns of being among the 20 percent lowest performing in reading fluency by the end of Grade 1 in Norway ($N = 918$) and Finland ($N = 378$). The two countries differ in orthographic consistency (semi-transparent versus transparent), age at school entry and pre-primary education. Letter knowledge, phoneme isolation and rapid automatized naming (RAN) were unique predictors in the Norwegian sample. Predictors in the Finnish sample were gender, phoneme blending, RAN, and reading status. The predictive model identified significantly more Finnish than Norwegian poor readers (46.2% versus 27.9%). The results suggest national screening instruments that are sensitive to educational context and orthography.

ARTICLE HISTORY
Received 24 April 2019
Accepted 12 January 2020

KEYWORDS
Reading difficulties; prediction; at-risk students; cross-linguistic comparison

1. Introduction

Studies carried out across a range of countries and educational contexts demonstrate that students who enter school with weak pre-reading skills run a high risk of being among the poorest readers at the end of the first year of school (Chapman & Tunmer, 1997; Eklund et al., 2013; Lerkkanen et al., 2004a; Torppa et al., 2017; Walgermo et al., 2018). Further, children who display poor reading skills during their first years of formal reading instruction run a high risk of remaining poor readers (Chard & Kameenui, 2000; Torppa et al., 2015). In the context of efforts to reduce this percentage, it has been found that – across different orthographies – at-risk students can benefit from intensive reading interventions carried out at an early stage (Scammacca et al., 2007; Solheim et al., 2018). In fact, interventions in Grade 1 seem to be more effective than later interventions (Lovett et al., 2017; Torgesen, 2002). Hence, it would seem to be a good idea not to wait for students to fail but to identify those at risk of having reading difficulties (RD) early on in their schooling, so that they may receive intensive support that will promote their skill development before they have extensive experience of struggling or failure.

However, early identification of students at risk of RD involves identifying students before they actually develop a problem with reading and even before they have received any formal reading

CONTACT Oddny Judith Solheim oddny.j.solheim@uis.no Norwegian Reading Centre, University of Stavanger, P.O. Box 8600 Forus, 4036 Stavanger, Norway

instruction at school. This means that screening instruments based on predictors of reading development and RD must be used. Fortunately, extensive research has been undertaken to understand the cognitive components underpinning reading. The main finding from this research is that a set of pre-reading skills predicts reading development across a range of alphabetic orthographies, even though prediction *patterns* may vary to some extent between orthographies (Caravolas et al., 2013; Georgiou et al., 2012; Landerl et al., 2013). Differences in prediction patterns have also been found between countries or regions owing to differences in the cultural and educational context, such as the extent to which parents tend to teach their children the letters before school entry, the age at school entry and the emphasis placed on the teaching of pre-literacy skills in early childhood education (Furnes & Samuelsson, 2011). Hence, the optimal set of at-risk predictors to be used at a specific point in time is likely to differ between countries. This study set out to explore such possible differences in at-risk predictors by comparing prediction patterns at school entry in two countries: Norway and Finland.

1.1 Predictors of RD

Several cognitive skills have been found to predict decoding ability, but the most frequently reported ones are phonological awareness (PA), letter knowledge and rapid automatized naming (RAN) (Furnes & Samuelsson, 2009; Hulme & Snowling, 2015). PA refers to the child's ability to categorize phonological units in spoken words, although it should be noted that the phonological units highlighted by different languages may vary (Goswami, 2001). According to Kilpatrick (2015), the development of PA can be divided into three phases: (i) Early/easy PA tasks include the ability to identify or suggest rhyming words and to identify the first sound of a spoken word. These skills typically develop in pre-schoolers. (ii) Basic PA tasks require awareness at the phoneme level (e.g., segmentation and blending) and typically develop throughout kindergarten and Grade 1. (iii) The most advanced forms of PA require manipulation of phonemes by excluding, replacing or reversing the order of phonemes and continues to develop beyond initial phases of learning to read. In the case of alphabetic writing systems, learning to read requires students to match graphemes to phonemes; hence the ability to perceive phonemes as (individual and) separate speech sounds is particularly strongly associated with reading success. To capture this aspect of PA, both phoneme-isolation and phoneme-blending tasks have been used for longitudinal prediction of word-reading ability (see e.g., Caravolas et al., 2013; Lundetræ & Thomson, 2017; Torppa et al., 2016). It is important to note that these two task types differ in the kind of awareness required: only implicit awareness is needed to identify the first or last sound of a word, but more explicit awareness is required to blend individual sounds into a spoken word (Kirby et al., 2008).

The other essential prerequisite for learning to read in an alphabetic language is knowledge of the letters (Georgiou et al., 2012). In the case of a language with a consistent orthography, in which letter names and sounds largely overlap, children with PA difficulties may derive a particularly strong benefit from knowing the letters when learning to read (Lerkkanen et al., 2004a). Like PA, letter knowledge can be assessed at various difficulty levels. The easiest tasks merely involve the recognition of letters, while more difficult ones involve the recall of letter names and/or letter sounds. Further, since beginning readers – both before and at school – tend to learn upper-case letters before lower-case ones, letter tasks involving the former tend to be easier than those involving the latter.

RAN refers to the ability to name, as quickly as possible, an array of highly familiar visual stimuli presented on a single page (Denckla & Rudel, 1974). While the reasons for the predictive power of the first two skill types discussed above are rather self-evident, it is still not fully understood, despite substantial research efforts over the past few decades, how RAN relates to reading and spelling (e.g., Georgiou et al., 2013). However, a series of studies have shown that RAN is associated with reading development both concurrently and prospectively (for a review, see Georgiou & Parrila, 2013). While PA has been found to be more closely related to reading accuracy, RAN seems to be more strongly related to reading speed/word-reading fluency (Landerl & Wimmer, 2008; Torppa et al., 2013).

The three predictors discussed so far are clearly "pre-reading" skills. However, as soon as children begin to learn how to read, their current reading level will in itself be the best predictor of their future reading skill (Eklund et al., 2018; Furnes & Samuelsson, 2011). For Norwegian (Lervåg et al., 2009) and Finnish (Lerkkanen et al., 2004b) children, this pattern (i.e., current reading level as the best predictor) is already evident three months into formal reading instruction. Consequently, if a significant proportion of students already know how to read when they start Grade 1, the accuracy of at-risk identification might be enhanced if measures of actual reading are also included as predictors. This might be especially relevant in transparent orthographies, which make it easy to learn how to read accurately at a young age, even without formal instruction (Seymour et al., 2003). Finally, another factor that has been found to increase the likelihood of developing RD is having close relatives with a history of RD (Eklund et al., 2015; Lundetræ & Thomson, 2017; Torppa et al., 2011).

1.2 Prediction Across Orthographies

The pre-reading skills discussed above have been found to predict word-reading development across a range of different alphabetical orthographies (Caravolas et al., 2012), but the transparency of orthographies has been found to affect prediction *patterns* (Caravolas et al., 2013; Lyytinen et al., 2015). This is, in all likelihood, because it is easier to learn how to read in orthographies that reflect a transparent relationship between phonemes and graphemes (e.g., Finnish or Spanish) than languages where that relationship is more opaque (e.g., English) (Caravolas et al., 2013; Seymour et al., 2003). Most students encountering transparent orthographies will read high-frequency words accurately within their first year of schooling, while students faced with opaque orthographies often continue to struggle with reading accuracy beyond Grade 1 (Seymour et al., 2003). In line with this, PA seems to be a sensitive predictor over a longer time window in opaque orthographies. For example, Furnes and Samuelsson (2010) studied prediction from pre-school through Grade 2 in two samples: students learning to read in Norwegian or Swedish (semi-transparent orthographies) and students learning to read in English (opaque orthography). Their findings show that PA as a predictor of RD was temporally limited to Grade 1 for Norwegian and Swedish but remained a unique significant predictor throughout the study period for English. By contrast, RAN – which is more strongly associated with reading fluency – was a significant predictor in both samples in both Grade 1 and Grade 2. A similar pattern has been found for Finnish (transparent orthography). For instance, Holopainen et al. (2001) found that RAN but not PA predicted reading fluency at the end of Grade 2.

1.3 Learning to Read in the Norwegian and Finnish Contexts

The present study concerns first-graders in Norway and Finland, where the principal languages are Norwegian and Finnish, respectively. Seymour et al. (2003) place Finnish at the extreme transparent end of the scale of orthographic transparency while Norwegian is classified as having a semi-transparent orthography. A transparent orthography has consistent pairings of phonemes and graphemes whereas an opaque one has multiple connections, spelling and recoding rules, and exceptions to the rules. The simple mapping of graphemes onto phonemes and vice versa found in a transparent orthography makes learning to read and write less of a challenge.

While both of the orthographies relevant here can thus be found towards the transparent end of the orthographic-depth continuum, there are also many differences between Finnish and Norwegian in this respect. For example, the Norwegian rule for representing vowel quantity in writing is more demanding than the Finnish one, which is more direct (Uppstad & Solheim, 2007).

The educational systems of Norway and Finland also share certain traits but differ in others. By the age of three, 97 per cent of Norwegian children attend the *barnehage*, a government-certified early-childhood educational programme, for 35 h a week (Norwegian Directorate for Education and Training, 2018). The Norwegian *barnehage* differs from early-childhood education in many other countries in that it does not aim for specific behavioural outcomes or daily time allocations

(OECD, 2013). Literacy activities are promoted through authentic literacy experiences within a child-centred environment. Children start Grade 1 in the autumn of the calendar year during which they turn six. The education provided builds on the principle of equal and adapted education in an inclusive environment, based on a single national curriculum (Ministry of Education and Research, 2018). Within the framework of statutes and national curricula, teachers are free to choose learning materials and teaching methods.

To guarantee the right to an adapted education, the Education Act obliges municipalities (which are in charge of education) to ensure a particularly high teacher–student ratio in the subjects of Norwegian and mathematics in Grades 1–4 (Education Act, 1998). It is explicitly stated that additional teaching resources should be specifically targeted towards low-performing students, but there is little tradition of carrying out early intensive interventions targeting students who enter school with limited pre-reading skills. In practice, a wait-for-failure approach has been widespread (Lundetræ & Gabrielsen, 2017).

Few studies have investigated Norwegian children's (pre-) reading skills at school entry. However, two recent studies provide some insight. Sigmundsson et al. (2017) found that, on average, children could name fewer than half of both the upper-case and lower-case letters of the Norwegian alphabet at school entry. McTigue et al. (2020) found that most students could recognize the upper-case letters, but that very few students were readers at school entry. In both studies, there was a great deal of variation in student skills.

In Finland, like in Norway, comprehensive school offers equal and adapted education in an inclusive environment based on a single national curriculum. However, Finnish children start school in the year when they turn seven, which is one year later than in Norway. Before school entry, all children attend pre-primary education for six-year-olds, which aims to prepare children for formal schooling but lacks systematic academic instruction (Finnish National Agency for Education, 2014). Hence, although it is emphasized in the Finnish curriculum for pre-primary education that it should lay the foundation for literacy skills, reading is not explicitly taught. Instead, children's emerging literacy skills are supported by playful activities and an environment that promotes their language development and awakens their interest in letters and language sounds. Although Finnish children are not given any systematic reading instruction in pre-primary education, about 30 per cent of school starters read fluently and another 30 per cent can decode some words (Soodla et al., 2015). Moreover, the vast majority of Finnish children learn to decode during the first months of Grade 1 (Lerkkanen et al., 2004b). Because of the transparent orthography of Finnish, RD typically manifest themselves as difficulties with fluency rather than with accuracy, and Finnish teachers tend to see poor fluency as the best indicator that a student may be at risk of RD.

In Finland, special support services for students with RD are provided without diagnosis and as part of students' general education, using a response-to-intervention (RTI) framework (Björn et al., 2016). There are three tiers of support, which may target either a student's overall learning or reading skills only. Tier 1 refers to general support for students in need of occasional help in their regular classroom, Tier 2 involves intensified support (part-time special education) over a longer period and in small groups, and Tier 3 is for students who mainly use individualized education plans (IEPs) in one or several subjects. The most effective support for students with RD seems to be part-time special education in small groups (i.e., Tier 2) during Grades 1 and 2 (Holopainen et al., 2018). However, recent studies (e.g., Virinkoski et al., 2017) have shown that teachers had failed to identify a number of children who, judging from their Grade 1 test scores, needed support for their reading development. This observation suggests a need for further studies.

1.4 The Present Study

Against the above background, it could be hypothesized that the optimal set of predictors to be included in a screening test to identify students at risk of developing RD administered at school entry could vary across countries depending on both (i) the orthography to be learned and (ii) the level of students' pre-reading and reading skills at school entry (i.e., if students already know how to read, their current reading level will be the best predictor). In the present study, we examine and compare predictors and the accuracy of prediction in two countries at a point in time crucial for the administration of early intervention, namely school entry. The differences that may exist between those countries and between their school systems (including in terms of age and skill level at school entry as well as the characteristics of the respective orthographic systems) can be viewed as problematic for this type of comparison. The rationale for carrying out such analyses despite those problems is that there is a need for research that can inform teachers and assist at-risk identification in practice. In a sense, rather than regretting that reality fails to match our carefully crafted map, we try to gather information that will help us draw a map which reflects reality better. For reasons of practical relevance, the potential predictors chosen for the study are measures that teachers can easily obtain and assess. The following research questions and hypotheses have guided the present study:

(1) *Do the same predictors contribute to prospective classification of poor reading fluency by the end of Grade 1 in samples of Norwegian and Finnish school starters?*

    Based on previous research into predictors of RD, we expected that PA, letter knowledge, RAN and familial risk of RD would be unique predictors in both samples. Further, as previous research indicates that many Finnish school starters already know how to read, we also expected reading status (early reader versus non-reader) to be a unique predictor in the Finnish sample.

(2) *Does the percentage of correctly classified poor readers differ between the Norwegian and Finnish samples?* Based on the assumption that higher levels of pre-reading and word-reading skills at school entry will yield a more accurate at-risk classification, we expected the percentage of correctly identified at-risk students to be higher in the Finnish sample than in the Norwegian one.

2. Method

2.1 Participants

2.1.1 Norwegian Sample

The Norwegian data were collected as part of a randomized controlled trial called "Two Teachers", which had a consent rate of 96.1 per cent. The students included in the present study all come from classrooms randomized to the control condition in Two Teachers, meaning that they did not receive any treatment as part of their participation in that study (for the Two Teachers` projects experimental protocol, see, Solheim et al., 2017). The present sample comprises 918 first-grade students (46.3% girls) from 51 classrooms at 51 different schools in the southern part of Norway. Mean age at school entry was 6.15 years.

2.1.2. Finnish Sample

The Finnish sample consisted of a random subsample of 378 first-grade students (48.1% girls) from 99 schools who participated in an extensive follow-up across pre-primary education and primary school of 1,880 children ("First Steps" study; Lerkkanen et al., 2006-2016). The subsample was followed more intensively than the full sample and was created by selecting 1–4 ($M = 2.5$) children from each classroom (number of children varying by the size of the classroom). The data were collected from three medium-sized towns and one municipality: two in Central Finland, one in Western Finland and one in Eastern Finland. The mean age at school entry of the children in the present study was 7.2 years.

2.2 Procedure

In Norway, data for all measures were collected by trained research assistants in a one-on-one setting. The assessments were carried out in a private location outside the classroom at each student's school. The first assessment took place during the first three weeks of formal schooling in Grade 1 (August/September 2016). At this time point, all students were assessed for first-phoneme isolation, phoneme blending, letter recognition, RAN and word reading. Towards the end of Grade 1 (e.g., May/June 2017), students were assessed for timed word reading.

In Finland, data for all measures were also collected by trained research assistants, either in a one-on-one setting outside the classroom or in the classroom as a group-administered test. RAN was assessed individually at the end of pre-primary education (April 2007). Letter knowledge and word-reading accuracy were assessed individually, and PA was assessed through a group test, at the beginning of Grade 1 (September 2007). Finally, at the end of Grade 1 (April 2008), students were assessed in a one-on-one setting with regard to a timed word-reading fluency test.

In both samples, information about familial risk of RD was collected through questionnaires administered to parents. In Finland, information about the mother's level of education was collected by questionnaire; the information about the Norwegian mothers' level of education was collected via Statistics Norway, the national statistics agency.

2.3 Measures

2.3.1 Measures Before or at the Start of Grade 1

2.3.1.1. *First-phoneme Isolation.* In Norway, the students were required to isolate and pronounce the first sound of ten monosyllabic words representing common objects. Each item consisted of a picture. The tester pointed to the picture, named the object and asked the student to give the first sound of the word (e.g., "This is a ball. What is the first sound in *ball*?"). Students responded orally. The items were ordered by difficulty (easiest first) and the test was automatically discontinued if the student made two subsequent errors. The measure consisted of the raw sum score for the ten items. Reliability (Cronbach's alpha) was .93.

In Finland, the students were first shown four pictures of objects that were named by the tester. Then the tester presented a phoneme orally and asked the students to identify the picture representing a word beginning with that phoneme (ARMI test battery; Lerkkanen et al., 2006). The measure consisted of the sum score based on the number of correct items. Cronbach's alpha was .74.

The raw sum scores for first-phoneme isolation were used for correlations between measures. In both samples, the scale score was recoded into a binary variable for the logistic regressions due to the U-shaped distribution in the Norwegian sample (see Section 3.1 "Preliminary Data Analysis"). The binary variable split the distribution at the 50th percentile.

2.3.1.2. *Phoneme Blending.* In the Norwegian sample, the phoneme-blending task required students to blend a sequence of phonemes presented (in correct order) to them into a word. The stimuli were pre-recorded to ensure that the pronunciation of the phonemes and the time interval between them (one phoneme per second) would be consistent across presentations. The test included ten words consisting of between two and seven phonemes which were ordered by difficulty (easiest first). It was automatically discontinued if the student made two subsequent errors. The measure consisted of the raw sum score for the ten items. Cronbach's alpha was .91.

In Finland, the students were first shown four pictures of objects. Then the tester pronounced a word phoneme by phoneme. The students had to recognize the resulting word and select the correct picture (Poskiparta et al., 1994). The measure consisted of the sum score based on the number of correct items. Cronbach's alpha was .73.

2.3.1.3. *Letter Knowledge.* In Norway, letter knowledge was measured using a letter-recognition test. The stimulus was a pre-recorded letter sound, and the student was asked to identify the corresponding letter among four upper-case letters. The test consisted of 24 items (all letters of the alphabet except those used only in English loan-words (*c*, *q*, *w*, *x*, *z*) were targets, presented in random order) and the raw score was used. Cronbach's alpha was .90.

In Finland, a letter-naming test was used instead (Lerkkanen et al., 2006). The tester showed the student 23 upper-case letters in random order (again all letters of the alphabet except those occurring only in English loan-words) and asked him or her to name each letter. The raw score was used. Cronbach's alpha was .70.

2.3.1.4. *Rapid Automatized Naming (RAN).*
RAN requires the naming of familiar objects presented simultaneously in random order. In both countries, the students were asked to name each stimulus as quickly and accurately as possible, working from left to right and from top to bottom. A practice session was carried out to ensure that the students were able to name all of the objects. In the Norwegian RAN test, the stimuli were illustrations of the monosyllabic words for "sun", "car", "aeroplane", "house", "fish", and "ball". Twenty stimuli were presented in a four-by-five matrix. In the Finnish RAN test, the stimuli were illustrations of the bisyllabic words for "pencil", "car", "house", "fish", and "ball". Fifty stimuli were presented in a ten-by-five matrix. For each trial, the completion time (in 1/100ths of a second) was recorded; the measure used was the sum of completion times across the two trials. Note that in the Finnish sample, the data were collected three months before school entry, at the end of pre-primary education.

2.3.1.5. *Word Reading.*
In both countries, students were asked to read written words, presented to them one at a time, aloud without a time limit. The words were written in upper-case letters, and they were ordered by difficulty (easiest first). If the student managed to decode a word, the tester scored it as correct.

The Norwegian assessment included eight words consisting of one or two syllables representing a variety of letters and letter sequences (CV, VC, CVC, VCC, VCC, CVCV, CVCC, CVCVC). The test was automatically discontinued if the student made two subsequent errors. Cronbach's alpha was .93.

In Finland, the decoding test (Lerkkanen et al., 2006) included ten increasingly difficult words consisting of two to five syllables. The words represented various letter sequences (CVC, CVCV, VVCV, CVCCV, CVCVV, CVVCVC, VCCVCV, CVCCVC, CVCCVCV, CVCVCCVVCCVCV). Cronbach's alpha was .94.

The raw sum scores for word-reading accuracy were used for correlations between school-entry measures. For the logistic regressions, however, the scale score was recoded into a binary variable of reading status (early reader versus non-reader). Given that many students recognized only the first word, which was a very easy one, the cut-off for status as an early reader was defined as being able to read two or more words correctly at school entry.

2.3.1.6. *Familial Risk of Reading Difficulties (RD).*
In both countries, information about familial risk of RD was collected through a questionnaire administered to parents. Familial risk was deemed to be present where parents had reported the existence of at least one close relative (mother, father or sibling) with RD. This self-report measure has previously proven to be a valid and reliable way of collecting information about parents' RD (Esmaeeli et al., 2018). Parents of 20.1 per cent of the students in the Norwegian sample reported that their child's mother, father or both had experienced RD. In the Finnish sample, 28.3 per cent of all parents reported that their child's mother, father or both had experienced RD.

2.3.1.7. *Socio-economic Status (SES), Operationalized as the Mother's Educational Level.*
In the Norwegian sample, information about the educational level of the students' mothers was collected from Statistics Norway. In Finland, the information was gathered from the parents through a questionnaire. For both countries, the classification of educational level is based on the International Standard Classification of Education (ISCED).

2.3.2. Measures at the End of Grade 1

As the majority of students in transparent orthographies will read almost 100 per cent accurately by the end of Grade 1, we used a measure of timed word reading to capture automaticity in word recognition (see also Torppa et al., 2016). To be able to test the predictive power of our various measures, we needed to define the category of "poor readers by the end of Grade 1". It was decided to define this as the 20 per cent of students who obtained the lowest scores on reading fluency.

2.3.2.1. Reading Fluency. In Norway, the students performed a Norwegian version of the Sight Word Efficiency sub-test (paper scheme A) from the Test of Word Reading Efficacy (TOWRE) (Torgesen et al., 1999). The students were given a list of printed words and told to read aloud as many of them as possible in 45 s. The cut-off was set at reading 13 words or fewer; those scoring 13 or less made up 19.5 per cent of the sample. In Finland, a similar task was administered from a Finnish normed reading-test battery (Häyrinen et al., 1999). The students were given a list of printed words and told to read aloud as many of them as possible in 45 s. The tester registered the number of correct words. The cut-off was set at reading 18 words or fewer; those scoring 18 or less made up 21.2 per cent of the sample.

2.4 Analytic Strategy

As mentioned above, poor readers were identified based on their reading fluency at the end of Grade 1, using a 20th-percentile cut-off. Logistic regression analyses were conducted to predict outcomes at the end of Grade 1 (poor readers versus other students) based on school-entry pre-reading and reading skills, familial risk, and gender.

3. Results

3.1 Preliminary Data Analysis

To begin with, the distributional properties of the various measures used in the study were examined. All of those measures along with means, standard deviations and minimum and maximum values are reported in Tables 1 and 2. In the Norwegian sample, there was a tendency towards a negatively skewed distribution for letter knowledge, the distribution for first-phoneme isolation was U-shaped, and those for phoneme blending and word reading were positively skewed. In the Finnish sample, letter knowledge and first-phoneme isolation had negatively skewed distributions. RAN was normally distributed in both samples.

Correlations between the various measures are reported in Table 3 for the Norwegian sample and in Table 4 for the Finnish sample. We report Pearson's r for correlations involving familial risk or gender (dichotomous x dichotomous variables and dichotomous x continuous variables). For correlations between pre-reading and reading measures (continuous variables), we report Spearman's rho as several of these variables had skewed distributions. Note that RAN correlates negatively with the other measures because a higher RAN score reflects worse performance (i.e., more time required to complete the two matrices).

Table 1. Descriptive statistics for measures in the Norwegian sample.

	Potential range	Actual range	Mean	SD
Phoneme isolation (T1)	0–10	0–10	5.37	3.71
Phoneme blending (T1)	0–10	0–10	1.83	2.72
Letter knowledge (T1)	0–24	0–24	16.61	6.03
RAN (T1)	n/a	21–144	60.96	15.84
Word reading (T1)	0–8	0–8	2.42	2.80
Reading fluency (T2)	0–104	0–71	22.50	10.91

Table 2. Descriptive statistics for measures in the Finnish sample.

	Potential range	Actual range	Mean	SD
Phoneme isolation (T1)	0–10	3–10	9.40	1.24
Phoneme blending (T1)	0–10	2–10	7.72	1.62
Letter knowledge (T1)	0–23	03–23	20.70	3.86
RAN (T1)	n/a	40–150	68.93	16.49
Word reading (T1)	0–10	0–10	5.65	4.31
Reading fluency (T2)	0–90	0–66	28.20	12.04

Table 3. Correlations for the Norwegian sample.

		1.	2.	3.	4.	5.	6.	7.	8.
1.	Gender	1							
2.	Familial risk	.004	1						
3.	Phoneme isolation (T1)	−.13***	−.08*	1					
4.	Phoneme blending (T1)	−.11***	−.09**	.64***	1				
5.	Letter knowledge (T1)	−.14***	−.11**	.58***	.56***	1			
6.	RAN (T1)	.06	.03	−.33***	−.30***	−.34***	1		
7.	Word reading (T1)	−.16***	−.11**	.64***	.69***	.64***	−.34***	1	
8.	Reading fluency (T2)	−.03	−.14***	.37***	.36***	.45* **	−.39***	.45***	1

Note: *$p < .05$; **$p < .01$; *** $p < .001$(two-tailed). For Word reading (T1) and Phonemic isolation (T1), sum scores are used.

Table 4. Correlations for the Finnish sample.

		1.	2.	3.	4.	5.	6.	7.	8.
1.	Gender	1							
2.	Familial risk	−.17**	1						
3.	Phoneme isolation (T1)	.21***	−.13*	1					
4.	Phoneme blending (T1)	.20***	−.17**	.47***	1				
5.	Letter knowledge (T1)	.20**	−.14**	.52***	.57***	1			
6.	RAN (T1)	−.09	.10	−.27***	−.32***	−.38***	1		
7.	Word reading (T1)	.22***	−.17**	.49***	.60***	.76***	−.35***	1	
8.	Reading fluency (T2)	.18**	−.20***	.42***	.48***	.61***	−.42***	.71***	1

Note: *$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed). For Word reading (T1) and Phonemic isolation (T1), sum scores are used.

3.2 Prediction of Poor Reading by the End of Grade 1

In a multivariate logistic regression analysis to predict poor reading fluency (i.e., low scores on time-limited word-list reading) at the end of Grade 1, the following variables served as predictors: gender, familial risk of RD, first-phoneme isolation, phoneme blending, letter knowledge, RAN, and reading status (i.e., early reader versus non-reader).

First, a series of *t*-tests were carried out to investigate group differences in pre-reading and word-reading skills at school entry between students below and above the cut-off point for reading fluency by the end of Grade 1. Significant group differences in pre-reading and word-reading skills were found for all predictors in both samples (see Tables 5 and 6).

In the logistic regressions, all variables were entered simultaneously in the model and the unique variance was calculated for each predictor. The logistic regression analysis provided models that fitted the data well. In the Norwegian sample, χ^2 (7, $N = 891$) was 190.54, $p < .001$, and the model explained 30.8 per cent of the variance (Nagelkerke R^2) in poor word reading at the end of Grade 1. In the Finnish sample, χ^2 (7, $N = 358$) was 112.39, $p < .001$, and the model explained 41.5 per cent of the variance (Nagelkerke R^2) in word reading by the end of Grade 1.

Different sets of significant predictors of poor word reading were found in the two samples: the significant predictors in the Norwegian sample were letter knowledge, first-phoneme isolation and RAN while those in the Finnish sample were gender, phoneme blending, RAN, and reading status (see Table 7). It should be noted that familial risk was not a predictor in either sample while RAN was a unique predictor in both samples. The other measures were unique predictors in only one of the samples.

Table 5. Mean scores for Norwegian students scoring below ($n = 177$) and above ($n = 732$) the 20th percentile, respectively, on timed reading at the end of Grade 1.

	Reading fluency below 20th percentile	SD	Reading fluency above 20th percentile	SD	df	$t(907)$	Cohen's D
T1 Phoneme isolation	3.00	3.21	5.95	3.60	292.71	10.72***	0.86
T1 Phoneme blending	0.58	1.50	2.13	2.86	523.21	10.06***	0.77
T1 Letter knowledge	12.66	5.19	17.60	5.81	292.24	11.11***	0.90
T1 RAN	72.69	19.65	58.10	13.28	216.45	−9.39***	0.87
T1 Word reading	0.79	1.27	2.82	2.92	656.33	14.25***	0.90
T2 Reading fluency	8.91	3.78	25.79	9.43	723,552	37.78***	2.35

Note: *** = tests statistic significant at the $p = .001$ level (two-tailed).

Table 6. Mean scores for Finnish students scoring below ($n = 80$) and above ($n = 289$) the 20th percentile, respectively, on timed reading at the end of Grade 1.

	Reading fluency below 20th percentile	SD	Reading fluency above 20th percentile	SD	df	t(359–365)	Cohen's D
T1 Phoneme isolation	8.45	2.00	9.65	0.78	83.40	5.20***	0.79
T1 Phoneme blending	6.45	1.69	8.06	1.43	109.11	7.69***	1.03
T1 Letter knowledge	17.21	5.22	21.66	2.71	88.71	7.28***	1.07
T1 RAN	77.52	15.78	66.49	15.63	365.00	−5.54***	−0.70
T1 Word reading	1.40	2.34	6.81	3.98	212.21	15.24***	1.66
T2 Reading fluency	11.85	5.48	32.72	9.07	211.30	25.70***	2.79

Note: *** = tests statistic significant at the $p = .001$ level (two-tailed).

Table 7. Logistic regressions for students scoring below the 20th percentile on timed word reading by the end of Grade 1.

	Norway					Finland				
	B	s.e. B	OR	95% CI for OR	R^2	B	s.e. B	OR	95% CI for OR	R^2
Gender	0.239	0.200	1.270	0.858–1.879	0.2	−0.755	0.338	0.470*	0.242–0.911	1.1
Familial risk	0.434	0.222	1.554	0.998–2.387	0.9	0.005	0.338	1.005	0.518–1.952	−0.4
Phoneme isolation	0.562	0.248	1.754*	1.078–2.853	0.8	−0.094	0.368	1.098	0.534–2.259	−0.2
Phoneme blending	−0.025	0.070	0.975	0.851–1.119	-	−0.232	0.099	0.793*	0.653–0.963	1.1
Letter knowledge	−0.082	0.019	0.922***	0.888–0.957	2.7	−0.084	0.046	0.910	0.831–0.997	0.6
RAN	0.045	0.006	1.046***	1.033–1.059	9.0	0.026	0.009	1.026**	1.007–1.045	1.8
Reading status	0.532	0.313	1.703	0.922–3.146	0.5	1.450	0.384	4.261***	2.010–9.036	4.2

Note: *$p < .05$; **$p < .01$; ***$p < .001$; s.e. = standard error; OR = odds ratio.

3.4 Comparison of Predictive Accuracy

The two samples were compared with respect to how well a model (encompassing all measures) could correctly identify students who would be poor readers by the end of Grade 1 based on their scores at (or before) school entry. Table 8 shows, for the two samples, the number of identified prospective poor readers (true positives) from a model including gender, familial risk of RD, first-phoneme isolation, phoneme blending, letter knowledge, RAN, and reading status. The model correctly classified a significantly larger proportion of Finnish than Norwegian prospective poor readers (true positive rate): 46.2 versus 27.9 per cent; difference = 18.3 percentage points, $\chi^2 = 40.377$, $df = 1$, p <.01. By contrast, the true negative rate (i.e., proportion of students correctly identified by the model as becoming good readers) was significantly lower in the Finnish than in the Norwegian sample (91.4% versus 96.7%, difference = 5.3 percentage points, $\chi^2 = 16.299$, $df = 1$, $p < .01$).

Table 8. Number of true positives, false negatives, false positives and true negatives (true positive rate, false negative rate, false positive rate and true negative rate in parenthesis).

			Predicted by model	
			Poor reader	Not poor reader
Observed in sample	Norway	Poor reader	48 (27.9)	124 (72.1)
		Not poor reader	24 (3.3)	695 (96.7)
	Finland	Poor reader	36 (46.2)	42 (53.8)
		Not poor reader	24 (8.6)	256 (91.4)

4. Discussion

The aims of the present study were, first, to investigate whether school-entry predictors contributed to prospective classification of poor reading fluency by the end of Grade 1 in samples of Norwegian and Finnish students; and, second, to investigate whether the percentage of correctly classified poor readers differed between the two samples.

With regard to the first research question, we hypothesized that PA, letter knowledge, RAN, and familial risk of RD would be unique predictors in both samples and that reading status would be an additional predictor in the Finnish sample. This hypothesis was only partly confirmed: in the Norwegian sample, first-phoneme isolation, letter knowledge and RAN were found to be unique predictors of poor reading, while gender, phoneme blending, RAN, and reading status were found to be unique predictors of poor reading in the Finnish sample. The only measure, which was a unique predictor in both samples, was RAN. In previous studies of prospective prediction relating to transparent orthographies, RAN also proved to be a better long-term predictor than PA, especially for measures of reading fluency (Georgiou et al., 2013; Landerl & Wimmer, 2008). This should be added that it has been found that RAN is less likely to be influenced by instruction than the other skills measured at school entry (Norton & Wolf, 2012).

The skills that are usually mastered earlier (i.e., first-phoneme isolation and letter knowledge) were better predictors in the Norwegian sample while more demanding tasks (phoneme blending and word-reading accuracy) had greater predictive power in the Finnish sample. These differences are probably due to the fact that, Finnish students were one year older at school entry and, on average, had stronger pre-reading and decoding skills at school entry than Norwegian students did. A further observation confirming this is that first-phoneme isolation but not phoneme blending predicted poor reading in the Norwegian sample whereas the opposite was true for the Finnish sample. As previously noted, first-phoneme isolation is an easier PA task and likely to have been mastered at an earlier stage of PA development than phoneme blending. The differences between the samples with regard to letter knowledge (a unique predictor only in the Norwegian sample) and reading status (a unique predictor only in the Finnish sample) reflect a similar situation. The ceiling effect observed in the Finnish sample for letter knowledge probably reduced its predictive value for identifying at-risk students. Hence, the differences between the samples could be ascribed to the higher level of pre-reading skills found among the Finnish students.

Gender was a unique predictor only in the Finnish sample, where a smaller proportion of all girls (13%) than of all boys (30%) were poor readers. Similar gender differences have been reported repeatedly in the PISA reading assessments of 15-year-old students, and one of the largest gender differences found in the PISA reading data in fact relates to Finnish students (OECD, 2016). Although the present study provides no explanation for this gender difference, it is interesting to note that it can be observed as early as in Grade 1. This issue clearly requires further research. One possible explanation might be gender differences in motivation for literacy activities, which can be observed even in pre-primary education (Lerkkanen et al., 2012).

Familial risk did not predict poor reading fluency by the end of Grade 1 in either of the samples. This finding seemingly contradicts a large body of previous research that has found familial risk to increase the risk for reading disability (Snowling & Melby-Lervåg, 2016). However, one possible explanation for the non-exciting predictive value of familial risk in the present study might be that the effect of familial risk was mediated by pre-reading and reading skills. Another possibility is that the self-report measure of parental RD used was not sensitive enough to capture family risk accurately.

When it comes to our second research question, we hypothesized that at-risk classification would be more accurate in the Finnish sample than in the Norwegian one. This hypothesis was confirmed: the proportion of correctly identified poor readers was 46.2 per cent in the Finnish sample versus 27.9 per cent in the Norwegian one.

At an overall level, we interpret both the differences found between the samples in the predictive power of PA, letter knowledge and reading status and the higher proportion of correctly identified poor readers in the Finnish sample as primarily reflecting the students' level of skills at a specific point in time (i.e., at school entry) rather than reflecting a difference between the two orthographies as such. The higher literacy skill level at school entry in the Finnish sample probably causes better longitudinal stability in reading (see Tables 3 and 4) and consequently better prediction of poor readers. In Norway on the other hand, literacy skills and longitudinal stability are lower, indicating more randomness in who has acquired reading skills and not. This indicates that students with good prerequisites for learning can start school with low literacy skills because they have not yet been interested in letters or nobody has introduced letters to them. Once all students get equal access to formal instruction in Grade 1 students who enter school with low literacy skills primarily due to lack of stimulation can be expected to have more rapid progress than students whose low literacy skills is connected to e.g., genetic disposition. Following from this reasoning, longitudinal stability and prediction of poor readeing among Norwegian first graders could be expected to be higher if students were assessed some months months into Grade 1. This interpretation is supported by previous research that has found that heritability increases when instruction is intensified (Samuelsson et al., 2008).

The differences in pre-reading and reading skills at school entry found in this study could have different origins. First, the Finnish school starters included in the present study were, on average, one year older than the Norwegian ones. It is a well-established fact that PA tends to increase with age (Goswami, 2001). Second, the orthography that Finnish children learn is even more transparent than the one encountered by Norwegian children. Previous research has found that transparent orthographies make it is easier to become phonologically aware of word units (Katz & Frost, 1992). Finally, we cannot rule out the possibility that, to some extent, the differences originate in the students' literacy environment (whether parents tend to support their children's acquisition of letter knowledge and reading skills) and/or in the practices of early childhood education (whether there is a strong focus on emerging literacy skills). However, it is beyond the scope of the present study to confirm or dismiss any such explanations.

4.1. *Implications for Practice*

From the perspective of students, early identification of their risk of RD makes sense only when intensive support is provided. Otherwise, the principal results are likely to be expectations of failure. Further, it is important to determine whether identification at such an early stage as school entry is worthwhile, given that numbers of both false positives and false negatives are likely to be substantial (see Virinkoski et al., 2017). However, considering the promising effects reported from early interventions for students at risk of RD (see e.g., Saine et al., 2011; Solheim et al., 2018), we still believe that early identification followed by intensive support is the most effective solution. To ensure that early intervention is provided to the students who need it the most, close attention should be paid to students' response to literacy instruction during the first months of school. In this way, students whose progress is faster than expected can be returned to mainstream classroom instruction while those who make less progress than expected can be given more intensive and part-time support in small groups (see Holopainen et al., 2018). Our study seems to suggest that as children start school at a younger age in Norway, their reading-related skills at that point are less developed than those of

Finnish school starters, which reduces the accuracy of prediction among Norwegian students. It should be noted that the Finnish children had had one more year to develop their pre-literacy skills in a supportive pre-primary environment where child-centred teaching practices dominate and tend to increase children's interest in reading (Lerkkanen et al., 2012). The finding of more accurate prediction in the Finnish sample indicates that continuous and early attention to skill development and early teaching practices is even more urgent in Norway than in Finland.

5. Limitations

Certain limitations to the present study need to be considered. First, comparisons across orthographies and educational systems always represent a challenge. The inevitable differences in circumstances make it more difficult to pinpoint the causes of any differences in outcomes that are observed. Second, there were minor differences in *how* letter knowledge and PA were measured between the samples. For instance, the letter-recognition task administered to the Norwegian students was an easier letter-knowledge task than the letter-naming task that the Finnish students faced. However, there is no reason to believe that an easier letter-knowledge task – where there would in all likelihood have been an even more evident ceiling effect – could have been a unique predictor in the Finnish sample. Also, the fact that the Finnish students scored higher for letter knowledge although their task was harder actually confirms that Finnish children, on average, have a higher level of letter knowledge at school entry. When it comes to PA, the stop criterion used in the Norwegian tasks (a test was discontinued if the student made two subsequent errors) could have contributed to lower scores for the Norwegian students – but as the items increased in difficulty it seems unlikely that students who made two errors in a row would have answered the next item(s) correctly and so would have obtained a higher score without that criterion. Further, the phoneme-blending tasks differed between the samples, but a previous study from a Norwegian context, in which the phoneme-blending task used was similar to the one administered in the Finnish sample in the present study, also found first-phoneme isolation, but not phoneme blending, measured at school entry to be a unique predictor of poor reading later on (Lundetræ & Thomson, 2017). Finally, as the Finnish students outscored the Norwegian ones across *all* pre-reading and reading measures at school entry (letter knowledge, first-phoneme isolation, phoneme blending, and word-reading accuracy), we feel confident that the results from this study reflect real differences in skill level between Norwegian and Finnish school beginners. Consequently, differences in measures are not likely to explain the differences in terms of predictors observed between the two samples. However, owing to the differences between measures, the data from the present study cannot be used to determine the real magnitude of the differences in skill level between school starters in the two countries.

6. Conclusion

According to Carvalho et al. (2017), the best early predictors of RD should be identified through separate longitudinal studies for each orthography. We would like to add that separate studies should be carried out in different countries even if they share the same orthography. The reason for this is that the cultural and educational context will also affect the development of students' academic skills. Hence the average reading-skill level at school entry may differ between two countries that share the same orthography, as a consequence of factors such as the extent to which pre-reading skills are emphasized or taught in early-childhood education. Given that different skills better predict RD at different stages of reading development (for example, easy phonological tasks and letter knowledge will gradually be replaced by more challenging phonological tasks and reading skill as the best predictors), the average reading-skill level in a student population will also determine which skills are the best predictors of RD at a given time point in the specific educational system and the specific orthography.

Finally, this study has demonstrated that there are differences in pre-reading and reading skills between Norwegian and Finnish students at school entry. Future research should try to determine the extent to which those differences originate from differences in home literacy environments, literacy practices in early-childhood education, orthographic transparency, age at school entry and any other factors that may be relevant.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

This study was supported by grants from the Norwegian Research Council (grant number 256197) and the Academy of Finland (grant number 276239; 292466).

ORCID

Oddny Judith Solheim http://orcid.org/0000-0002-9365-9052
Minna Torppa http://orcid.org/0000-0003-3834-9892
Per Henning Uppstad http://orcid.org/0000-0002-5775-9830
Marja-Kristiina Lerkkanen http://orcid.org/0000-0002-5709-5800

References

Björn, P. M., Aro, M. T., Koponen, T. K., Fuchs, L. S., & Fuchs, D. H. (2016). The many faces of special education within RTI frameworks in the United States and Finland. *Learning Disability Quarterly*, *39*(1), 58–66. https://doi.org/10.1177/0731948715594787

Caravolas, M., Lervåg, A., Defior, S., Málková, G. S., & Hulme, C. (2013). Different patterns, but equivalent predictors, of growth in reading in consistent and inconsistent orthographies. *Psychological Science*, *24*(8), 1398–1407. https://doi.org/10.1177/0956797612473122

Caravolas, M., Lervåg, A., Mousikou, P., Efrim, C., Litaský, M., Onochie-Quintanilla, E., & Hulme, C. (2012). Common patterns of prediction of literacy development in different alphabetic orthographies. *Psychological Science*, *23*(6), 678–686. https://doi.org/10.1177/0956797611434536

Carvalho, A., Pereira, M., & Festas, I. (2017). Indicadores precoces da dislexia de desenvolvimento: Um estudo longitudinal. [early indicators of dyslexia: A longitudinal study]. *Revista de Estudios e Investigación en Psicología y Educación*, *4*(2), 71–88. https://doi.org/10.17979/reipe.2017.4.2.3208

Chapman, J. W., & Tunmer, W. E. (1997). A longitudinal study of beginning reading achievement and reading self-concept. *British Journal of Educational Psychology*, *67*, 279–291. https://doi.org/10.1111/j.2044-8279.1997.tb01244.x

Chard, D. J., & Kameenui, E. J. (2000). Struggling first-grade readers: The frequency and progress of their reading. *The Journal of Special Education*, *34*(1), 28–38. https://doi.org/10.1177/002246690003400103

Denckla, M. B., & Rudel, R. (1974). Rapid "automatized" naming of pictured objects, colors, letters and numbers by normal children. *Cortex*, *10*(2), 186–202. https://doi.org/10.1016/S0010-9452(74)80009-2

Education Act. (1998). Retrieved April 4, 2019, from. https://lovdata.no/dokument/NL/lov/1998-07-17-61. https://www.regjeringen.no/contentassets/b3b9e92cce6742c39581b661a019e504/education-act-norway-with-amendments-entered-2014-2.pdf. (in English)

Eklund, K., Torppa, M., Aro, M., Leppänen, P. H. T., & Lyytinen, H. (2015). Literacy skill development of children with familial risk for dyslexia through Grades 2, 3, and 8. *Journal of Educational Psychology*, *107*(1), 126–140. https://doi.org/10.1037/a0037121.

Eklund, K., Torppa, M., & Lyytinen, H. (2013). Predicting reading disability: Early cognitive risk and protective factors. *Dyslexia*, *19*(1), 1–10. https://doi.org/10.1002/dys.1447

Eklund, K., Torppa, M., Sulkunen, S., Niemi, P., & Ahonen, T. (2018). Early cognitive predictors of PISA reading in children with and without family risk for dyslexia. *Learning and Individual Differences*, *64*, 94–103. https://doi.org/10.1016/j.lindif.2018.04.012

Esmaeeli, Z., Lundetræ, K., & Kyle, F. (2018). What can parents' self-report of reading difficulties tell us about their children's emergent literacy at school entry? *Dyslexia*, *24*(1), 84–105. https://doi.org/10.1002/dys.1571

Finnish National Agency for Education. (2014). *National core curriculum for pre-primary education*.

Furnes, B., & Samuelsson, S. (2009). Preschool cognitive and language skills predicting kindergarten and grade 1 reading and spelling: A cross-linguistic comparison. *Journal of Research in Reading*, *32*(3), 275–292. https://doi.org/10.1111/j.1467-9817.2009.01393.x

Furnes, B., & Samuelsson, S. (2010). Predicting reading and spelling difficulties in transparent and opaque orthographies: A comparison between Scandinavian and US/Australian children. *Dyslexia*, *16*(2), 119–142. https://doi.org/10.1002/dys.401

Furnes, B., & Samuelsson, S. (2011). Phonological awareness and rapid automatized naming predicting early development in reading and spelling: Results from a cross-linguistic study. *Learning and Individual Differences*, *21*(1), 85–95. https://doi.org/10.1016/j.lindif.2010.10.005

Georgiou, G. K., & Parrila, R. (2013). Rapid automatized naming and reading: A review. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (2nd ed., pp. 169–185). The Guilford Press.

Georgiou, G. K., Parrila, R., Cui, Y., & Papadopoulos, T. C. (2013). Why is rapid automatized naming related to reading? *Journal of Experimental Child Psychology*, *115*, 218–225. https://doi.org/10.1016/j.jecp.2012.10.015

Georgiou, G. K., Torppa, M., Manolitsis, G., Lyytinen, H., & Parrila, R. (2012). Longitudinal predictors of reading and spelling across languages varying in orthographic consistency. *Reading and Writing*, *25*(2), 321–346. https://doi.org/10.1007/s11145-010-9271-x

Goswami, U. (2001). Early phonological development and the acquisition of literacy. In S. B. Neuman & D. Dickinson (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 111–125). The Guildfor Press.

Häyrinen, T., Serenius-Sirve, S., & Korkman, M. (1999). *Lukilasse – Lukemisen, kirjoittamisen ja laskemisen seulontatesti 1-6 vuosiluokille [test for reading, spelling and arithmetics for Grades 1-6]*. Psykologien kustannus.

Holopainen, L., Ahonen, T., & Lyytinen, H. (2001). Predicting delay in reading achievement in a highly transparent language. *Journal of Learning Disabilities*, *34*(5), 401–413. https://doi.org/10.1177/002221940103400502

Holopainen, L., Kiuru, K., H, N., Mäkihonko, M. K., & Lerkkanen, M.-K. (2018). The role of Finnish part-time special education supporting students with reading and spelling difficulties from Grade 1 to Grade 2 in Finland. *European Journal of Special Needs Education*, *33*(3), 316–333. https://doi.org/10.1080/08856257.2017.1312798

Hulme, C., & Snowling, M. J. (2015). Learning to read: What we know and what we need to understand better. *Child Development Perspectives*, *7*(1), 1–15. https://doi.org/10.1111/cdep.12005

Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: The orthographic depth hypothesis. *Advances in Psychology*, *94*, 67–84. https://doi.org/10.1016/S0166-4115(08)62789-2

Kilpatrick, D. A. (2015). *Essentials of assessing, preventing and overcoming reading difficulties*. John Wiley & Sons.

Kirby, J. R., Desrochers, A., Roth, L., & Lai, S. S. V. (2008). Longitudinal predictors of word reading development. *Canadian Psychology*, *49*(2), 103–110. https://doi.org/10.1037/0708-5591.49.2.103

Landerl, K., Ramus, F., Moll, K., Lyytinen, H., Leppänen, P. H., Lohvansuu, K., & Bruder, J. (2013). Predictors of developmental dyslexia in European orthographies with varying complexity. *Journal of Child Psychology and Psychiatry*, *54*(6), 686–694. https://doi.org/10.1111/jcpp.12029

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8-year follow-up. *Journal of Educational Psychology*, *100*(1), 150. https://doi.org/10.1037/0022-0663.100.1.150

Lerkkanen, M.-K., Kiuru, N., Pakarinen, E., Viljaranta, J., Poikkeus, A.-M., Rasku-Puttonen, H., & Nurmi, J.-E. (2012). The role of teaching practices in the development of children's interest in reading and mathematics in kindergarten. *Contemporary Educational Psychology*, *37*, 266–279. https://doi.org/10.1016/j.cedpsych.2011.03.004

Lerkkanen, M.-K., Poikkeus, A.-M., & Ketonen, R. (2006). *ARMI- Luku - ja kirjoitus-taidon arviointimateriaali 1. luokalle* [ARMI – A tool for assessing reading and writing skills in grade 1]. *Helsinki: WSOY*.

Lerkkanen, M.-K., Rasku-Puttonen, H., Aunola, K., & Nurmi, J.-E. (2004a). Predicting reading performance during the first and the second year of primary school. *British Educational Research Journal*, *30*(1), 67–92. https://doi.org/10/1080.01411920310001629974.

Lerkkanen, M.-K., Rasku-Puttonen, H., Aunola, K., & Nurmi, J.-E. (2004b). Reading performance and its developmental trajectories during the first and the second grade. *Learning and Instruction*, *14*(2), 111–130. https://doi.org/10.1016/j.learninstruc.2004.01.006

Lervåg, A., Bråten, I., & Hulme, C. (2009). The cognitive and linguistic foundations of early reading development: A Norwegian latent variable longitudinal study. *Developmental Psychology*, *45*(3), 764. https://doi.org/10.1037/a0014132

Lovett, M., Frijters, J. C., Wolf, M., & Morris, R. D. (2017). Early intervention for children at risk for reading disabilities: The impact of grade at intervention and individual differences on intervention outcomes. *Journal of Educational Psychology*, *109*(7), 889–914. https://doi.org/10.1037/edu0000181

Lundetræ, K., & Gabrielsen, E. (2017). Skolens oppfølging av elever som strever med lesing. [How schools follow up students who struggle with reading]. In E. Gabrielsen (Ed.), *Klar framgang! Leseferdighet på 4. Og 5. Trinn i et femtenårsperspektiv* [*Obvious progress! reading skill in grades 4 and 5 from a 15-year perspective*] (pp. 154–165). Universitetsforlaget.

Lundetræ, K., & Thomson, J. M. (2017). Rhythm production at school entry as a predictor of poor reading and spelling at the end of first grade. *Reading and Writing*, *31*(1), 215–237. https://doi.org/10.1007/s11145-017-9782-9

Lyytinen, H., Erskine, J., Hämäläinen, J., Torppa, M., & Ronimus, M. (2015). Dyslexia – early identification and prevention: Highlights from the Jyväskylä longitudinal study of dyslexia. *Current Developmental Disorders Reports*, *2* (4), 330–338. https://doi.org/10.1007/s40474-015-0067-1

McTigue, E., Solheim, O. J., Uppstad, P. H., Lundetræ, K., & Schwippert, K. (2020). *Gender differences and distribution in pre-reading, reading and spelling at school entry and in initial learning gains: A female advantage*. [Manuscript submitted for publication].

Ministry of Education and Research. (2018). *The education system*. Retrieved March 5, 2020, from https://www.regjeringen.no/en/topics/education/school/the-norwegian-education-system/

Norton, E. S., & Wolf, M. (2012). Rapid automatized naming (RAN) and reading fluency: Implications for understanding and treatment of reading disabilities. *Annual Review of Psychology*, *63*, 427–452. https://doi.org/10.1146/annurev-psych-120710-100431

Norwegian Directorate for Education and Training. (2018). *The education mirror: Facts and analysis of kindergarten, primary and secondary education in Norway*. Utdanningsdirektoratet.

OECD. (2013). *Quality matters in early childhood education and care*. OECD Publishing.

OECD. (2016). *PISA 2015 results (Volume I): Excellence and equity in education*. OECD Publishing.

Poskiparta, E., Niemi, P., & Lepola, J. (1994). *Diagnostiset testit 1. Lukeminen ja kirjoittaminen* [*Diagnostic tests 1. Reading and writing*]. University of Turku, Centre for Learning Research.

Saine, N., Lerkkanen, M.-K., Ahonen, T., Tolvanen, A., & Lyytinen, H. (2011). Computer-assisted remedial reading intervention for school beginners at risk for reading disability. *Child Development*, *82*(3), 1013–1028. https://doi.org/10.1111/j.1467-8624.2011.01580.x

Samuelsson, S., Byrne, B., Olson, R. K., Hulslander, J., Wadsworth, S., Corley, R., & DeFries, C. J. (2008). Response to early literacy instruction in the United States, Australia, and Scandinavia: A behavioral-genetic analysis. *Learning and Individual Differences*, *18*(3), 289–295. https://doi.org/10.1016/j.lindif.2008.03.004

Scammacca, N., Vaughn, S., Roberts, G., Wanzek, J., & Torgesen, J. K. (2007). *Extensive reading interventions in Grades K-3: From research to practice*. RMC Research Corporation, Center on Instruction. http://buildingrti.utexas.org/sites/default/files/booklets/Extensive_Reading_Interventions_K-3.pdf

Seymour, P. H., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, *94*(2), 143–174. https://doi.org/10.1348/000712603321661859

Sigmundsson, H., Eriksen, A. D., Ofteland, G. S., & Haga, M. (2017). Letter-sound knowledge: Exploring gender differences in children when they start school regarding knowledge of large letters, small letters, sound large letters, and sound small letters. *Frontiers in Psychology*, *8*, 1593. https://doi.org/10.3389/fpsyg.2017.01539.

Snowling, M. J., & Melby-Lervåg, M. (2016). Oral language deficits in familial dyslexia: A meta-analysis and review. *Psychological Bulletin*, *142*(5), 498–545. https://doi.org/10.1037/bul0000037

Solheim, O. J., Frijters, J. C., Lundetræ, K., & Uppstad, P. H. (2018). Effectiveness of an early reading intervention in a semi-transparent orthography: A group randomised control. *Learning and Instruction*, *58*, 65–79. https://doi.org/10.1016/j.learninstruc.2018.05.004

Solheim, O. J., Rege, M., & McTigue, E. (2017). Study protocol: "Two teachers": A randomized controlled trial investigating individual and complementary effects of teacher-student ratio in literacy instruction and professional development for teachers. *International Journal of Educational Research*, *86*, 122–130. https://doi.org/10.1016/j.ijer.2017.09.002

Soodla, P., Lerkkanen, M.-K., Niemi, P., Kikas, E., Silinskas, G., & Nurmi, J.-E. (2015). Does early reading instruction promote the rate of acquisition? A comparison of two transparent orthographies. *Learning and Instruction*, *38*, 14–23. https://doi.org/10.1016/j.learninstruc.2015.02.002

Torgesen, J. K. (2002). The prevention of reading difficulties. *Journal of School Psychology*, *40*(1), 7–26. https://doi.org/10.1016/S0022-4405(01)00092-9

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1999). *TOWRE: Test of word reading efficiency*. Psychological Corporation.

Torppa, M., Eklund, K., van Bergen, E., & Lyytinen, H. (2011). Parental literacy predicts children's literacy: A longitudinal family-risk study. *Dyslexia*, *17*, 339–355. https://doi.org/10.1002/dys.437

Torppa, M., Eklund, K., van Bergen, E., & Lyytinen, H. (2015). Late-emerging and resolving dyslexia: A follow-up study from age 3 to 14. *Journal of Abnormal Child Psychology*, *43*(7), 1389–1401. https://doi.org/10.1007/s10802-015-0003-1.

Torppa, M., Georgiou, G. K., Lerkkanen, M.-K., Niemi, P., Poikkeus, A.-M., & Nurmi, J.-E. (2016). Examining the simple view of reading in a transparent orthography: A longitudinal study from kindergarten to Grade 3. *Merrill-Palmer Quarterly*, *62*(2), 179–206. https://doi.org/10.13110/merrpalmquar1982.62.2.0179

Torppa, M., Georgiou, G. K., Niemi, P., Lerkkanen, M.-K., & Poikkeus, A.-M. (2017). The precursors of double dissociation between reading and spelling in a transparent orthography. *Annals of Dyslexia*, *67*, 42. https://doi.org/10.1007/s11881-016-0131-5

Torppa, M., Parrila, R., Niemi, P., Poikkeus, A.-M., Lerkkanen, M.-K., & Nurmi, J.-E. (2013). The double deficit hypothesis in the transparent Finnish orthography: A longitudinal study from kindergarten to Grade 2. *Reading and Writing*, *26*, 1353–1380. https://doi.org/10.1007/s11145-012-9423-2

Uppstad, P. H., & Solheim, O. J. (2007). Aspects of fluency in writing. *Journal of Psycholinguistic Research*, *36*(2), 79–87. https://doi.org/10.1007/s10936-006-9034-7

Virinkoski, R., Lerkkanen, M.-K., Eklund, K., Holopainen, L., & Aro, M. (2017). Teachers' ability to identify children at early risk for reading difficulties in Grade 1. *Early Childhood Education Journal*, *46*(5), 497–509. https://doi.org/10.1007/s10643-017-0883-5

Walgermo, B. R., Foldnes, N., Uppstad, P. H., & Solheim, O. J. (2018). Developmental dynamics of early reading skill, literacy interest and reader self-concept within the first year of formal schooling. *Reading and Writing*. https://doi.org/10.1007/s11145-018-9843-8