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Author(s): Silinskas, Gintautas; Gedutiene, Reda; Torppa, Minna; Raiziene, Saule

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Simple View of Reading Across the Transition from Kindergarten to Grade 1 in a Transparent Orthography

Gintautas Silinskas[a], Reda Gedutiene[b], Minna Torppa[c], and Saule Raiziene[d]

[a]Department of Psychology, University of Jyväskylä, Jyväskylä, Finland; [b]Department of Psychology, Klaipeda University, Klaipeda, Lithuania; [c]Department of Teacher Education, University of Jyväskylä, Jyväskylä, Finland; [d]Department of Psychology, Vilnius University, Vilnius, Lithuania

ABSTRACT

Purpose: This longitudinal study investigated the simple view of reading (SVR) model and its cognitive basis in a transparent orthography of the Lithuanian across the transition from kindergarten to Grade 1.

Method: The language and early literacy skills of 229 children (Mage = 6.79, SD = .47) were tested at the end of kindergarten (vocabulary, letter knowledge, phonological awareness, and RAN); listening comprehension and word reading fluency were tested at the start of Grade 1; and reading comprehension was measured at the end of Grade 1.

Results: Together with parental education, word reading fluency and listening comprehension predicted reading comprehension (R2 = 43.2%). The second model, which also included language and early literacy skills, showed that vocabulary and phonological awareness indirectly predicted reading comprehension via listening comprehension, while phonological awareness, letter knowledge, and rapid automatized naming (RAN) indirectly predicted reading comprehension via word reading fluency (R2 = 43.6%). However, after allowing the direct paths from language and early literacy skills in kindergarten to reading comprehension, listening comprehension and word reading fluency were no longer significant predictors of reading comprehension, whereas vocabulary and letter knowledge were (R2 = 58.9%).

Conclusion: The results provided support for the SVR model in transparent Lithuanian orthography in that linguistic and decoding components are important for early reading comprehension. However, the results also suggested that, in the Lithuanian context, kindergarten vocabulary and letter knowledge are stronger measures in predicting reading comprehension than listening comprehension and word reading fluency in Grade 1.

Children's ability to understand what they have read is a goal in children's first years of schooling, and it further predicts later school success (Cunningham & Stanovich, 1997; Juel, 1988). According to one popular model of reading acquisition – the simple view of reading (SVR) – reading comprehension is a product of two components: linguistic comprehension and decoding (Gough & Tunmer, 1986; Hoover & Gough, 1990). Linguistic (or listening) comprehension refers to the ability to understand and make sense of spoken language (Hogan et al., 2014; Kendeou et al., 2009), and decoding is understood as the ability to rapidly produce sounds corresponding to the graphemes of a given

CONTACT Gintautas Silinskas gintautas.silinskas@jyu.fi Department of Psychology, University of Jyväskylä, Jyväskylä 40014, Finland

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orthography (Hoover & Gough, 1990; Kendeou et al., 2009). Although previous research has emphasized the need for longitudinal studies to support the SVR (Florit & Cain, 2011), many studies have relied on concurrent data and tested children attending primary school and after (Tilstra et al., 2009). These studies found that the amount of explained variance in reading comprehension decreased in higher grades (Joshi, 2018; Tilstra et al., 2009), and that the relative importance of decoding decreased, while the relative importance of listening comprehension increased with higher grades (Joshi et al., 2012; Tilstra et al., 2009). Given these tendencies, it is surprising that only a few studies considered following children earlier, for instance, across the transition from kindergarten to Grade 1 (see, e.g., LARRC & Chiu & LARRC, 2018; Torppa et al., 2016).

The vast majority of SVR research has concerned children learning to read in English (Florit & Cain, 2011; J. R. Kirby & Savage, 2008; Joshi, 2018; Stuart et al., 2008). This is a clear gap in the literature, given that the majority of alphabetic languages in which children learn to read are languages other than English (Arab-Moghaddam & Sénéchal, 2001; Gedutienė, 2020). Some SVR research is also available in different orthographies varying in transparency (e.g., Finnish: Torppa et al., 2016; Greek: Kendeou et al., 2013; Italian: Florit et al., 2022; German: Landerl & Wimmer, 2008), but such research has not yet been examined among children learning to read Lithuanian. As children are learning to read in a large variety of cultural environments, and orthographies vary in transparency (Florit & Cain, 2011), new evidence coming from different orthographies may enrich our current understanding of the generalizability of the SVR across orthographies.

Transparency of orthography has important effects on reading acquisition (Seymour et al., 2003), and Lithuanian orthography represents a relatively consistent grapheme – phoneme correspondence with a somewhat complex syllable structure. In transparent orthographies, the decoding component of reading comprehension can be tested early due to early and rapid reading acquisition. Therefore, a novelty of the current study is that it uses longitudinal data following children across the critical period of acquiring reading skills – the transition from kindergarten to formal reading instruction in Grade 1. This study also examines whether the SVR components offer the best prediction of reading comprehension or whether an extension of the model is needed for accurate early prediction of reading comprehension. When investigating early reading development, it has been proposed that a variety of language (e.g., vocabulary) and early literacy skills (e.g., letter knowledge, RAN) predict SVR components and reading comprehension across orthographies (e.g., Kim, 2020a, 2020b; LARRC & Chiu & LARRC, 2018; Torppa et al., 2016). In sum, the present longitudinal study investigates the SVR model in a transparent orthography of Lithuanian children learning to read across the critical transition from kindergarten to Grade 1. We also sought to determine a set of language and early literacy skills that would best predict early reading acquisition and to identify whether their impact on reading comprehension was direct or mediated via the key components of SVR, decoding, and listening comprehension.

Listening comprehension, reading fluency, and reading comprehension

According to SVR, linguistic comprehension is one of the two major contributors to children's reading comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). Linguistic comprehension can be viewed as a broad construct, including the understanding of words, sentences, and text-level skills, and it is often labeled by a variety of concepts, such as language, listening, and oral (language) skills (Hogan et al., 2014; Kendeou et al., 2009). Previous studies have typically measured linguistic comprehension by listening comprehension or vocabulary tasks (Cutting & Scarborough, 2006; Kendeou et al., 2009; Torppa et al., 2016). In the present study, the oral language tasks measured children's understanding of spoken language at the story comprehension level, which is referred to as listening comprehension.

The second crucial predictor of reading comprehension in SVR is decoding (or word recognition; Hoover & Tunmer, 2022), which can broadly be described as the ability to apply knowledge of letter – sound relations in reading (Hoover & Gough, 1990; Kendeou et al., 2009). Decoding has been assessed using a variety of measures related to the accuracy and fluency of reading. Within the SVR theoretical

framework, decoding has been defined as the ability to read isolated words efficiently (i.e., quickly and accurately; Gough & Tunmer, 1986; Hoover & Tunmer, 2018, 2022). To this end, many researchers, especially those investigating SVR in transparent orthographies, have incorporated timed measures of decoding (i.e., measures of word reading fluency) to assess the efficiency of word recognition (Huo et al., 2021; Silverman et al., 2013; Torppa et al., 2016). In the context of transparent orthographies, using timed measures for decoding is especially relevant, as children learn to read with almost full accuracy soon after school entry (Aro & Wimmer, 2003; Seymour et al., 2003).

Although both listening comprehension and decoding feed into reading comprehension, explaining 40%–80% of the variance (Joshi, 2018), their relative importance in predicting reading comprehension differs between transparent and opaque orthographies. Florit and Cain's (2011) meta-analysis concluded that, in opaque orthographies (i.e., English), decoding is a stronger contributor to reading comprehension than oral language measures for a longer time than in transparent orthographies. This is because decoding in transparent orthographies becomes fluent/automatized earlier (de Jong & van der Leij, 2002; Joshi et al., 2012; Seymour et al., 2003). However, over time, listening comprehension becomes a more important predictor of reading comprehension than decoding in both transparent and opaque orthographies (e.g., Florit & Cain, 2011). Once decoding becomes automatized and fast enough, the effect of listening comprehension on reading comprehension should become stronger than that of decoding, as decoding no longer causes cognitive load or burdens the memory required for reading comprehension (e.g., Perfetti, 1985). Therefore, in transparent orthographies (e.g., Lithuanian), listening comprehension can be a more powerful predictor of reading comprehension than decoding quite early on (Florit & Cain, 2011; Florit et al., 2022; Torppa et al., 2016). However, particularly in the beginning stages of reading development, it is possible that decoding still has a large effect on reading comprehension. Consequently, in the present study, we expected to find a significant effect of both listening comprehension and decoding on Grade 1 reading comprehension.

Language and early literacy predictors of listening comprehension, word reading fluency, and reading comprehension

The two main predictors of reading comprehension in the SVR – listening comprehension and decoding efficiency – are based on a number of language and early literacy skills (e.g., vocabulary, phonological awareness, letter knowledge, RAN). This idea is comprehensively described in the direct and indirect effects model of reading (DIER; Kim, 2017, 2020a, 2020b, 2020c). According to DIER, foundational cognitive skills (e.g., language and early literacy skills) are necessary building blocks for the decoding and listening comprehension components of SVR. In addition to the hierarchical structure, the DIER also emphasizes interactive and dynamic relations between the component skills. That is, developing skills are interrelated with each other, and their relative importance changes as a function of reading skill development (Kim, 2017, 2020a, 2020b, 2020c). From a practical viewpoint, knowledge of the cognitive predictors of the components of SVR can thus add to the efficacy of the early identification of children at risk for reading difficulties.

In the present study, we examine the roles of vocabulary, phonological awareness, letter knowledge, and rapid automatized naming (RAN) as predictors of the SVR components, word reading fluency, listening comprehension, and reading comprehension. First, among a number of predictors identified to predict listening comprehension, vocabulary has been shown to be among the strongest (Cain et al., 2004; Florit et al., 2022; G. P. Ouellette, 2006; Manolitsis et al., 2011; Sénéchal, 2006). For instance, in the transparent Finnish orthography, vocabulary in kindergarten was found to predict listening comprehension in Grade 1 (Silinskas, Torppa, et al., 2020; Torppa et al., 2016).

Second, several predictors have been identified to predict decoding in terms of word reading fluency. Letter knowledge and phonological awareness are among the strongest predictors of early reading fluency development (e.g., Manolitsis et al., 2009; Puolakanaho et al., 2007; Torppa et al., 2016). This is not surprising because difficulties in the ability to recognize letters or process speech sounds (e.g., identify or manipulate phonemes in the words) may undermine the ability to make

sequences of grapheme – phoneme connections that are required for the development of decoding. Furthermore, as a spoken language measure, phonological awareness is also closely linked with other linguistic measures (e.g., vocabulary; Puolakanaho et al., 2007; Torppa, Poikkeus, et al., 2007a, 2007b) and is therefore proposed as a potential predictor of reading comprehension via both decoding and linguistic pathways.

Finally, another important cognitive predictor of decoding is RAN, which is especially predictive of timed reading-related tasks such as word reading fluency (Georgiou et al., 2008; Landerl et al., 2019; Savage & Frederickson, 2005). The exact mechanism explaining the association between RAN and reading fluency is debated, but in general terms, the association stems from RAN and reading requiring the rapid serial cascaded processing of familiar linguistic items (e.g., Altani et al., 2020; J. R. Kirby et al., 2010; Protopapas et al., 2013).

Early predictors of reading skill development have been extensively investigated but not in the Lithuanian context. Research on the early prediction of reading difficulties among Lithuanian children is still sparse (e.g., Labanienė et al., 2019). Also of interest to researchers is the longitudinal perspective – the pathways through which these cognitive skills measured at the end of kindergarten predict reading comprehension at the end of Grade 1 directly and indirectly through related skills at the start of Grade 1. The idea of these direct and indirect relations is advocated by the DIER (Kim, 2017, 2020a, 2020b, 2020c), suggesting that foundational early cognitive skills, through the development of oral language or decoding skills, enhance higher-order cognition or skills (e.g., reading comprehension). To investigate this idea in detail, we raised two alternative hypotheses. As the first alternative, we tested the indirect effects model, which implemented a strict hierarchical structure (Kim, 2020a). Previous research suggests that early literacy skills (e.g., letter knowledge and phonological awareness) before Grade 1 can influence reading comprehension indirectly through later decoding (Catts et al., 2005, 2006; Kendeou et al., 2009; Storch & Whitehurst, 2002; Torppa et al., 2016). While these indirect paths through decoding are frequently found, only a handful of studies have investigated how early language skills (e.g., vocabulary) indirectly predict reading comprehension through, for example, listening comprehension (Florit et al., 2022; LARRC & Chiu & LARRC, 2018; Lepola et al., 2016). As the second alternative, we tested the indirect and direct effects models (Kim, 2020a). The rationale for the second alternative was that, although language and early literacy skills in kindergarten can indirectly predict reading comprehension, it is possible that those early kindergarten skills can exert their influences on reading comprehension directly, over and above listening comprehension and reading fluency (Kim, 2020a). Notably, previous studies have typically measured reading comprehension among older children (e.g., Grade 3; LARRC & Chiu & LARRC, 2018; Lepola et al., 2016) or children in Grade 1 (Florit et al., 2022). Consequently, to expand on previous research, our longitudinal study followed children and applied age-appropriate measures to investigate reading development over the transition from kindergarten (T1) to Grade 1 (T2) and until the end of Grade 1 (T3).

Reading skill development in the Lithuanian language and cultural/educational environment

Lithuanian is the only official language of the Republic of Lithuania and one of the official languages of the European Union. The language represents the Baltic branch of the Indo-European language family and is widely considered to be among the oldest Indo-European languages still spoken today, retaining some archaic phonological and grammar features found only in extinct languages (Gedutienė, 2020). By contrast, the modern standard literary Lithuanian orthography was created in the early 20th century and thus represents a relatively new orthography with a relatively consistent grapheme – phoneme correspondence in reading (Gedutienė, 2020). The Lithuanian alphabet consists of 32 letters (20 consonants/45 phonemes and 12 vowels/10 phonemes). Vowels are represented in writing by 12 letters. The Lithuanian vowels are pronounced as short and long sounds. The two pairs of letters – y and į, ū and ų—represent the same long vowel phonemes,/i:/and/u:/, respectively. Consonants are represented in

writing by 20 letters; for 3 consonants, the digraphs ch, dz, dž are used. The Lithuanian consonants are pronounced as hard and soft sounds (Gedutienė, 2020). As in some instances the same sound can be represented by a few letters/letter combinations, it is assumed that the Lithuanian orthography has quite consistent grapheme – phoneme correspondences (feedforward or spelling-to-sound consistency) but less consistent phoneme – grapheme correspondences (feedback or sound-to-spelling consistency). This "asymmetry" (the fact that spelling is more difficult than reading) is common even in orthographies considered highly transparent for both reading and spelling (Babayiğit, 2022). Apart from grapheme – phoneme correspondence, another criterion for classifying alphabetic orthographies is the complexity of the syllable structure (Seymour et al., 2003). In this respect, Lithuanian is quite complex, as it has numerous closed CVC (consonant-vowel-consonant) syllables (Gedutienė, 2020). As the transparency of the writing system has a direct effect on the speed with which children acquire reading skills (Pinto et al., 2015; Seymour et al., 2003), these features of language need to be acknowledged in reading research.

Lithuanian children enter kindergarten on the first of September of the calendar year of their sixth birthday. In Lithuania, kindergarten education, which became compulsory in 2016, takes place one year before Grade 1 (LR [Republic of Lithuania] Ministry of Education, Science, and Sports, 2014). Kindergarten teachers have significant autonomy in choosing their pedagogical practices – which are confirmed by the school – and considering the individual needs of the children (LR Ministry of Education, Science, and Sports, 2014). The kindergarten curriculum does not set criteria for determining levels of reading skills before school entrance. Rather, kindergarten education is meant to "fill the gap" between children from diverse socioeconomic backgrounds, especially the gaps concerning spoken language (Gedutienė, 2020). To this end, speech therapists screen children to identify difficulties in expressive and receptive spoken language and to help them cope before their entrance to Grade 1 (Gedutienė, 2020).

It is only in Grade 1 that children are exposed to the systematic teaching of reading at school. During the first semester of Grade 1, listening to spoken language and comprehension of spoken text are emphasized. Children also start Grade 1 by learning letters and letter – sound correspondences, reading longer chains of letters quickly and accurately. Due to the transparency of the Lithuanian orthography (falling toward the transparent end on the opaque – transparent continuum), Lithuanian children become relatively accurate decoders by the end of the first semester of Grade 1 but mostly vary by the speed of reading (Gedutienė, 2008). Toward the end of Grade 1, reading comprehension plays a central role in reading skill development (Republic, 2014). These characteristics of Lithuanian language and instruction in Lithuanian schools dictated the measures and timeline of our longitudinal investigation.

Research questions

The main aim of our longitudinal study was to examine the SVR model in Lithuanian across the transition from kindergarten to Grade 1. To examine whether an extension of SVR is useful in predicting reading comprehension, we also examined the role of key language and early literacy skills in kindergarten as predictors of the components of SVR and asked the following research questions:

(1) To what extent do listening comprehension and word reading fluency at the start of Grade 1 predict reading comprehension at the end of Grade 1? We expected to confirm the SVR model (Gough & Tunmer, 1986; Hoover & Gough, 1990), meaning that listening comprehension and word reading fluency would predict reading comprehension among Grade 1 Lithuanian children (Model 1).
(2) To what extent do language and early literacy skills (i.e., vocabulary, phonological awareness, letter knowledge, RAN) directly and indirectly predict reading comprehension, listening

comprehension, and word reading fluency (Kim, 2020a)? We constructed two alternative models: Model 2A and Model 2B.

Model 2A: The Hierarchical, Indirect Effects Path Model. Language and early literacy predictors at the end of kindergarten only indirectly predict reading comprehension at the end of Grade 1 through listening comprehension (Florit et al., 2022; LARRC & Chiu & LARRC, 2018; Torppa et al., 2016) and word reading fluency (Catts et al., 2005; Kendeou et al., 2009; Storch & Whitehurst, 2002) at the start of Grade 1.

Model 2B: The Direct and Indirect Effects Path Model. Language and early literacy predictors both directly and indirectly (via listening comprehension and word reading fluency) predict reading comprehension (Kim, 2020a).

Methods

Participants and procedure

The data came from the longitudinal data collection "*Get involved! Transition to Grade 1*" (Silinskas & Raiziene, 2017–2018), which followed Lithuanian children across their transition from kindergarten to Grade 1. The study was approved by the Ethical Committee of the University of Jyväskylä (3.5.2017), and the study conforms to the Declaration of Helsinki. Legal guardians of the participating children provided informed written consents, and children gave their assent prior to their inclusion in the study. We initially approached six principals who granted us permission to collect data at their schools. All participating kindergarten classes were situated in the same buildings as the children's future primary schools, and all the schools were Lithuanian-speaking. Regarding their home language environments, 89.6% of the children spoke only Lithuanian at home, and 6.8% spoke a combination of Lithuanian and Russian or Polish. In particular, 1.8% spoke only Russian at home, and 0.9% spoke only Polish at home, but these children did not differ from the rest in terms of any of the study variables. This language profile of our sample is fairly representative of the overall population of Lithuania, where the minority languages most commonly spoken at home are Polish (6%) and Russian (5%) (Statistics Lithuania, 2014). Moreover, the sample was highly homogeneous with regard to the ethnic and cultural backgrounds of the study participants, which is typical of the school population in Lithuania. In terms of parental education (Statistics Lithuania, 2014), our sample comprised somewhat highly educated parents: 66.4% reported that they had obtained a university degree, 24.1% had completed a college or polytechnic program, 7.1% had completed high school, and only 2.4% had completed a level lower than high school.

The children were tested individually at the end of kindergarten (T1, April – May, 2017, n = 229, 116 girls), at the beginning of Grade 1 (T2, October – November, 2017, n = 183), and at the end of Grade 1 (T3, April – May, 2018, n = 186). On each occasion, testing took place in the office of the school psychologist who administered the test battery. They all received training on the use of this particular test battery prior to each measurement point. On the first testing occasion, many of the children were approaching seven years of age (M_{age} = 6.79, SD = .47). Forty-six children dropped out of the study between T1 and T2 because they moved away, changed schools, or were absent from the schools for the testing periods. The analyses of the missing data revealed no systematic differences between the children who had dropped out, stayed in the study, or joined the study at any time point (also see Little's MCAR test results in the Analysis Strategy section).

Table 1. Descriptives of all study variables, based on the present sample.

	N	*M*	*SD*	Cronbach's α	Range		Skewness	Kurtosis
					Potential	Actual		
End of Kindergarten (T1)								
Vocabulary	229	18.03	3.93	.68	0–30	7–26	−0.46	0.18
Initial phoneme identification	229	9.99	3.04	.91	0–12	0–12	−2.30	4.54
Initial phoneme deletion	229	3.53	4.67	.97	0–12	0–12	0.77	−1.21
Phonological awareness[a]	229	0.00	0.81	.93		−2.02–1.24	−0.52	0.19
Letter knowledge	229	26.92	7.31	.96	0–32	1–32	−2.07	3.61
RAN (objects per second)	228	0.72	0.17			0.25–1.22	0.19	0.20
Beginning of Grade 1 (T2)								
Listening comprehension	183	17.00	4.84	.90	0–26	0–25	−0.96	1.24
Word reading fluency	183	15.61	11.52	.97	0–75	0–57	0.99	1.40
End of Grade 1 (T3)								
Reading comprehension	186	8.49	3.01	.91	0–13	0–13	−1.14	1.08
Control variables								
Child gender (girl 0, boy 1)	229							
• Girl	116							
• Boy	113							
Highest education in a family[b]	212	4.54	0.75			1–5	−1.82	3.44

Note. T1—end of Kindergarten, T2—beginning of Grade 1, and T3—end of Grade 1.
[a]Phonological awareness is a mean score of two z-scores (initial phoneme identification and initial phoneme deletion).
[b]highest education in a family was scored as follows: 1 = 0–8 years, 2 = 9–10 years, 3 = 11–12 years, 4 = college or polytechnics, 5 = university.

Measures—child tests (T1, T2, and T3)

All the measures used in this study were developed based on those employed in the Finnish First Steps longitudinal study (M.-K. Lerkkanen et al., 2006–2016) and another longitudinal study in Lithuania (Gedutienė, 2008). Table 1 presents the psychometric properties of all the study variables. All psychometric properties, including reliabilities, were based on the present sample.

End of kindergarten (T1)

Vocabulary. The 30-item shortened version of the Peabody Picture Vocabulary Test – Revised (PPVT-R, Form L; Dunn & Dunn, 1981) was used to measure children's receptive vocabulary in kindergarten. The children were presented with four pictures and asked to point to the picture that correctly represented the word the tester had pronounced. The items for the shortened version were previously used in the Finnish First Steps longitudinal study (M.-K. Lerkkanen et al., 2006–2016).

Phonological Awareness. Two tests were used to measure phonological awareness: (1) initial phoneme identification and (2) initial phoneme deletion (Gedutienė, 2008). In the initial phoneme identification test, the children were read 12 words aloud and were asked to name the first sound of that word. In the initial phoneme deletion test, the children were read 12 words aloud and were asked to say the word without the first sound. Before both tasks, the children were presented with three practice items to ensure that they understood the instructions. The tasks were discontinued after three incorrect answers were given in a row. The scores for both tests were obtained by counting the number of correct items. For the main study analyses, the mean score of the two standardized test scores (z-scores) was calculated.

Letter Knowledge. The children named all 32 letters of the Lithuanian orthography, which were arranged randomly into three rows (Gedutienė, 2008; M.-K. Lerkkanen et al., 2006). All letters were uppercase letters. The children named the letters one row at a time, while the other rows were covered. Both letter names and letter sounds were accepted as correct answers. The score was the number of correctly named letters/sounds.

RAN. RAN was assessed using the standard procedure (Denckla & Rudel, 1976). The children were presented with five rows with 10 pictures each and were asked to name those pictures as quickly as possible. The 50 pictures comprised five randomly ordered objects (i.e., the sun, house, chair, mouse, and tree). Before the actual task, a practice trial was arranged to ensure that each child was familiar with the objects. The total time in seconds that the child had taken to name all 50 objects was recorded. The score was the number of objects per second. The test-retest reliability of this measure in our study (the end of kindergarten [T1]—the end of Grade 1 [T3]) was .727 ($p < .001$) (Silinskas & Raiziene, 2017–2018).

Beginning of grade 1 (T2)

Listening Comprehension (T2). The listening comprehension test (Gedutienė, 2008) included five short stories, each followed by two to three questions (Story 1: three questions, Story 2: three questions, Story 3: two questions, Story 4: three questions, Story 5: two questions). One sample story is presented in the Appendix A. The test administrator read the stories and asked the questions, and the child answered the questions aloud. There were 13 questions; each full and correct answer was awarded two points, and partly correct or less detailed answers were awarded one point.

Word Reading Fluency (T2). An individually administered word reading fluency test based on the Lukilasse test (6- to 12-year-old children; Häyrinen et al., 1999) and the work of Gedutienė (2008) was used. The child was presented with 75 real words divided into three columns. The words ranged from one to four syllables and were written in uppercase letters. The child was instructed to read the words aloud as quickly as possible without mistakes. The score was based on the number of words read correctly within a 45-second time frame. The test-retest reliability of this measure in our study (the beginning of Grade 1 [T2]—the end of Grade 1 [T3]) was .873 ($p < .001$) (Silinskas & Raiziene, 2017–2018).

End of grade 1 (T3)

Reading Comprehension (T3). To measure reading comprehension, the story comprehension task (Gedutienė, 2008) was used. The child was asked to read three short stories aloud. After each story, the test administrator read questions with multiple-choice answers (only one correct answer each), and the child answered the questions aloud. The child had access to the story during the questions; however, the child's attention was directed to the answer options, which were placed in front of the child as colorful shapes (squares). The child did not necessarily have to verbally reproduce the answer after hearing the questions and multiple answers, as they could choose one of the answers by pointing at the corresponding colorful shape. The first two stories included four questions with three multiple-answer options each; the third story included five questions with four multiple-answer options each. Most of the questions required the children to make simple inferences. There was no time limit for completing the task. One sample story is presented in the Appendix B.

Analysis strategy

To answer our research questions, path models were constructed using the M*plus* statistical package (version 8.8; Muthén & Muthén, 1998–2017). Before proceeding with the model specifications, all variables were standardized. Child gender (dichotomous variable) and parent education (ordinal variable) acted as control variables and were not standardized. We applied standard procedure that is implemented in the M*plus* statistical package. That is, in the path analyses, all study variables were treated as continuous. This default specification was not altered because none of the study variables were nominal with more than two groups, and all three dependent variables (listening comprehension, word reading fluency, and reading comprehension) were continuous. In all path models, the control variables (child gender and parental education) were specified to correlate with the other T1 variables and to predict the T2 and T3 variables. In addition, in all

models, listening comprehension and word reading fluency residuals were specified to correlate. To answer our first research question, we predicted reading comprehension at the end of Grade 1 (T3) by listening comprehension and word reading fluency at the start of Grade 1 (T2). To answer our second research question, we tested the two models. Model 2A assumed hierarchical associations; that is, that the effects of language and early literacy skills in kindergarten on reading comprehension are indirect via listening comprehension and word reading fluency. In model 2A, reading comprehension at T3 was set to be predicted by listening comprehension and word reading fluency at T2; listening comprehension was set to be predicted by vocabulary and phonological awareness at the end of kindergarten (T1); and word reading fluency was set to be predicted by phonological awareness, letter knowledge, and RAN (T1). All T1 language and early literacy predictors were specified to correlate with each other. In model 2A, we estimated the indirect effects of vocabulary and phonological awareness on reading comprehension via listening comprehension; we also estimated the indirect effects of phonological awareness, letter knowledge, and RAN on reading comprehension via word reading fluency. To test model 2B, the above-described model (2A) was modified by adding the direct paths from all language and early literacy skills (vocabulary, phonological awareness, letter knowledge, and RAN) to reading comprehension at T3.

We calculated intraclass correlations (ICCs), which ranged from .016 ($p > .05$) to .185 ($p < .001$) across all study variables. As the variation of some variables was partially related to children's class membership, we used the COMPLEX option of Mplus, which accounts for the nested structure of the data. Teacher/classroom ID in Grade 1 was used as a clustering variable; we had 25 clusters, with an average cluster size of 9.16. Little's missing completely at random (MCAR) test was used to investigate the type of missingness; the results of the test (χ^2 [60] = 46.091, $p = .907$) suggested that the data were MCAR. As a result, we estimated the models using full information maximum likelihood (FIML) estimation with robust standard errors, which is considered robust to non-normality and uses all available information to estimate the model (Muthén & Muthén, 1998–2017). Model fit was evaluated using a combination of the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). The CFI values above .90, and RMSEA and SRMR values below .10 indicated a good fit (Hu & Bentler, 1999).

This study was not preregistered. The study materials, data, and analysis code are available from the corresponding author upon reasonable request.

Results

Table 1 presents the descriptive statistics of all measures (number of valid cases, means, standard deviations, reliabilities, potential and actual range, skewness, and kurtosis) based on the current sample. Table 2 presents the correlations between all study variables.

Table 2. Correlations of all study variables.

		1	2	3	4	5	6	7	8	9
1	Vocabulary (T1)	1								
2	Phonological awareness (T1)	.438***	1							
3	Letter knowledge (T1)	.343***	.663***	1						
4	RAN (T1)	.342***	.435***	.315***	1					
5	Listening comprehension (T2)	.529***	.513***	.532***	.416***	1				
6	Word reading fluency (T2)	.263***	.609***	.582***	.444***	.349***	1			
7	Reading comprehension (T3)	.552***	.518***	.608***	.392***	.573***	.458***	1		
8	Child gender (girl 0, boy 1)	−.135*	−.152*	−.207**	−.047	−.224**	−.199**	−.166*	1	
9	Parental education	.262***	.360***	.387***	.249***	.512***	.330***	.475***	−.061	1

Note. T1—end of Kindergarten, T2—beginning of Grade 1, and T3—end of Grade 1.
* $p < .05$, ** $p < .01$, *** $p < .001$.

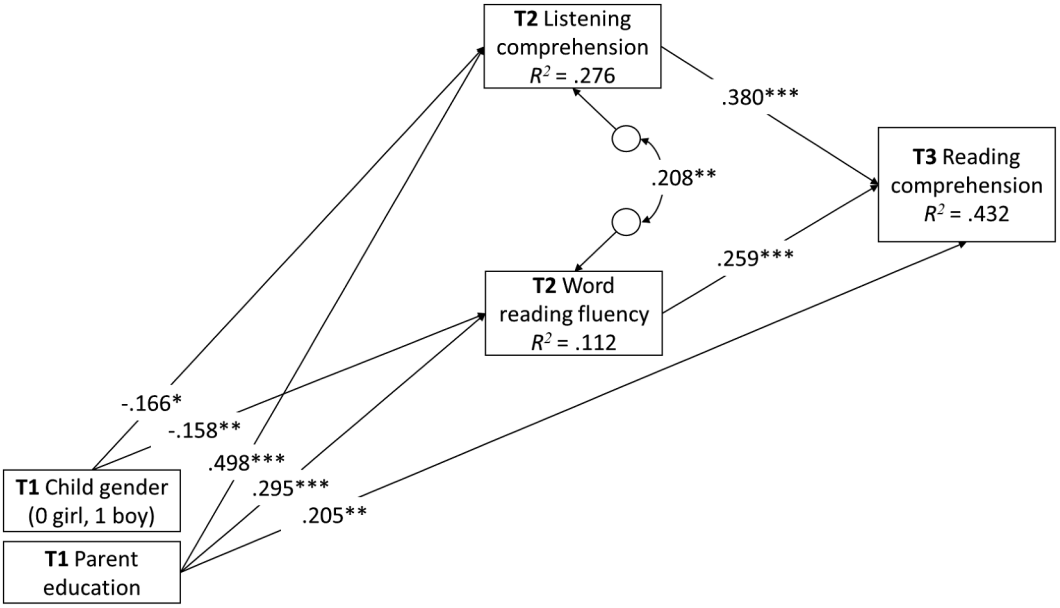

Figure 1. Development of reading skills across transition to grade 1 (model 1). *Note.* T1—end of Kindergarten, T2—beginning of Grade 1, and T3—end of Grade 1.

The path model predicting reading comprehension by listening comprehension and word reading fluency

To answer our first research question, we estimated a path model (Model 1; Figure 1) in which reading comprehension at the end of Grade 1 (T3) was predicted based on listening comprehension and word reading fluency at the beginning of Grade 1 (T2), after controlling for child gender and parental education. A well-fitting model was obtained: CFI = .998, RMSEA = .046, SRMR = .021. In this model, the residual correlation between listening comprehension and word reading fluency was $r = .208$, $p = .003$. The results showed that reading comprehension ($R^2 = 43.2\%$) was significantly predicted by listening comprehension ($\beta = .380$, $p < .001$) and word reading fluency ($\beta = .259$, $p < .001$). To test whether the strength of these two paths was similar, we fixed them to be the same and compared the model against the freely estimated model using the Satorra-Bentler procedure (Satorra & Bentler, 2010). A non-significant test, $\Delta\chi^2$ (1) = .621, $p = .430$, indicated that the strength of the paths was similar.

The direct and indirect effects path model

To answer the second research question, we first tested the hierarchical, indirect effects path model (Model 2A; not depicted). We estimated the indirect effects of language and early literacy predictors in kindergarten (T1) on reading comprehension at the end of Grade 1 (T3) via listening comprehension and word reading fluency at the beginning of Grade 1 (T2). The model fit was CFI = .854, RMSEA = .187, SRMR = .055, with only SRMR suggesting a good-enough fit to the data. This model explained 43.6% of reading comprehension, 46.5% of listening comprehension, and 45.9% of word reading fluency.

To answer the second research question, we also tested the direct and indirect effects path model (Model 2B; Figure 2). In this model, we specified and estimated the direct paths between language and early literacy predictors in kindergarten (T1) and reading comprehension at the end of Grade 1 (T3). We also estimated the indirect effects of language and early

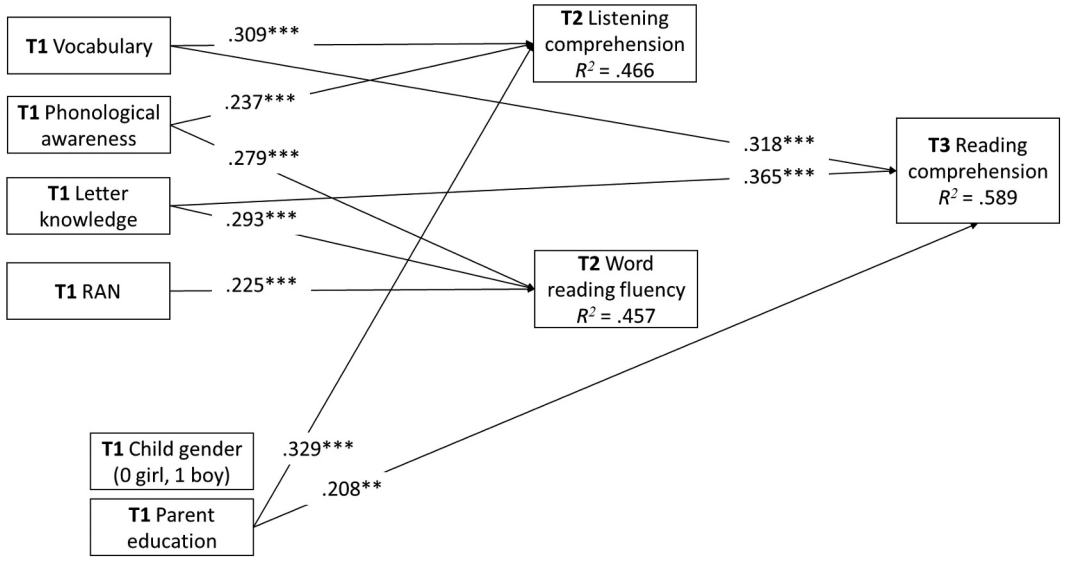

Figure 2. Development of reading skills across transition to grade 1 (model 2B). *Note.* T1—end of Kindergarten, T2—beginning of Grade 1, and T3—end of Grade 1. Only significant associations at $p < .05$ are shown. Concurrent associations between T1 variables and control variables (child gender and parental education) were estimated, but not depicted. Significant concurrent associations were as follows: vocabulary correlated with phonological awareness ($r = .440$, $p < .001$), letter knowledge ($r = .346$, $p < .001$), RAN ($r = .343$, $p < .001$), and parental education ($r = .270$, $p < .001$). Phonological awareness correlated with letter knowledge ($r = .665$, $p < .001$), RAN ($r = .436$, $p < .001$), child gender ($r = -.151$, $p = .013$), and parental education ($r = .350$, $p < .001$). Letter knowledge correlated with RAN ($r = .317$, $p < .001$), child gender ($r = -.207$, $p = .002$), and parental education ($r = .386$, $p < .001$). RAN correlated with parental education ($r = .246$, $p < .001$). Listening comprehension and word reading fluency residuals were not correlated ($r = -.114$, $p = .120$).

literacy predictors on reading comprehension via listening comprehension and word reading fluency at the beginning of Grade 1 (T2). The model fit was CFI = .960, RMSEA = .149, SRMR = .027, with CFI and SRMR suggesting a good fit to the data. This model explained 58.9% of reading comprehension, 46.6% of listening comprehension, and 45.7% of word reading fluency.

The difference in the model fits of both models 2A and 2B was calculated using the Satorra-Bentler procedure (Satorra & Bentler, 2010). A significant test was obtained, $\Delta\chi^2$ (4) = 46.162, $p < .001$, indicating that model 2B was significantly better than model 2A. Consequently, we report and interpret the results of the model 2B (Figure 2).

The results of the 2B model showed that reading comprehension was no longer significantly predicted by listening comprehension (β = .079, $p = .413$) and word reading fluency (β = .083, $p = .172$), but it was significantly predicted by vocabulary (β = .318, $p < .001$) and letter knowledge (β = .365, $p < .001$). Listening comprehension was predicted by vocabulary (β = .309, $p < .001$) and phonological awareness (β = .237, $p < .001$), and word reading fluency was predicted by phonological awareness (β = .279, $p < .001$), letter knowledge (β = .293, $p = .003$), and RAN (β = .225, $p < .001$). The listening comprehension and word reading fluency residuals were specified to correlate, but the coefficient was insignificant ($r = -.114$, $p = .120$).

None of the indirect paths were significant in model 2B. First, the results of the specific indirect paths showed that listening comprehension no longer mediated the path from vocabulary to reading comprehension (β = .024, $p = .408$; 95% CI [−.033–.082]) or from phonological awareness to reading comprehension (β = .019, $p = .422$; 95% CI [−.027–.064]). Second, word reading fluency did not mediate paths from phonological awareness to reading comprehension (β = .023, $p = .173$; 95% CI [−.010–.056]), from letter knowledge to reading comprehension (β = .024, $p = .195$; 95% CI [−.012–.061]), or from RAN to reading comprehension (β = .019, $p = .260$; 95% CI [−.014–.051]).

Discussion

The present study used longitudinal data to investigate the SVR model in Lithuanian orthography. The focus of the study was on early reading skill development, that is, across the transition from kindergarten to Grade 1. Thus, the role of language and early literacy skills prior to formal reading instruction was also investigated. Research on the antecedents and developmental mechanisms through which children become good at reading comprehension is evidently needed, as these mechanisms can facilitate the early identification of children with reading difficulties. In particular, evidence coming from different orthographies is needed to allow greater generalizability across orthographies. On the one hand, our results supported the SVR model in a transparent Lithuanian orthography among children at the very start of their reading instruction in Grade 1. On the other hand, the addition of language and early literacy skills to the model revealed the utility of these kindergarten predictors. They directly predicted listening comprehension and word reading fluency, and once direct effects were allowed, vocabulary and letter knowledge also predicted reading comprehension over and above listening comprehension and word reading fluency. In fact, after the inclusion of the direct effects from kindergarten language and early literacy skills, the Grade 1 listening comprehension and word reading fluency measures were no longer significant predictors of reading comprehension. These direct and indirect predictive relations underline the utility of expanding SVR when aiming to understand the basis of reading comprehension, which is, in that sense, in line with the DIER model (Kim, 2017, 2020a, 2020b, 2020c). Among early learners in Lithuania, vocabulary and letter knowledge seem to be even more robust predictors of reading comprehension than listening comprehension and word reading fluency.

The SVR in transparent Lithuanian orthography

Our first research question asked about the extent to which listening comprehension and word reading fluency at the start of Grade 1 predicted reading comprehension at the end of Grade 1. Overall, the results from the first model provided empirical evidence for the SVR model (Gough & Tunmer, 1986; Hoover & Gough, 1990) in a transparent Lithuanian orthography in that both linguistic comprehension and word reading fluency were significant components. Our listening comprehension and decoding measures explained 43.2% of story comprehension variance, which is in line with many previous studies that have typically explained 40%–80% of the variance (Joshi, 2018). Importantly, the results suggest that the SVR model is applicable in explaining children's reading comprehension as early as Grade 1 in Lithuanian, a transparent orthography. Previous studies in transparent orthographies have reported similar results among Grade 1–2 children (e.g., Manolitsis et al., 2011; Silinskas, Torppa, et al., 2020; Torppa et al., 2016).

It has been suggested that SVR predictions may vary according to the transparency of the orthography and children's age (or stage of reading development) (Florit & Cain, 2011; Torppa et al., 2016). At first glance, our results appear to contradict the conclusions from Florit and Cain's (2011) meta-analysis, which suggests that in transparent orthographies, listening comprehension is a stronger predictor of reading comprehension than decoding (the opposite is true in opaque orthographies). However, one needs to be cautious about the exact timeline of the studies, that is, the age and stage of children's reading acquisition. It is possible that the relative importance of listening comprehension (versus decoding) will increase soon after Grade 1 also in Lithuanian when children become more fluent decoders. That is, the contribution of decoding to reading comprehension is likely to decline quickly in transparent orthographies (Florit & Cain, 2011), and soon after Grade 1, linguistic comprehension becomes a major player in story comprehension (Torppa et al., 2016). Had we measured the SVR components for a longer period of time, we could have found a similar trend of decreasing the role of decoding. This remains a target for future research in Lithuanian.

Language and early literacy skills predicting listening comprehension, word reading fluency, and reading comprehension

Our second research question asked about the extent to which language and early literacy skills at the end of kindergarten (e.g., vocabulary, phonological awareness, letter knowledge, and RAN) predict listening comprehension, word reading fluency, and reading comprehension. We tested two models: model 2A, where language and early literacy skills in kindergarten predicted reading comprehension indirectly via listening comprehension and word reading fluency, and model 2B, where language and early literacy skills in kindergarten directly and indirectly predicted reading comprehension.

The Model 2A (*The Hierarchical, Indirect Effects Path Model*) did not fit our data well, thus we interpret the results of the Model 2B (*The Direct and Indirect Effects Path Model*).

In the Model 2B, all indirect effects were insignificant, as were the direct effects from listening comprehension and word reading fluency. However, the direct effects from vocabulary and letter knowledge in kindergarten to reading comprehension in Grade 1 were significant. First, vocabulary directly predicted reading comprehension, taking over the significant prediction from listening comprehension to reading comprehension in Model 1 without the kindergarten predictors. The direct links between vocabulary and reading comprehension have been reported also in many previous studies (Florit & Cain, 2011; Sénéchal, 2006; Torppa, Poikkeus, et al., 2007a, 2007b). Even some SVR studies have measured linguistic comprehension by vocabulary tasks (e.g., Huo et al., 2021), and some SVR studies have found vocabulary to be a more powerful contributor to reading comprehension than listening comprehension (e.g., G. Ouellette & Beers, 2010). One reason for the stronger effect of vocabulary than listening comprehension on reading comprehension can be that listening comprehension is a complex skill to assess. For example, G. Ouellette and Beers (2010) suggested that vocabulary may represent oral language skills better than current assessment tools of listening comprehension where performance often depends on memory (G. Ouellette & Beers, 2010). Another reason may relate to the differences in the sampling of linguistic content in the vocabulary versus listening comprehension tasks. Vocabulary tasks typically include words from different categories and difficulty levels while a short paragraph with narrower vocabulary typically represents the stimuli in the listening comprehension task. In designing this study, we followed the recommendations of the original SVR authors (Hoover & Tunmer, 2018, 2022), suggesting that if the reading comprehension measure is measured at a text comprehension level, then the listening comprehension measure also needs to be measured at a text comprehension level. That is, one of the key aspects of the SVR is that the measurement of listening comprehension and reading comprehension should be equivalent (Gough & Tunmer, 1986; Hoover & Gough, 1990; Kim, 2020a). However, it should be noted that equivalence of measurement is not limited to format or linguistic grain size (e.g., word, sentence or passage), but instead should consider various aspects, such as linguistic demands, demands on background knowledge and inference (e.g., Kim, 2020a) which we did not control. For example, if reading comprehension measures include substantially greater vocabulary demand than do listening comprehension measures, then, vocabulary will have a direct relation to reading comprehension over and above listening comprehension. In other words, measurement of constructs influences results (Kim, 2020).

Second, letter knowledge directly predicted reading comprehension, likely taking over the previously significant prediction from word reading fluency to reading comprehension. A direct association between letter knowledge and reading comprehension has been shown previously (Sénéchal, 2006). Because letter knowledge can be considered an early decoding skill, its relation to reading comprehension is unsurprising. However, unexpected was the finding that once the kindergarten letter knowledge was set to predict reading comprehension, the direct effect of word reading fluency and, at the same time, the indirect effect of letter knowledge through word reading fluency became insignificant. It appears that at this early phase of reading development in Lithuanian, early emergence of letter knowledge is still a more important predictor of reading comprehension than word reading fluency. Recent study in a similar consistent orthography (Greek) showed that word reading fluency did not have a direct effect on reading comprehension by the end of Grade 1, when word reading accuracy was in the model (Kargiotidis et al., 2022). Letter knowledge is closely related to reading

accuracy skill, and thus Kargiotidis et al's (2022) study indirectly supports the validity of our findings. It should be noted, however, that letter knowledge, phonological awareness, and word reading fluency were strongly related to each other and the fact that the effect of word reading fluency disappeared after letter knowledge was entered to the model does not mean that word reading fluency would not be an important predictor of reading comprehension. Letter knowledge was merely the strongest measure among the predictors at this early phase of reading acquisition. It is also important to recognize that letter knowledge measure was not current (i.e., was not measured at the same time as reading comprehension) but rather from the previous year. It is expected that children learn all the letters by the end of Grade 1, thus the association between letter knowledge in kindergarten and reading comprehension at the end of Grade 1 highlights also the importance of children's learning environments, either at home (Silinskas et al., 2021; Silinskas, Sénéchal, et al., 2020; Silinskas, Torppa, et al., 2020; Sénéchal, 2006) or kindergarten (Silinskas et al., 2017).

Overall, in line with previous theories (SVR, Gough & Tunmer, 1986; DIER, Kim, 2017, 2020a, 2020b, 2020c), the current study suggests that children's language and early literacy skills play an important role in their further development of reading comprehension. The findings thus emphasize the importance of kindergarten education in developing children's future reading skills. In particular, children who score lower in vocabulary, letter knowledge, phonological awareness, or RAN might be at a higher risk of developing difficulties in decoding, listening comprehension, and, ultimately, reading comprehension. Consequently, kindergarten education in Lithuania could pay special attention to developing language and early literacy skills and thus monitor and provide early help to children to ensure that they do not fall behind their peers in Grade 1 reading development.

Limitations

The present study has some limitations. First, our study, although longitudinal, can indicate tentative relations and does not imply causality. Second, although our study was longitudinal, all the constructs were measured once; that is, no autoregressors were included. To examine mediations using longitudinal data, autoregressors need to be included. This was not the case in the present study but needs to be taken into consideration in the future studies. Third, our study followed children across the transition from kindergarten to Grade 1 and was unable to examine the developmental dynamics between SVR components and their language and early literacy predictors in the longer run. Future studies should implement additional usage of the same measures (enabling autoregressor effects).

Fourth, the sample comprised somewhat highly educated parents. Although the home learning environment or parental literacy-related beliefs and activities were not the focus of this study, one needs to be careful when generalizing our results among children of lower-educated parents. Fifth, many of our measures were assessed by single tests and sometimes had somewhat low reliabilities and skewed distributions. To this end, we used an MLR estimator that took non-normality into account. However, to decrease measurement error, more than one test per construct should be used in future studies.

Finally, although the SVR offered a parsimonious and comprehensive way of thinking about reading outcomes and their precursors, some competing views need to be acknowledged. The present study benefited from taking the DIER model into account when exploring the kindergarten predictors of reading comprehension. However, other theoretical approaches were not considered. For instance, the complete view of reading (CVR; Francis et al., 2018; see a commentary on this framework by Hoover & Tunmer, 2018) and the extended complete view of reading (ECVR; Snow, 2018) pay attention to the variation in readers (e.g., level of reading skills), features of reading tasks/texts, and reading strategies. Another framework – the active view of reading (AVR; Duke & Cartwright, 2021; see also a response by Hoover & Tunmer, 2022) – calls for acknowledgment of active, self-regulatory processes that affect reading development. Although the original SVR authors (Hoover & Tunmer, 2018, 2022) view these alternatives as complementary models that focus on different aspects of reading, these two models provide a promising framework for deepening our understanding about reading even further. Developing and testing these frameworks remains a challenge for future research.

Conclusion

In sum, our findings generally supported the SVR model in transparent Lithuanian orthography among Grade 1 students. That is, listening comprehension and word reading fluency longitudinally predicted reading comprehension in Grade 1. However, the findings also emphasized the role of language and early literacy skills in kindergarten, such as vocabulary, letter knowledge, phonological awareness, and RAN. In fact, they were stronger predictors of reading comprehension than listening comprehension and word reading fluency. Therefore, in practice, vocabulary and letter knowledge likely work better in the early identification of children at risk for developing early reading comprehension problems, at least in the Lithuanian context.

Our study makes some important contributions to the literature. First, while the model of the SVR has been extensively examined in English (Florit & Cain, 2011; J. R. Kirby & Savage, 2008; Joshi, 2018; Stuart et al., 2008), less is known about how it generalizes in the context of transparent orthographies. No previous studies of the SVR have been conducted in Lithuanian. While the model has been examined in a few transparent orthographies, such as Finnish (Torppa et al., 2016), German (Landerl & Wimmer, 2003), Greek (Kendeou et al., 2013), and Italian (Florit et al., 2022), transparent orthographies differ by the degree of transparency, syllabic structure, the language they represent and other aspects of language, and their educational and cultural environments. That is, it is difficult to quantify the degree of transparency of individual writing systems (Babayiğit, 2022). Thus, for greater generalizability across orthographies, the SVR model needs to be tested in different orthographies. Second, the current study is longitudinal; that is, data were collected three times during the important transition from kindergarten to systematic formal reading instruction commencing in Grade 1. By doing so, we were able to expand our viewpoint beyond SVR and detect the direct connections between the language and early literacy predictors and the components of the SVR. In particular, as suggested by the DIER theory, we estimated the direct and indirect pathways from language and early literacy skills in kindergarten to the goal – reading comprehension – at the end of Grade 1. Doing so allowed us to find the powerful role of vocabulary and letter knowledge in kindergarten in reading comprehension in Grade 1. Taken together, this knowledge can help in the early identification of children at risk for reading difficulties, and consequently enable timely and effective support in early reading development.

Disclosure statement

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

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ORCID

Gintautas Silinskas http://orcid.org/0000-0001-5116-6877

Ethics approval statement

The study was approved by the Ethical Committee of the University of Jyväskylä (3.5.2017), and the study conforms to the Declaration of Helsinki. Legal guardians of the participating children provided informed written consents, and children gave their assent prior to their inclusion in the study.

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APPENDIX A

Listening Comprehension

Today was Vilius' birthday. All of the children played hide and seek. Candles were lit on the boy's birthday cake. He made a wish and blew out all nine candles. Everyone clapped and sang "Happy Birthday"

(1) What is the boy's name?
(2) How old is Vilius?
(3) What did the children play?

APPENDIX B

Reading Comprehension

Rasa's wish

Rasa woke up very early. She quickly washed up and put on her school dress. After that, she hurriedly ate breakfast – oat porridge and cocoa. Rasa said goodbye to her mother, "Today is going to be a very interesting day. I hope I see a bear."

1. Rasa does not want:
□ to be late
□ to rush
□ to get ready

2. Rasa feels:
□ sleepy
□ sick
□ happy

3. Rasa will go:
□ to the doctor
□ to the library
□ to the zoo

4. What time does the action take place?
□ in the morning
□ during lunch
□ at night