

# Promoting decoding among young students with Swedish as a first and second language within a response to intervention model

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**Abstract:** Many young students with Swedish as their second language need support to acquire reading ability. There is a need for evidence-based reading instruction in early reading education for students with Swedish as their first or second language. Therefore, the current study investigated whether early reading education based on a Response to Intervention (RTI) model with a focus on decoding skills can promote reading ability among young students with Swedish as their first or second language. In Grades 1 and 2, 113 students with Swedish as a first and Swedish as a second language were followed. Applying the RTI model, teachers used evidence-based reading instruction in the whole class. Besides, additional instructions were provided in small groups and individually for students with weak decoding. Results of the study showed that the additional instruction provided within the RTI model had the potential to promote decoding, but to a different extent among students with Swedish as their second language. The importance of differentiated instruction, early monitoring and support, a bilingual approach in reading education for second language students, and collaboration between teachers are discussed.

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RTI; Swedish as a second language; Reading; Young students

## Introduction

Competent reading is crucial for students' development in school and is a prerequisite for academic achievement (Herbers et al., 2012). Therefore, acquiring good reading ability during the first school years is essential (Arnold & Doctoroff, 2003; Herbers et al., 2012). Students with another first language than the school language often need more support from the teacher to acquire good reading ability (Abedi & Gándara, 2006). In international evaluations, such as Progress in International Reading Literacy Study (PIRLS, 2011; 2016) and Programme for International Student Assessment (PISA, 2012; 2015; 2018), second language (L2) students in Grades 4 and 9 in Sweden perform weaker in reading comprehension compared to first language (L1) students. Their word decoding and vocabulary also lag behind their L1 peers (Fälth et al., 2023). About 20% of L2 students in Grades 1-3 in Sweden need additional instruction to develop decoding skills, and 18-38% need additional instruction to strengthen reading comprehension. To our knowledge, no previous studies address both L1 and L2 students' reading development in Swedish in early reading education using the Response to Intervention (RTI) model with three tiers. Therefore, the current study investigated whether early reading education based on an RTI model with a focus on decoding skills could promote early reading ability among young students with Swedish either as their first or second language.

## Theoretical Frameworks

In the theoretical model, the *Simple View of Reading* (Gough & Tunmer, 1986; Hoover & Gough, 1990), reading comprehension is conceived as the product of two factors, decoding and linguistic comprehension

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( $R = D \times L$ ). The factors are combined multiplicatively, and according to the model, both fast and accurate word decoding and linguistic processes contribute to reading comprehension. If one factor is zero, the product, i.e., the reading comprehension, is zero. Consistent with the model, it is also claimed that automatized word decoding frees resources for comprehension in reading. Therefore, both decoding and linguistic comprehension must be stimulated and trained for both L1 and L2 students to acquire reading comprehension. Likewise, in L2 reading comprehension, word decoding and linguistic comprehension are two major components contributing to reading comprehension (Lee et al., 2022). In orthographic decoding, there are links between phonology, orthography, and vocabulary knowledge (Ehri, 2014). Therefore, word decoding and linguistic comprehension should not be seen as two separate processes. As a further development of the Simple View of Reading, Duke and Cartwright (2021) described an *Active View of Reading*, where different components of word decoding and language comprehension overlap and bridge to each other rather than influencing reading independently. For example, students with a limited vocabulary and unsecured word pronunciation might struggle to acquire decoding skills.

An additional useful framework for understanding L2 students reading acquisition is the *Linguistic Interdependent Hypothesis* (Cummins, 1979; 2021). According to Cummins, languages within multilingual learners do not develop in isolation. Strong linguistic skills can be transferred between languages, and developed concepts in one language are more easily available in another. Crosslinguistic transfer in reading tends to be stronger when the languages are similar according to the orthography and syllable structure (Cummins, 2021; Jeon & Yamashita, 2014). Consistent with Cummins (2021), the transfer can be seen in phonological and morphological awareness, metacognitive strategies, pragmatic aspects of the language, and understanding the concepts of elements and words. Melby-Lervåg and Lervåg (2011) reported that the association between L1 and L2 decoding is higher if both L1 and L2 are alphabetic writing systems.

### ***Early Reading in L1 and L2***

The importance of students cracking the alphabetic principle to be able to decode is well-known; students must be taught that graphemes symbolize phonemes in alphabetic writing systems (Castles et al., 2018). The National Reading Panel (2000) summarized what teaching reading in both L1 and L2 should focus on, namely phonological awareness and the correspondence between phonemes and graphemes, to synthesize the sounds into words, to decode words confident and correct and to make sure that the students reach reading fluency. When the student can connect phonemes to graphemes and decode isolated words without effort, this can free resources for reading comprehension (Oakhill et al., 2014). Skills underlying reading comprehension in L1 and L2 are similar, and fluent word recognition skills are essential for both (Lipka & Siegel, 2012).

According to Jeon and Yamashita (2014), four components demonstrate strong correlations with students' reading comprehension in L2, namely their word decoding ( $r=.56$ ), vocabulary ( $r=.79$ ), and grammar knowledge ( $r=.85$ ). Moreover, reading comprehension in L1 is positively associated with the reading comprehension in L2 ( $r=.50$ ). These components are also moderated by age of the reader, L2 proficiency, the distance between L1 and L2 in both script and structure of the language. Furthermore, crucial for reading comprehension in L2 is also phonological awareness, orthographic knowledge, morphological knowledge, listening comprehension, working memory, and metacognition.

Longitudinal studies demonstrated the significance of word decoding skills for L2 reading comprehension, particularly in the early grades (Hou et al., 2021; Lervåg & Aukrust, 2010; Verhoeven & van Leeuwe, 2012). Grabe (2009) argued that for L1 students, the connection between fluent word decoding and reading comprehension is strong, although more complex for L2 students since the language proficiency for L2 students varies more than for L1 students. Nevertheless, Lee et al. (2022) stated that the language comprehension abilities of L2 readers play a more critical role when word decoding has become fluent and efficient. Moreover, vocabulary might be crucial for reading comprehension in L2 readers (Droop & Verhoeven, 2003; Lervåg & Aukrust, 2010; Nation, 2009). Therefore, vocabulary instruction in grades 1-3 is also necessary for L2 students to develop and acquire good reading comprehension (Lervåg & Aukrust, 2010).

Consistent with Lovett et al. (2017), early identification of students with reading difficulties is essential, and L2 students should be offered evidence-based interventions to prevent long-term difficulties. However, few studies on reading interventions address L2 students' individual needs in reading and their various second languages (Hall et al., 2019). Rivera et al. (2009) recommended that reading interventions should be carefully matched to the student's individual needs and provided within a RTI model.

### *Early Reading Interventions for L2 Students and the Response to Intervention*

There is substantially less evidence of effective interventions for L2 students than for L1 students (Hall et al., 2019). However, students learning English as L2 seem to benefit from the same explicit and systematic early interventions as L1 students (August & Shanahan, 2017). According to Ludwig et al. (2019), the reading interventions should not be postponed until L2 students have reached a certain level in English as an oral second language. They tend to benefit from reading interventions despite their oral language proficiency at different levels. Early reading interventions for students learning English as L2 are recommended to focus on phonological awareness, grapheme-phoneme correspondence, and word decoding (Hall et al., 2019). The instructions should be explicit and systematic and delivered in small groups of students (Ludwig et al., 2019). However, languages differ, so research on various languages is needed. It is still unclear whether L2 students with Swedish as their second language show the same benefits from early reading education as L2 students learning English. Thus, there is a need to establish whether results from L2 students learning to read in English apply to L2 students acquiring reading in Swedish. For example, compared to English, Swedish has a shallower orthography with a more consistent grapheme-phoneme correspondence, whereas the syllabic complexity is more equivalent between these languages (Seymour et al., 2003). Consequently, such differences might affect the outcome of an intervention, as both syllabic complexity and the orthographic depth in a language affect decoding skills development.

As mentioned, Rivera et al. (2009) recommended that reading interventions for L2 students should be provided within an RTI model. Fuchs and Fuchs (2006) described RTI as a prevention model in two to four tiers with evidence-based reading instruction and early identification of students with difficulties throughout the different tiers. When using RTI, the efforts increase gradually, become more individualized and rely on specialized educators to enable each student to reach the best possible result. The student's progress is regularly monitored throughout the intervention to check that the students benefit from core classroom reading instruction and targeted and tiered interventions. Data from monitoring is used to decide if there is a need for changes in curricula, materials, or instructional procedures or moving students from one tier to another. The model aims to identify students at risk of reading difficulties, provide struggling students with early support, and adapt the teaching to the needs of the students. It has been used mainly in the US (Denton, 2012; Mellard, 2010). The education is evidence-based and based on assessment data in different tiers (Denton, 2012; Fuchs & Fuchs, 2006). According to Fien et al. (2011), multi-tiered support systems can support all students' early reading development, including English language learners, especially when L1 and L2 are alphabetic languages.

According to Denton (2012), three tiers in an RTI model for preventing reading difficulties must include effective and explicit instruction in phonemic awareness, phonics, and automatic recognition of high-frequency irregular words. Moreover, vocabulary, reading fluency, and comprehension should be promoted. Tier 1 is differentiated and evidence-based core classroom reading instruction. The differentiation in instruction is based on data from progress monitoring. In Tier 2, additional interventions are typically provided in smaller and more homogenous group settings with more intensity, systematic, and explicit instruction based on data from student curriculum-based reading assessments. Similarly, the interventions in Tier 3 are based on data from the student curriculum-based reading assessment, but the instructions are more individualized and provided one-to-one with even more intensity.

Although there are studies (e.g., Arias-Gundín & García Llamazares, 2021; Gersten et al., 2020) demonstrating the importance of supporting students' reading development in several tiers, Haager (2007) discussed cautions with RTI for students learning to read English as L2. For example, the evidence-based

and flexible teaching in Tier 1 and the additional instructions in Tier 2 regarding explicit teaching in phonological awareness, letter-sound relationships, and decoding must be integrated into meaningful contexts to be appropriate for L2 students. There is limited research on RTI among second-language learners. However, earlier studies have shown positive results of early Tier 2 small-group reading interventions for Spanish-speaking students learning English as L2 (Kamps et al., 2007; Nelson et al., 2011; O'Connor et al., 2014). In the Kamps et al. (2007) study, Tier 2 interventions with small groups of 6-15 students positively affected the L2 students' phonological awareness, grapheme-phoneme correspondence, word decoding, reading fluency, and reading comprehension. Findings in the study by Nelson et al. (2011) demonstrated that instructions within Tier 2 positively affected root word vocabulary and word decoding among L2 students. In addition, O'Connor et al. (2014) reported significantly higher outcomes in phonological awareness, nonword decoding, and word decoding at the end of Grade 2 for students attending Tier 2 interventions compared to a control group. In addition, O'Connor et al. (2014) did not find significant differences between L1 and L2 students in response to the Tier 2 treatment condition.

### **Aim of the Present Study**

No previous studies have, to our knowledge, addressed the RTI model and targeted young students' individual needs to develop basic reading skills and word decoding, focusing on L1 and L2 students. Therefore, it is also unclear whether early reading education using an RTI model could support both L1 and L2 students' reading development and prevent them from later reading difficulties. Early reading instruction should have a strong focus on supporting young students to acquire a secure phoneme-grapheme correspondence, cracking the alphabetical principle, and decoding skills (Castles et al., 2018), which one of our previous studies on a multi-tier RTI model focused on and showed positive outcomes in students' development of decoding skills (Nilvius, 2022; Nilvius et al., 2023). The proportion of students with weak decoding skills was significantly reduced after two years of reading education compared to a reference group. However, whether the L2 students benefitted from the multi-tier reading instructions is unclear. Therefore, the present study investigated whether early reading education based on an RTI model with a focus on decoding skills could promote early reading ability among young students with Swedish as their first or second language. The following research questions guided the study:

- Do L1 and L2 students have different letter knowledge, listening comprehension, decoding, and reading comprehension skills at the beginning of Grade 1?
- What proportion of L1 and L2 students perform below or at the 25<sup>th</sup> percentile in decoding tests after one semester of evidence-based reading education within Tier 1 and were therefore provided additional decoding instruction within Tier 2 during Grade 1?
- What proportion of L1 and L2 students performed below or at the 25<sup>th</sup> percentile in decoding tests in Grade 2 and were provided additional decoding instruction within Tiers 2 and 3?

## **Materials and Methods**

### **Context of the Study**

The present study was conducted in Grades 1 and 2 in three Swedish schools in rural areas. In Sweden, parents can choose a school, but most commonly, students attend the school nearest their homes. The year the students turn six, students in Sweden start a compulsory preschool class. Preschool and compulsory school are free of charge (Swedish Education Act, 2010:800). In elementary schools in Sweden, teachers are expected to meet students' diversity (e.g., ethnicity, educational background, language, special needs) and adjust the education for all students in the classroom.

The Swedish national curriculum (Swedish National Agency for Education, 2022a) emphasizes the importance of including play in preschool class education. In addition, educational activities within the preschool class aim to stimulate language development and prepare students for reading education. The year students turn seven years old, they start first Grade, and the formal teaching of reading in the subject Swedish or Swedish as a second language starts. There are two options for L2 students: they can follow the curriculum for Swedish or Swedish as a second language. The principal will decide for each L2 student

which curriculum is most appropriate (Swedish School Ordinance, 2011:185). Teaching in Swedish as a second language starts from a second language perspective, but the knowledge requirements in reading in the two subjects are similar and specified for Grades 1-3. In both Swedish and Swedish as a second language, the connection between sound and letter and strategies for word decoding are addressed. In the current study, the teaching for both L1 and L2 students was conducted in the same classroom.

### Participants

In the current study, 113 students participated, 53% were boys, and 47% were girls. At the beginning of the study, they attended first grade in elementary schools in Sweden. Their mean age was 7.2 years ( $SD=0.3$ ), and 30 (27%) students had Swedish as their second language. The first language of the L2 students was Albanian ( $n=1$ ), Arabic ( $n=3$ ), Assyrian ( $n=1$ ), Bosnian ( $n=10$ ), Chinese ( $n=2$ ), Finnish ( $n=1$ ), Polish ( $n=1$ ), Syrian ( $n=1$ ), Tigris ( $n=1$ ), Twi ( $n=1$ ), and Vietnamese ( $n=4$ ). Five (4% of the total sample) students arrived in Sweden close to the school start in Grade 1, which was also the same time as the start of the present study. Therefore, these five students had not attended preschool or preschool class education in Sweden. Consequently, the participating students had different educational backgrounds, exposure to Swedish as L2, and had reached different levels of their oral second language. All students and their caregivers signed an informed consent form. The study has received ethical approval (Dnr 2019-04814).

### Measures

We used several reading tests to measure the students' letter knowledge, decoding of nonwords and words, listening comprehension, and reading comprehension in Grades 1 and 2. The tests were retrieved from LegiLexi (Fälth et al., 2017). LegiLexi is a non-profit, free-of-charge, educational online resource for teachers reading education of Swedish students in grades 1–3. During the school year 2021 to 2022, about 20000 teachers were registered for using LegiLexi's tests, and about 126000 students were assessed with the tests (LegiLexi, 2023). LegiLexi's tests have also been applied in previous reading research (Hallin et al., 2022; Fälth et al., 2023). For the present study, LegiLexi was contacted, and we received cut-off scores for the 25<sup>th</sup> percentile based on the performance of over 16 000 students. The cut-off scores were delivered for each test and Grade. The test procedure was standardized and followed the instruction in the test manual (Fälth et al., 2017). Paper and pen versions of the tests were applied in the current study. The researchers collected all data at the beginning, middle, and end of Grades 1 and 2 with six tests described in more detail below.

#### *Letter Knowledge*

Letter knowledge was measured in a group setting three times during first Grade. The test leader pronounced the phoneme, articulated the sound, and stated, for example, *L as in lamp* and *S as in the sun*. The students were instructed to choose the corresponding grapheme from 10 possible alternatives. Students could receive scores between 1 and 12, where a higher score indicated better performance. The test took five minutes to complete. The test-retest correlation for Grade 1 is  $r=.58$  (Fälth et al., 2017).

#### *Listening Comprehension*

The listening comprehension test was conducted in a group setting three times in Grade 1 and on the last test occasion in Grade 2. The test leader read a text out loud, and the students were instructed to choose one picture out of five corresponding with the text. It starts with simple sentences like *Today the sun is shining, and Leo goes out without a jacket*. Then the sentences become more numerous and extended; for example, *It is Friday. When school is over, Sara calls home. She wants to bring Leo home to play, but Sara's mom says they are going to the supermarket to shop for the weekend. She says Sara will get to choose ice cream for their Friday treat. Sara and Leo are disappointed but decide to play tomorrow instead. What does Sara do after school?* The

scores on the test are between 0 and 12, and high scores indicate better performance. The test-retest correlation reported for Grades 1 and 2 is  $r=.65-.59$  (Fälth et al., 2017).

### ***Decoding Words***

The test leader accomplished the test by measuring word decoding skills individually with each student. The student was requested to read aloud common words with increasing length and difficulty as quickly and accurately as possible within one minute. The test initiates with elementary two-letter words, e.g., *on, in, me*, to gradually increase the number of letters to a maximum of seven and complexity, specifically in consonant clusters, e.g., *think, summer, before, running*. One correct read word represented one score. The maximum test score was 144. For students in Grades 1-2, the reported test-retest correlation is  $r=.88-.89$  (Fälth et al., 2017).

### ***Decoding Nonwords***

The test measuring nonword decoding skills was also completed individually with each student. The students were asked to read aloud nonwords from a horizontal list of nonwords with increasing length and difficulty. In line with the decoding words test, this assessment commences with two-letter words and progressively increases the number of letters to a maximum of seven. One correctly read nonword represented one score; the maximum test score and the maximum score was 84. The test-retest correlation is  $r=.84-.85$  for Grades 1 to 2 (Fälth et al., 2017).

### ***Reading Comprehension – Short Text***

The reading comprehension “short text” test was carried out in groups of students. The task for the student was to read short texts of one to three sentences silently on their own and mark the corresponding picture from a choice of five options. The test commences with short sentences, such as *Sara jumps high*, and gradually increases in length and complexity, exemplified by sentences like *Simon runs and runs. He climbs over a fence, runs under a bridge, and then up a high hill. There, the headwind blows fiercely*. The test is time-limited to five minutes. The maximum score for the test was 12, and the test-retest correlation reported for Grades 1 to 2 is  $r=.73-.80$  (Fälth et al., 2017).

### ***Reading Comprehension – Long Text***

The second applied reading comprehension test, “long text”, is developed for students attending Grades 2 and 3. The test was completed in a group setting. The task for the student was to read silently on their own and mark the correct answer out of three multiple-choice questions corresponding to the text. The length and complexity of the six texts in the test increased; the time limit was 7 minutes. For example, one of the texts was: *The sun is shining, and it is warm outside. When Axel looks out the window, he sees grandma coming. She is carrying a large cake and three small packages. She walks carefully on the small road that leads up to the house*. The maximum score was 18, and the reported test-retest correlation for Grade 2 is  $r=.82$  (Fälth et al., 2017).

### **Procedure**

The study was implemented according to the RTI model in three tiers, and all participating teachers and special needs teachers were given training before the study. Primary school teachers and special education teachers implemented the intervention. There were seven teachers, each responsible for a class, and all qualified to teach reading at the primary school level. Their working experience ranged from 4 to 30 years. Besides, each of the three participating schools had one special needs teacher.

None of the teachers or the special needs teachers had prior experience working with RTI in practice. Therefore, the research team presented the project plan and provided the teachers with training to familiarize them with the RTI model and intervention content, which focused on balanced and evidence-based reading instruction following the recommendations of Taube et al. (2015). The recommendations comprise systematic and explicit instruction of grapheme-phoneme correspondence, counteracting word guessing in reading (secure correct decoding), repeated reading to obtain fluency (as a motivational

activity), implicit and explicit word activities, and reading comprehension strategies. In addition, the teachers had an introduction to LegiLexi and how the test material could be applied to monitor individual students' progress during the project. Students were assessed at the beginning, middle, and end of Grades 1 and 2. From the middle of Grade 1, those students scoring at or below the 25<sup>th</sup> percentile on the tests measuring word or nonword decoding were considered in need of additional instruction provided in Tier 2 or 3. Monitoring was conducted by the researchers and occurred before, in the middle and end of Tier 2 and 3. The teachers and the research team jointly analyzed the data obtained from the reading test and the observations made by teachers in the classroom regarding the reading development of each student. This monitoring aimed to facilitate the differentiation of teaching methods and interventions and to determine the students who would benefit from Tier 2 and Tier 3 interventions and the extent to which these interventions should be provided for each student.

### *Evidence-based Instruction in Grade 1*

The teaching in Grade 1 followed evidence-based recommendations for early reading education (Taube et al., 2015). In the first semester of Grade 1, L1 and L2 students were taught together in the classroom. They were all provided reading instruction within Tier 1, and no additional teaching was provided for L2 students. Students' reading was monitored with several reading tests (see the section on measures). Those identified as having weak grapheme-phoneme correspondence knowledge and decoding skills at the beginning of Grade 1 were explicitly highlighted to the teachers as needing targeted instruction during the first semester in Tier 1. After one semester of reading education in Tier 1, students scoring at or below the 25<sup>th</sup> percentile on the tests measuring word or nonword decoding were considered in need of additional instruction offered in Tier 2. Therefore, during the second semester in Grade 1, students were taught reading in Tiers 1 and 2.

*Tier 1.* Ordinary teaching for all students was provided within Tier 1 in the current study. Consequently, all students participated in Tier 1 in the classroom setting during the first semester in Grade 1. They were taught together in the classroom, and the teachers provided differentiated reading instruction for 7 hours per week. The teaching followed evidence-based recommendations for early reading education from Taube et al. (2015), including explicit and systematic teaching of grapheme-phoneme correspondence, counteraction of word guessing to secure correct decoding, repeated reading to obtain reading fluency and motivation, implicit and explicit word activities, and reading comprehension strategies. The teachers strived for a balanced reading program. The students used a reading book in Swedish for beginners (Felth Sjölund et al., 2011) with three different decoding levels, enabling a joint reading experience for the whole class. A new chapter, a new grapheme, and the corresponding phoneme were introduced weekly. Students were instructed to read the week's chapter several times at school and at home to enhance reading fluency. The most advanced book was also used when the teacher read for the students to stimulate language development, listening comprehension, and vocabulary. In addition, multisensory activities were used for grapheme-phoneme correspondence training. The reading in the book was inspired by Reciprocal teaching (Palinscar & Brown, 1984). In reciprocal teaching, the teachers educate students to acquire reading comprehension strategies. Difficult words from the chapter were explicitly explained. The Tier 1 instruction also contained additional reading of fiction books, writing activities, and illustrations and dramatizations of the texts.

*Tier 2.* Students with weak letter knowledge or decoding skills (i.e., <25<sup>th</sup> percentile) were provided additional instruction within Tier 2. A special needs teacher provided the Tier 2 instruction in small groups with 2-5 students in three 30-minute lessons for five weeks, a total of 15 lessons. L1 and L2 students were mixed in small groups. The teaching was primarily focused on grapheme-phoneme correspondence using the Fonomix material (Löwenbrand-Jansson, 2018). This material is inspired by Lindamood and Lindamood (1998) and is multisensory, and concretizes the phoneme-grapheme correspondence. In addition, the students practiced phoneme synthesis by decoding lists with words and nonwords (Wendick, 2018) and reading fluency by repeatedly reading texts from a Swedish book series for beginners (Natur & Kultur, 2020). When students spontaneously asked questions about the meaning of single words or texts,

the special needs teachers explained the content. Materials and instruction were differentiated in word complexity level according to each student's progress.

### *Evidence-based Instruction in Grade 2*

In Grade 2, the students continued to be taught reading in Tier 1, and the teachers used evidence-based teaching based on recommendations by Taube et al. (2015). Data from continuous monitoring informed the teachers during Grade 2 regarding students' progress in reading, especially decoding. Those who had not reached the 25<sup>th</sup> percentile in word or nonword decoding were provided additional instruction in Tiers 2 or 3 during the first and second semesters of Grade 2. When a student reached the 25<sup>th</sup> percentile on nonword and word decoding, the student participated only in regular teaching within Tier 1.

*Tier 1.* A balanced reading program was provided to L1 and L2 students, who were educated together in the classroom. Their education was mainly based on a reading book (Felth Sjölund et al., 2012). The book was available in two versions with different text complexity but the same content, which enabled the teacher to differentiate the reading instruction and give the students a joint reading experience. Each week a new chapter in the book was presented to the students, who read the text several times in school and as homework—the repeated reading of the chapters aimed to enhance each student's reading fluency. The teacher explicitly taught difficult words and reading comprehension strategies following recommendations by Palinscar and Brown (1984) and strived to enhance the students' motivation to read and their ability to formulate their ideas in writing. The students also illustrated and dramatized text from fiction books during the lessons.

*Tier 2 and Tier 3.* A special needs teacher provided additional instruction for students with weak decoding skills (i.e., <25<sup>th</sup> percentile). Teaching in Tier 2 was offered to 2-5 students in a group. L1 and L2 students were taught together and provided three 30-minute weekly lessons for five weeks, a total of 15 lessons. If needed, the students were, after four weeks, offered 15 additional lessons within Tier 2 and, after that, moved to Tier 3 for one-to-one tutoring. In Tier 3, students were provided five 30-minute weekly lessons for three weeks, a total of 15. The content of Tiers 2 and 3 was the same as provided in Tier 2 in Grade 1, with instruction differentiated in complexity level to each student's individual needs. When the students cracked the alphabetic code by training in grapheme-phoneme correspondence, this increased the training in phoneme synthesis and word decoding. This was followed by training in reading fluency by repeatedly reading.

### **Fidelity**

In the current study, all teachers were qualified to teach both the subject Swedish and Swedish as a second language in Grades 1-3. Furthermore, the research team advised and guided the teachers and special needs teachers throughout the study. Students' progress according to the test results was discussed during six meetings between researchers and teachers and special needs teachers. At these meetings, joint decisions were made about students' needs for additional instruction in Tiers 2 and 3.

A logbook was used by the teachers and the special needs teachers during the study. They documented the content of the lessons within Tiers 1-3, and the logbooks revealed that they followed the instruction recommended by Taube et al. (2015). Moreover, to secure fidelity, one of the authors visited all special needs teachers during at least one Tier 2 or Tier 3 session to observe whether the instructional recommendations were applied accurately. It was noted that special needs teachers typically followed decided instructions.

### **Analysis of Data**

Data were analyzed with IBM SPSS Statistics, version 29. In order to evaluate differences in test scores between L1 and L2 students independent sample t-test was applied, whereas the Pearson Chi-Square test was used for category data. Fisher's Exact test was applied in cases with less than 5 cases in a cell. The



decrease of students scoring at or below the 25<sup>th</sup> percentile in word and nonword decoding was conducted with the McNemar test. The significance level was set to 5%, and we applied two-tailed tests.

## Results

### L1 and L2 students' Reading Ability at the Beginning of Grade 1

At the beginning of Grade 1, all students performed tests in alphabetic knowledge, listening comprehension, decoding of words and nonwords, and reading comprehension. The test scores of L1 and L2 students at T1 were compared, and no significant differences were found except in listening comprehension (see Table 1).

**Table 1.** Comparison of reading test scores between students with Swedish as L1 and L2 at the beginning of Grade 1.

Test	L1	L2	<i>t</i> (111)	<i>p</i>
	( <i>n</i> =83)	( <i>n</i> =30)		
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )		
Letter knowledge	10.5 (2.1)	9.5 (2.9)	1.70	.08
Listening comprehension	9.8 (1.7)	8.2 (2.7)	3.16	.01
Decoding words	21.6 (18.7)	19.0 (22.0)	0.58	.36
Decoding nonword	8.7 (7.9)	8.4 (9.7)	0.15	.38
Reading comprehension, short text	3.7 (3.3)	3.0 (3.7)	0.88	.79

### The Proportion of L1 and L2 Students in Need of Additional Decoding Instruction during Grade 1

Students' word and nonword decoding was assessed after one semester of evidence-based teaching in Tier 1. Those who scored at or below the 25<sup>th</sup> percentile in any of the two tests were considered at risk of reading difficulties. There were students scoring at or below the 25<sup>th</sup> percentile in either of the two decoding tests (*n*=46, 41%). In the word decoding test, L1 students (*n*=30, 36%) and L2 students (*n*=13, 43%) scored at or below the 25<sup>th</sup> percentile ( $\chi^2=0.48$ , *df*=1, *p*=.49, *phi*=0.49). The difference was not significant. In the nonword decoding test, L1 students (*n*=32, 39%) and L2 students (*n*=16, 53%) scored at or below the 25<sup>th</sup> percentile ( $\chi^2=1.97$ , *df*=1, *p*=.16, *phi*=0.13). Consequently, many L1 and L2 students needed additional decoding instruction during the second semester of Grade 1. This instruction was provided in Tier 2 for L1 students (*n*=19, 23%) and L2 students (*n*=15, 50%). The proportion of the L2 students requiring additional instruction was higher, but the difference was not significant ( $\chi^2=7.70$ , *df*=1, *p*=.01, *phi*=0.26).

The students' decoding skills were assessed at the end of Grade 1. In the word decoding test, L1 students (*n*=15, 18%) and L2 students (*n*=8, 27%) still scored at or below the 25<sup>th</sup> percentile, and in the nonword decoding test, L1 students (*n*=19, 23%) and L2 students (*n*=10, 33%) scored at or below the 25<sup>th</sup> percentile. The proportion of students who scored at or below the 25<sup>th</sup> percentile in word decoding decreased during the second semester ( $\chi^2=18.05$ , *df*=1, *p*<.001), as well as in nonword decoding ( $\chi^2=12.00$ , *df*=1, *p*<.001). The decreased number of students with weak word decoding was significant among L1 students ( $\chi^2=13.07$ , *df*=1, *p*<.001) but not among the L2 students ( $\chi^2=3.20$ , *df*=1, *p*=.06). A similar pattern was found in nonword decoding; there was a significant decrease of L1 students with weak decoding ( $\chi^2=8.47$ , *df*=1, *p*=.01) but not L2 students ( $\chi^2=2.50$ , *df*=1, *p*=.11). Some L1 and L2 students still needed support to develop their decoding at the end of Grade 1.

**Table 2.** The proportion of L1 and L2 students scoring at or below the 25<sup>th</sup> percentile in reading tests at the end of Grade 1

Test	Total sample	L1		L2		<i>X</i> <sup>2</sup>	<i>p</i>	$\phi$
	( <i>N</i> =113)	<i>n</i>	(%)	<i>n</i>	(%)			
Letter knowledge	9 (8)	3	(4)	6	(20)	8.07	.01	.27
Listening comprehension	6 (5)	2	(2)	4	(13)	5.23	.04	.22
Word decoding	23 (20)	15	(18)	8	(27)	1.00	.32	.09
Nonword decoding	29 (26)	19	(23)	10	(33)	1.26	.26	.11
Reading comprehension, short text	21 (19)	11	(13)	10	(33)	5.87	.02	.31

Note: Chi<sup>2</sup> was calculated with Pearson Chi-Square. Effect sizes are presented with *phi*, and .1 is considered a small effect, .3 is a medium effect, and .5 is a large effect.

Besides the decoding tests, the students were assessed with letter knowledge, listening comprehension, and reading comprehension at the end of Grade 1. A significantly higher proportion of L2 students scored at or below the 25<sup>th</sup> percentile in letter knowledge, listening comprehension, and reading comprehension than L1 students at the end of Grade 1 (see Table 2). Among the L2 students with weak letter knowledge, 3 of 5 students had arrived in Sweden close to the start of Grade 1 compared to 3 of 25 L2 students with experience of Swedish preschool class education ( $\chi^2=5.69$ ,  $df=1$ ,  $p=.05$ ,  $phi=.044$ ). However, no significant differences in word and nonword decoding among the L1 and L2 students were found at the end of Grade 1.

### The Proportion of L1 and L2 Students in Need of Additional Decoding Instruction during Grade 2

At the beginning of Grade 2, students were again assessed with decoding tests to evaluate their need for additional instruction. In the word decoding test, L1 students ( $n=16$ , 19%) and L2 students ( $n=9$ , 30%) scored at or below the 25<sup>th</sup> percentile. The proportion of students with such low scores in word decoding did not differ between L1 and L2 students ( $\chi^2=1.47$ ,  $df=1$ ,  $p=.23$ ,  $phi=.11$ ). In the nonword decoding test, L1 students ( $n=14$ , 17%) and L2 students ( $n=7$ , 23%) scored at or below the 25<sup>th</sup> percentile. The proportion of students with weak nonword decoding skills did not differ between L1 and L2 students ( $\chi^2=0.61$ ,  $df=1$ ,  $p=.44$ ,  $phi=.07$ ).

During Grade 2, students with weak decoding skills were offered additional instruction in Tiers 2 and 3. Both L1 ( $n=17$ , 21%) and L2 students ( $n=7$ , 23%) were supported in Tier 2, whereas L1 students ( $n=8$ , 10%) and L2 students ( $n=6$ , 20%) had additional instruction in Tier 3. A slightly larger proportion of L2 than L1 students were supported in Tier 2 and 3 in Grade 2 (33% vs. 27%). The difference was not significant ( $\chi^2=2.18$ ,  $df=1$ ,  $p=.19$ ,  $phi=.14$ ).

The proportion of students scoring below or at the 25<sup>th</sup> percentile in any of the word and nonword decoding tests decreased during Grade 2. From 22% to 13% in word decoding ( $\chi^2=8.10$ ,  $df=1$ ,  $p=.004$ ) and 19% to 11% in nonword decoding ( $\chi^2=4.92$ ,  $df=1$ ,  $p=.02$ ). Further analyses revealed that the proportion of L1 students with weak word decoding had significantly decreased during Grade 2 ( $\chi^2=5.14$ ,  $df=1$ ,  $p=.02$ ), but the proportion of L1 students with weak nonword decoding did not significantly decrease ( $\chi^2=1.79$ ,  $df=1$ ,  $p=.12$ ). According to our results, the proportion of L2 scoring below or at the 25<sup>th</sup> percentile in word decoding ( $\chi^2=1.33$ ,  $df=1$ ,  $p=.25$ ) and nonword decoding ( $\chi^2=2.25$ ,  $df=1$ ,  $p=.13$ ) had not significantly decreased. For the proportions of L1 and L2 students with weak decoding skills, see Table 3.

Besides the decoding tests, the students were also assessed with listening and reading comprehension tests at the end of Grade 2. The proportion of students scoring at or below the 25<sup>th</sup> percentile is presented in Table 3. The proportion of students with weak listening comprehension was significantly higher among the L2 than L1 students. Similarly, a higher proportion of the L2 had weak reading comprehension of a long text than the L1 students.

**Table 3.** The proportion of L1 and L2 students scoring at or below the 25<sup>th</sup> percentile at the end of Grade 2

Test	Total sample	L1		L2		$X^2$	$p$	$\phi$
	( $N=113$ )	$n$	(%)	$n$	(%)			
Listening comprehension	9 (8)	3	(4)	6	(20)	8.07	.01	.27
Word decoding	15 (13)	9	(11)	6	(20)	1.61	.21	.12
Nonword decoding	12 (11)	9	(11)	3	(10)	0.02	1.00	.01
Reading comprehension, short text	18 (16)	10	(12)	8	(27)	3.52	.06	.18
Reading comprehension, long text	30 (27)	17	(21)	13	(43)	5.90	.02	.23

Note:  $\chi^2$  was calculated with Pearson Chi-Square. Effect sizes are presented with  $phi$ , and .1 is considered a small effect, .3 is a medium effect, and .5 is a large effect.

### Conclusion and Discussion

The present study investigated whether early reading education based on an RTI model with a focus on decoding skills could promote reading ability among young students with Swedish as either their first

or second language. The result showed that early reading education based on an RTI model with a focus on decoding skills, aiming to support all students but not with a particular focus on L2 students, has the potential to promote decoding among L1 and L2 students in Grades 1 and 2. The decoding instructions must be differentiated to each L1 and L2 student's reading development and needs.

The proportion of L1 and L2 students scoring at or below the 25<sup>th</sup> percentile in word decoding decreased in Grades 1 and 2; however, the decrease was only significant for the L1 students. An explanation could be the more limited vocabulary knowledge among L2 than L1 students. This might entail that it is more difficult for L2 students to build up an L2 reading vocabulary and to use contextual clues in word decoding, and the orthographic processes might be slower for L2 students than for L1 students (see Verhoeven, 2000). Therefore, word decoding and comprehension should not be seen as separate factors but rather as overlapping and influencing each other (Duke & Cartwright, 2021). The more positive results among L1 students might also be explained by statistical power due to the limited sample size of L2 students. However, comparing L1 and L2 students revealed small word and nonword decoding effect sizes. This indicates that early reading education based on an RTI model with a focus on decoding skills, aiming to support all students and not with a particular focus on L2 students, has the potential to promote reading ability in Swedish among both young L1 and L2 students. Consequently, many of the students were able to develop early basic reading skills, such as cracking the alphabetical principle, developing secure grapheme-phoneme correspondence, synthesizing the sounds into words, and decoding words confidently and correctly. These are essential skills to focus on in early reading education (National Reading Panel, 2000; Verhoeven, 2000). The importance of fluent word decoding for the development of reading comprehension has been highlighted in reading research for both L1 and L2 students (Lipka & Siegel, 2012).

The L1 and L2 students' development of decoding skills in the current study could be explained by the early identification of their needs in basic reading skills (Lovett et al., 2017). Another explanation could be that both L1 and L2 students were monitored throughout the early grades and that the tiers were matched to the individual needs of each student according to the RTI model (Rivera et al., 2009). Worth noting is that a larger proportion of the L2 students were supported during both the second semester in Grade 1 and during Grade 2 compared to the L1 students, but the difference was not significant. This is in line with Abedi and Gándara (2006), who stated that students with another first language than the school language often need more support from the teacher to develop good reading ability. Their challenges in learning to read in a second language could result from difficulties grasping the linguistic patterns of the second language (Verhoeven, 2000). It is also possible that the larger proportion of L2 students in need of additional support in word decoding could be related to the fact that the L2 students, to a higher degree than L1 students, may not have known the meanings of the words. Vocabulary knowledge is crucial for early reading in L2 (Droop & Verhoeven, 2003; Lervåg & Aukrust, 2010). As decoding a word can be supported by the student's understanding of the word or the surrounding words (Ehri, 1998; 2014), the special needs teachers in the current study explicitly taught difficult words and reading comprehension strategies, especially in Tier 2. Such instruction will support the student in predicting which word will come next, thus facilitating decoding. Subsequently, the early reading instructions within the current study might have contributed to the support of L2 students' development of word decoding skills.

The positive effects of the RTI model with a focus on decoding skills to promote early reading development among L1 and L2 students with weak decoding skills could be related to teachers' high expectations of both L1 and L2 students. L1 and L2 students were considered as having reading difficulties if they scored at or below the 25<sup>th</sup> percentile and had the same access to additional instruction in Tier 2 and 3. That might have led to high expectations for both L1 and L2 students' development of decoding skills. The importance of high expectations of students' academic achievement independently of their ethnic group has been highlighted previously (Peterson et al., 2016). High expectations are also a part of the conceptualization of differentiation in education. Eikeland and Ohna (2022) described four levels of differentiation: differentiation as individualization, as an adaption to specific groups, as adaptations within diverse classrooms, and in a systematic perspective. At the first level, i.e., differentiation as individualization, teachers' high expectations of their students to achieve their full academic potential is

essential. In addition, at this level, differentiation means adapting the tasks and teaching to each student's different needs and skills in early reading. Adapting teaching to specific groups and within diverse classrooms entails finding effective strategies for teaching learners of different levels of reading development and proficiency in a second language. The fourth level of differentiation is a systematic perspective, which includes a broader context beyond just teachers and classrooms. It includes school leadership's role in making differentiation an everyday school practice. In the RTI model used in the current study, the instruction in three tiers was differentiated as individualization in specific groups and diverse classrooms, trying to find effective strategies for learners of different levels. Further, Tomlinson (2015) highlighted assessment as a part of the differentiated classroom and instruction centered on the learner, knowledge, and community. In the present study, data from assessing students' letter knowledge, decoding of nonwords and words, listening comprehension, and reading comprehension continuously informed the teachers on how to differentiate the instruction into different Tiers.

The present study showed that word decoding interventions might effectively support students with Swedish as a second language at different stages. This aligns with Ludwig et al. (2019), who argued that such interventions should not be postponed until students have reached a confidence level in the oral abilities of the second language. Given that languages do not develop in isolation, cross-language carryovers can be possible regarding phonological awareness and early reading skills (Cummins, 1979; 2021; Jeon & Yamashita, 2014). Consequently, a student with well-developed language proficiency in L1 may find it easier to develop reading skills in L2. Likewise, it might be a greater challenge to develop early reading in L2 if the student has an L1 that differs regarding the alphabetic writing system, orthography, or syllable structure in the current L2 (Jeon & Yamashita, 2014; Melby-Lervåg & Lervåg, 2011). Waiting to provide additional instruction can leave L2 students lagging behind their peers in developing decoding skills. All students should have the opportunity to acquire fluent word decoding as soon as possible. The relationship between basic reading skills and vocabulary is highlighted by Stanovich (1986), who describes The Matthew Effect whereby the 'rich-get-richer.' For example, students who read with success in the early grades get a richer vocabulary, and a richer vocabulary and language skills contribute to success in reading development. The relationship between regular early reading, a developed vocabulary, and a deeper understanding of reading is also confirmed in later studies (Keuleers et al., 2015; Nation, 2009; Schoonen & Verhallen, 2008). Consequently, good decoding ability is essential for both L1 and L2 students at all levels of language acquisition to create a positive spiral. That means it is essential as soon as possible to provide all students with learning opportunities to acquire basic reading skills in their early school years. All students should have the possibility to practice reading and become better word decoders and build vocabulary through their reading.

### **Practical Implications**

One useful model for planning and teaching reading education to young L1 and L2 students is the *Simple View of Reading* (Gottardo & Mueller, 2009; Jeon & Yamashita, 2014; Sparks, 2019). This model by Gough and Tunmer (1986) highlights the importance of focusing on both decoding and linguistic comprehension to acquire good reading comprehension. Results from the present study showed that decoding skills can be taught to both L1 and L2 young students. However, teachers should be aware that decoding and linguistic comprehension are related (see the *Active Model of Reading*, Duke & Cartwright, 2021). Consequently, both decoding and linguistic comprehension should be included in early reading education to promote all students reading acquisition.

The results of our study highlighted the importance of early monitoring of all students' reading abilities to support their teachers in providing differentiated instruction. Early and differentiated reading education provided in the whole class, in small groups, and with individual students has the potential to meet the needs of both L1 and L2 students and to develop their word decoding skills. L2 students at different levels of their second language development can benefit from interventions regarding word decoding. We argue that there is no need to delay interventions regarding basic reading skills until L2 students have reached a certain level in the second language, in line with earlier research on students

learning English as L2 (Ludwig et al., 2019). L1 and L2 students needing support should be identified and supported to develop secure word decoding in Tier 2 as early as possible. The study indicated that early reading interventions for L1 and L2 students could be provided in the same groups according to the RTI model to support all students' word decoding skills. When L1 and L2 students attend the same group, their heterogeneity might benefit the students' decoding skills development (Woore, 2010). For example, L2 students might find distinguishing between graphemes in Swedish easier when they hear accurate pronunciation from their L1 peers when attending the same group.

Our findings also revealed that only 15 lessons of small group interventions in Tier 2 could improve word decoding during Grade 1 for some L1 and L2 students. Monitoring the students' reading ability and the differentiated teaching in Tier 1 during both Grade 1 and Grade 2 could also motivate both L1 and L2 students who have reached secure word decoding skills and reading fluency to develop reading comprehension further. Some L1 and L2 students still needed support at the end of Grade 2. Therefore continuous monitoring and support of the reading development in Grade 3 are essential. Students who still score below the 25<sup>th</sup> percentile in decoding at the end of Grade 2 should continue to be provided instruction in Tier 2 and Tier 3 in Grade 3. To enable all students to crack the alphabetic principle and develop secure grapheme-phoneme correspondence in the first part of the first semester in Grade 1 (Castles et al., 2018), we first suggest monitoring letter knowledge and word decoding skills during the first semester in Grade 1. We also recommend providing additional decoding instruction in Tier 2 as early as possible, i.e., in the second part of the first semester in Grade 1, especially for L2 students in need of developing secure grapheme-phoneme correspondence. According to Verhoeven (2000), being able to distinguish sounds can be more challenging for L2 students, and the orthographic processes can be slower than for L1 students. Therefore additional instruction could be necessary for L2 students who struggle with grapheme-phoneme correspondence and word decoding.

Of course, early reading education should focus on more than just developing the students' decoding skills; a balanced approach is preferable (Taube et al., 2015). Our results indicate that systematic decoding instruction limits the number of students with weak decoding skills, although not significantly among L2 students. Similarly, some students might need more intense and systematic instruction in vocabulary, grammar, and reading comprehension strategies (e.g., Jeon & Yamashita, 2014) to acquire reading comprehension. Collaboration between class teachers, second language teachers, first language teachers, and special needs teachers in assessment, evidence-based teaching, and interventions is crucial during the early school years. This suggestion aligns with Fuchs and Fuchs (2006), who argued for involving more specialized educators throughout the RTI model to enable each student to reach the best possible result. The second language teacher has knowledge about second language acquisition and teaching from a second language perspective in all tiers. The first language teacher could contribute with knowledge about the structure of the student's first language and the language proficiency in L1 to take cross-linguistic carryovers between languages into account (Cummins, 1979, 2021; Jeon & Yamashita, 2014). Besides, the special needs teacher's competence in reading difficulties, assessment of reading development, and content of the interventions to meet each student's reading development needs are valuable in the different Tiers of RTI.

### **Limitations and Future Studies**

The current study has some limitations. Firstly, the nonsignificant results could result from the small sample size that limits the statistical power. Secondly, the group of L2 students is heterogeneous in language and exposure to Swedish. Besides, like L1 students, these students' results could be influenced by additional factors such as developmental disorders, social-economic status, and other cultural and social factors. Moreover, the student's exposure to the Latin alphabet could vary. These factors were impossible to control for in the present study due to the limited number of L2 students in each group, but they could be a focus of future studies.

The proportion of L2 students was 27% in the current study and corresponded to the national average of L2 students in Grades 1-2 in Sweden, which was 26% in Grades 1-2 in the school year 2021/2022

(Swedish National Agency for Education, 2022b). In replicating the study with more participants, the proportion of L2 students should still correspond to the national average proportion of L2 students. Also, in a future study, it would be valuable to include a comparison group without additional instructions in the multi-tier RTI model to evaluate the effects of the different tiers on the reading ability among L1 and L2 students.

According to our results, L2 students had a weaker result than L1 students in reading comprehension at the end of Grades 1 and 2. This aligns with Grabe (2009), who argues that the connection between word decoding and reading comprehension varies more for L2 and L1 students. Therefore, future studies should investigate the impact of an RTI model on vocabulary and comprehension skills in L1 and L2 students in Grades 2 and 3. Future studies should also investigate whether differentiated teaching in Tier 1 or Tier 2 and 3 interventions is more effective for developing vocabulary, grammar, and comprehension skills. Differentiated instruction in Tier 1 might be preferable regarding how much additional instruction the students can handle. The fourth level of differentiation (e.g., Eikland & Ohna, 2022) is also essential to consider in future studies, i.e., differentiation in a broader context than teachers and classrooms and the role of the school leadership in making differentiation a norm pattern in schools.

The evidence-based teaching in Tier 1 in the current study was based on Taube et al. (2015) recommendations but did not have a particular focus on second language development. Therefore, evidence-based teaching from a second language perspective in Tier 1 could be a focus of future studies. Besides, it is crucial to integrate instruction within all tiers into meaningful contexts to be suitable for L2 students (Haager, 2007). Tier 1, aimed at supporting all students, may need to provide more explicit, scaffolded instruction and practice for L2 students (Fien et al., 2011). Accordingly, Fien argued that future studies should examine the intensity and the length of the interventions to develop the language proficiency of L2 students. L2 students need more time and teaching from a second language perspective to develop cognitive academic language proficiency (Cummins, 1979; 2021).

## Declarations

### *Authors' Declarations*

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**Authors' contributions:** HE conceptualized and wrote the present study. It is part of a research project designed by LF, CN, and IS. Both CN and LF trained teachers and collected data. HE reviewed and summarized the literature. HS performed the statistical analysis and revised and edited the article. LF, CN, and IS reviewed the article.

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