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Predicting Papiamento and Dutch reading comprehension development in a post-colonial context

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Abstract

The current research aims to predict L1 Papiamento and L2 Dutch reading comprehension development in 180 children in the upper primary grades (4–6) in a post-colonial Caribbean context from initial language of decoding instruction, cognitive and linguistic child characteristics, and linguistic transfer. Overall, children showed better reading comprehension proficiency in L1 as compared to L2 Dutch. Over the grades, strong autoregression effects in reading comprehension development in both languages were evidenced. Language of decoding instruction was found to predict L2 reading comprehension, but not L1 reading comprehension. The development of L2 reading comprehension showed better outcomes in the case of initial decoding instruction in L2. Word decoding, reading vocabulary, and grammar in respectively L1 and L2 were related to L1 and L2 reading comprehension in Grade 4, while L2 reading comprehension was additionally related to L2 basic oral vocabulary. Moreover, only reading vocabulary was related to L1 and L2 reading comprehension development across the grades. Finally, evidence of cross-linguistic interdependencies in the development of reading comprehension in L1 and L2 was found.

1. Introduction

Comprehending text is essential for participation in society and educational success (Snow et al., 2007; World Literacy Foundation, 2015). Most children worldwide develop reading comprehension skills in their native language (L1) with individual differences being explained by word decoding, on the one side, and linguistic abilities, on the other side (i.e., the so-called lexical quality theory (Perfetti, 2017). Nevertheless, due to migration or immersion school systems, many children develop reading comprehension skills in a second language (L2), with often poorer (L2) comprehension skills compared to monolingual readers as a result (Melby-Lervåg & Lervåg, 2014). These findings, however, may very well be different when children are in a school environment where the language of instruction is a foreign language, as is the case for *children* in *a postcolonial setting. Many of these children* develop reading comprehension skills in the language of the prior colonizer country (L2) with minimal exposure outside school. Their mother tongue (often a Creole) has been almost completely excluded from the education system for a long time. Recently, the mother tongue in some of these postcolonial countries has been included in the school curriculum (permanently or as a pilot project), with substantial L1 reading comprehension development as a consequence (Carpenter & Devonish, 2010; Murtagh, 1982; Siegel, 1997; van der Elst-Koeiman et al., 2022). However, it is by no means clear how the initial language of decoding instruction and cognitive and linguistic child factors predict L1 and L2 reading comprehension in these communities and to what extent there is evidence of linguistic interdependencies. Studies that have been conducted were cross-sectional or had a descriptive nature (e.g., Carpenter & Devonish, 2010). Therefore, in the present study, we researched the effect of language of decoding instruction, cognitive and linguistic child characteristics, and linguistic interdependencies factors as predictors of the development of reading comprehension in L1 Papiamento Creole language and L2 Dutch as a foreign language, in the upper grades (Grades 4–6) on the Dutch Caribbean islands of Aruba, Bonaire, and Curaçao.

1.1. Reading comprehension development in L1

Reading comprehension entails the processing of written text in order to derive meaning. Research shows that when word decoding skills are automized this frees up mental resources, which facilitates reading comprehension process (National Reading Panel, 2000; Stanovich, 2000). Less skilled text comprehenders have been found to be less skilled in word reading

(García & Cain, 2014; Melby-Lervåg & Lervåg, 2014). The Reading System Framework (Perfetti & Helder, 2022; Perfetti & Stafura, 2014) posits that it is *not only* essential that readers can automatically map grapheme-phoneme relations but also that they can access word meanings quickly and integrate them into the whole text. This theory places lexical quality central in the reading comprehension process. Vocabulary knowledge has to be accessed by word decoding, which then has to be integrated into sentences through grammar rules (i.e., syntax), which in its turn has to be integrated into the text and to enable text comprehension (Perfetti & Helder, 2022; Perfetti & Stafura, 2014). Importantly, there is abundant evidence that reading comprehension skills of L1 readers continue to develop across grades (Farnia & Geva, 2013).

In initial primary grades, variation in reading comprehension is mostly explained by word decoding (García & Cain, 2014). However, in the upper grades, as word decoding skills become more or less automatized, language comprehension (e.g., vocabulary and grammar), begins to explain a larger proportion of reading comprehension (Droop & Verhoeven, 2003; Foorman et al., 2015; Storch & Whitehurst, 2002). Verhoeven and van Leeuwe (2008), conducted a longitudinal study throughout the elementary school among Dutch children and found word decoding, listening comprehension, and vocabulary to predict reading comprehension growth in the lower grades. However, for the upper grades the impact of word decoding decreased substantially, while vocabulary became the most important predictor of reading comprehension. Geva and Farnia (2012), and Verhoeven and van Leeuwe (2012) reproduced these findings, showing the pivotal role of language comprehension skills regarding reading comprehension in the upper grades. In a more recent study, Lervåg et al. (2017) examined the reading development of L1 Norwegian children (Grade 2–7), and again found that when decoding abilities are sufficiently developed to decode a text (by the end of Grade 3), listening comprehension (vocabulary, grammar and inference skills) determines reading comprehension growth across the upper grades.

1.2. Reading comprehension development in L2

Across different studies, L2 readers have shown poorer L2 reading comprehension skills compared to their L1 peers (for an overview, see Melby-Lervåg & Lervåg, 2014). This gap in L2 reading comprehension between L1 and L2 readers has been explained by lower L2 linguistic skills (e.g., vocabulary and grammar) of L2 readers, but not by differences in word decoding skills between L1 and L2 readers (e.g., Babayiğit, 2014; Oller & Eilers, 2002; Raudszus et al., 2021). L2 readers have been found to perform similar or even better than their L1 peers on word decoding in lower and upper grades (Jean & Geva, 2009; Lesaux et al., 2006; Raudszus et al., 2019; Van den Bosch et al., 2020). Despite the differences in performance in reading comprehension between L1 and L2 readers, L2 reading skills have been found to be predicted by the same linguistic skills (i.e., word decoding, vocabulary, and grammar) as L1 reading comprehension (Babayiğit, 2014; Droop & Verhoeven, 2003; Jeon & Yamashita, 2014; Raudszus et al., 2019; Verhoeven & van Leeuwe, 2012). However, in a study by Droop and Verhoeven (2003), vocabulary appeared to be of high importance for reading comprehension for L2 readers, even more so than for L1 readers.

Divergent results were found across different studies regarding reading comprehension growth processes between L1 and L2 readers. A comparative study of English language learners and English monolinguals across Grades 4–6 found L2 reading comprehension growth to decelerate, while L1 reading comprehension growth was found to be linear (Farnia & Geva, 2013). Another longitudinal study among L1 Dutch readers and L2 Dutch readers (Grades 4–6), found no differences in growth between the two groups (Raudszus et al., 2021). And yet another study, among Spanish-English bilingual children and English monolinguals children (Grades 2–5), found that the bilingual children developed faster over time (Silverman et al., 2015) without any structural differences in L1 and L2 reading comprehension processes. Similar to L1 reading comprehension development, the impact of word decoding on L2 reading comprehension development decreased over time, while the impact of language comprehension increased over time (Verhoeven & van Leeuwe, 2012). As word decoding skills are automatized, mental resources are freed up and more used mainly for language comprehension in both L1 and L2.

1.3. Interdependencies in L1 and L2 reading skills

The level of L1 proficiency has additionally been found to have an impact on L2 reading comprehension (for an overview, see Chung et al., 2019). These findings build on the theory of Cummins (1981, 1991, 2000), claiming that languages are interdependent and that sufficient input in one language, may accelerate better language understanding in the second language. Nevertheless, it is a prerequisite that there is sufficient exposure to the second language and enough motivation to acquire skill in that language. According to Cummins (2000), academic cross-linguistic interdependency is related to similarities between *cognitive attributes* (i.e., conceptual knowledge) and *linguistic structures* between languages. For this reason, Cummins (2007) argues for flexible instructional strategies, where teachers spend time during the lessons on similarities and differences between languages and where effective learning strategies are structurally taught to students across languages, so transfer between languages can occur (also see Vogel & García, 2017).

However, the way time is divided between the L1 and L2 is also relevant, it namely determines the exposure to these languages which in its turn influences the performance of L1 and L2 reading comprehension. As a case in point, Thomas and Collier (2002) conducted a study among primary school (Grade 1–5) English language learners and found that children in dual-language reading programs (with children learning to read in both L1 and L2) outperformed children in transition programs (with children first learning to read in L1 followed later by L2) and children in single-language learning programs regarding English proficiency (e.g., English reading tasks). Similar results were found in several other studies (Baker et al., 2012; Berens et al., 2013; Soltero-González et al., 2016; Rolstad et al., 2005; Slavin & Cheung, 2005) among English language learners throughout primary education.

1.4. L1 and L2 reading comprehension in a post-colonial context

Due to remaining colonial ties, many postcolonial countries continued to use the colonizer country's official language after receiving their independence (Siegel, 2010). This resulted in various L2 education systems, with little to no space for the children's mother tongue. For this reason, for many years, these children developed their reading comprehension skills in a second language that they seldom hear or use outside school (i.e., subtractive language model; see Lambert, 1974). However, awareness of the importance of the mother tongue in education has increased across the years (e.g., Rolstad et al., 2005; Thomas & Collier, 2002), with the United Nations Educational, Scientific and Cultural Organization [UNESCO] (2016) recommending *education in the mother tongue*,

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for all children. In the past decades, there has been an increase in mother tongue education in postcolonial countries, but research regarding language development and reading in a mother tongue is still scarce.

Studies that have been done in a postcolonial context in Australia and New Guinea showed higher oral language scores (in L1 and L2) and reading comprehension scores (in L2) for pupils who received L1-L2 bilingual education compared to pupils who only received education in L2 (Murtagh, 1982; Siegel, 1997). More recently, a descriptive study (in Jamaica) showed that children enrolled in an L1-L2 bilingual school program have similar L2 reading comprehension scores as their peers who only received L2 education (Carpenter & Devonish, 2010). Moreover, a study conducted prior to the introduction of the mother tongue in schools on Curaçao, showed that children were more proficient in L1 reading comprehension, compared to L2 reading comprehension in the upper grades, without ever receiving L1 reading education (Severing, 1997). This could be explained by the fact that children have developed mostly L1 oral language skills (i.e., a crucial predictor of reading comprehension) at home and in their outside environment (excluding school) that surpasses the L2 oral development developed in school (Narain, 1994; Severing, 1997). Evidence indeed has shown these children to have stronger cognitive-linguistic skills (e.g., grammar and vocabulary) in the mother tongue compared to the second language (Narain, 1995; Severing, 1997).

Finally, in a cross-sectional study, on L1-L2 reading skills in the 4th Grade on the postcolonial islands of Aruba, Bonaire, and Curaçao, we found that children were better in reading comprehension in their mother tongue (Papiamento), compared to the second school language (Dutch) and that children's L1 and L2 reading comprehension proficiency was associated with word decoding, basic vocabulary and grammatical ability (van der Elst-Koeiman et al., 2022). However, longitudinal research in which the impact of initial language of decoding instruction and child predictors of the development of reading comprehension in a postcolonial context are studied, has yet to be conducted. For this reason, in the current study the reading comprehension development of Papiamento (L1) and Dutch (L2) in the upper grades (4–6 Grade) of children on the postcolonial Dutch Caribbean islands of Aruba, Bonaire, and Curaçao was predicted from the language of initial language of decoding instruction, children's cognitive-linguistic skills, and cross-linguistic interdependencies.

1.5. The present study

Only after the twentieth century the mother tongue (Papiamento) of Aruba, Bonaire, and Curaçao was introduced into the education system as an official language of instruction (Ministerie van Onderwijs en Cultuur van de Nederlandse Antillen [MINOC], 2005). Before the introduction of Papiamento, Dutch (the official language of the Netherlands), was the dominant language in the education system. Creating a very complex education context, as the Dutch language (which is almost never heard outside of school by the children) is very distinct from the Papiamento language, except for some Dutch words that over the years were adapted to Papiamento. Papiamento is namely a Spanish-Portuguese-based Creole language that mostly makes use of open syllables and makes use of simple grammar rules (e.g., no verb-conjunction) (Pereira, 2018; Severing, 2015; Van Putte, 1999). The Dutch language, on the other hand, is a West-Germanic language that uses mostly closed syllables and makes use of relatively complex grammar rules (e.g., verb conjunction). Nevertheless, both languages have relatively transparent orthographies. Due to poor school outcomes and a high drop-out rate, many people argued for introducing the mother tongue of the children in the education system to adequately support the children(Central Bureau of Statistics [CBS], Netherlands Antilles, 2001). At present, a grand majority of the schools on the islands have a biliterate reading curriculum, but still, most schools teach the children to read in L2 Dutch. Partly this has to do with the lack of school materials and reading books in Papiamento and the fact that the Dutch language is strongly associated with school success and success in the labor market, showing the high status of this L2 language in an extensive L1 dominant community (Van Putte, 1999). Currently, around 27% of schools teach the children the principles of reading in L1 Papiamento (van der Elst-Koeiman et al., 2022). Children first learn to read in L1 Papiamento in Grade 1 and make the first step towards learning to read in Dutch at the end of Grade 1 or during Grade 2. Official reading instructions and lessons in L1 and L2 are generally given separately, but some teachers (mainly informally) use the L1 to support the teaching of L2 literacy (e.g., by pointing out differences between graphemes and phonemes). Official materials and instructions where similarities and differences are discussed however are not common (see Jacobson & Faltis, 1990).

This bilingual postcolonial context forms a natural context to examine L1-L2 reading development (Grade 4–6) while considering the initial language of decoding instruction (learning to read in L1 or L2), children's cognitive-linguistic skills (word decoding, grammar, and vocabulary), and linguistic interdependencies. Furthermore, because the participants in this study are in the post-primary grades, reading comprehension can be measured more authentically and less influenced by word decoding. We aimed to answer the three following questions:

(1) What are the differences between L1 Papiamento and L2 Dutch reading comprehension development and their linguistic precursors, and how does initial language of decoding instruction effects these developments?
(2) To what extent can the development of reading comprehension in L1 and L2 be predicted from children's word decoding and linguistic abilities?
(3) Is there evidence of interdependencies between L1 and L2 within the development of reading comprehension?

With respect to the first question, we expected higher levels of reading comprehension development for Papiamento than for Dutch, as this has been found in earlier research conducted in this similar context (Severing, 1997; van der Elst-Koeiman et al., 2022). Furthermore, based on earlier research of van der Elst-Koeiman et al. (2022), we expected the order of decoding instruction to have an impact on Papiamento and Dutch reading comprehension development; we expected for reading comprehension Papiamento that children who learned to read in Papiamento scored higher, and for reading comprehension Dutch, that children who learned to read in Dutch scored higher. Concerning the second research question, high stability across reading comprehension development in L1 and L2 was expected (Raudszus et al., 2021). Moreover, based on earlier studies (Babayiğit, 2014; Droop & Verhoeven, 2003; Severing, 1997; van der Elst-Koeiman et al., 2022), we expected the development of reading comprehension in Papiamento and Dutch reading to be predicted by word decoding, vocabulary, and grammar of that same language. We also expected the effect of vocabulary to be more extensive for L2 reading comprehension than for L1 reading comprehension (Droop & Verhoeven, 2003).

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With reference to the third research question, we expected to find evidence linguistic interdependencies from L1 reading comprehension to L2 reading comprehension and the other way around, as high coherence among L1 and L2 language skills have been found in in earlier research in this same context (van der Elst-Koeiman et al., 2022), and in other contexts (Chung et al., 2019).

2. Method

2.1. Participants

In this 3-year longitudinal study, 293 children (157 girls and 136 boys; Mage = 10.14; SD = 0.78) from eleven primary schools from the Dutch Caribbean islands of Aruba, Bonaire, and Curaçao took part. The measurement points of this study took place in the second half of Grade 4 (CY 2018; with 293 children (100%)), in the second half of Grade 5 (CY 2019; with 264 children (90.1%)), and in the second half of Grade 6 (CY 2019; with 180 children (61.8%)). Reduction of the sample size in the second wave was due to attrition and class repeat, while attrition, class repeat, and especially COVID-19 caused reduction of the sample size in the third wave. From the eleven participant schools, five schools start with decoding instruction in Papiamento (number of children per wave: 127, 116 and 74), while six schools start with decoding instruction in Dutch (number of children per wave: 166, 148 and 106). Schools were selected through collaboration with the schoolboards, in which next to the initial language of decoding instruction (L1 versus L2), socio-economic status of schools were taken into consideration. For Aruba and Curaçao, two schools with language of decoding instruction in Papiamento and two schools with language of decoding instruction in Dutch, participated in this study. For Bonaire, the only school with language of decoding instruction in Papiamento and two schools with language of decoding instruction in Dutch participated in this study (three schools in total). To compensate, two classrooms (instead of one) from the school that offers initial decoding instruction in Papiamento of Bonaire were recruited. The majority of the children (75.6%) indicated that they speak Papiamento at home, of which 25.6% indicated that next to Papiamento, they also spoke Dutch, English or Spanish at home. The remaining children (24.4%) had the following home languages: 3.6% Dutch, 15.8% English or Spanish, and 4.9% another language. The groups (L1 instructed children versus L2 instructed children) did not differ in home language ($X2(11) = 14.83$, $p = .19$), SES ($H(1) = 1.14$, $p = .29$, M(L1 instructed children) = 2.60 (SD = 1.00), M(L2 instructed children) = 2.74 (SD = 0.85)) or non-verbal reasoning, ($t(165) = -1.22$, $p = .22$, $d = .19$, M(L1 instructed children) = 30.72 (SD = 4.72), M (L2 instructed children) = 31.56 (SD = 4.18)). SES levels were determined through the profession level of the caregivers which were divided in four categories (low, lower middle, upper middle and high) (Central Bureau of Statistics, 2008), and non-verbal reasoning was assessed via the Raven (1958), 2003) blocks 1 and 2.

2.2. Materials

The language of Papiamento has two language variants: Papiamentu (which has a phonological spelling) that is used in Curaçao and Bonaire and Papiamento (which has an etymologically based spelling) that is used in Aruba. Papiamentu and Papiamento differ somewhat in their vocabulary, but in terms of phonology and sentence structures the two Papiamento variants hardly differ (Pereira, 2018; Severing, 1997). Parallel tasks were constructed for the two language variants in this study.

2.2.1. Basic vocabulary

To measure basic vocabulary in Dutch, half of the *Dutch Peabody Picture Vocabulary (PVTT)* (sets 4–11; the even numbers) for basic vocabulary was used (Dunn et al., 2005). The other half of the test (sets 4–11; the uneven numbers) was used to measure basic vocabulary in Papiamento. Each test consisted of 7 sets with increasing difficulty (42 items in total, 6 words per set). The test leader read each word aloud and the children were asked to choose the picture that best depicted that word. The children could choose from four pictures per item. The scoring was terminated after four consecutive wrong answers, following PVTT scoring guidelines. Per correct answer, the children received 1 point, and the total number of points was used in our analyses. The Cronbach's α for the Dutch test was .90 (showing excellent reliability), and the Cronbach's α for the Papiamento test was .80 (showing good reliability).

2.2.2. Reading vocabulary

To measure reading vocabulary, the *Leeswoordenschattaak Taaltoets Alle Kinderen* [Reading Vocabulary Language Test for All Children] (Verhoeven & Vermeer, 2001), with a total of 50 items, was used. Each item consisted of one sentence with an underlined word or sentence part. Beneath the sentence, four answers were displayed (in multiple choice form), from which the children had to choose the correct answer (i.e., synonym of the underlined word(s)). Based on the reading vocabulary test in Dutch, a parallel test was developed for reading vocabulary in Papiamento. Word frequency, sentence length, and the language context of Papiamento were taken into account. The Cronbach's α for the Dutch test was .71 (showing acceptable reliability) and Cronbach's α for the Papiamento test was .81 (showing good reliability).

2.2.3. Grammatical ability

To measure grammatical ability in Dutch, the *Zinsvormingstaak Taaltoets Alle Kinderen* [Sentence Task Language Test for All Children] consisting of 10 sentences and *Zinsvormingstaak van de Toets Tweetaligheid* [Sentence Task from Bilingualism Test] also consisting of 10 sentences, were used (Verhoeven et al., 1995; Verhoeven & Vermeer, 2001). Based on the grammatical ability test in Dutch, a parallel test was developed for grammatical ability in Papiamento, taking frequency of words, sentence length, and sentence complexity into account. Both grammatical tests (for Dutch and Papiamento) consisted of 20 sentences with increasing difficulty. Per test, the sentences were read aloud to the child and after every sentence the child was asked to repeat that sentence. Per sentence the child received one point for each correct function word that was repeated and one point for every correct syntactic pattern that was repeated (with a maximum of 40 points). Raw scores were used for analysis. Both tests showed excellent reliability. The Cronbach's α for the Dutch test was .93 and Cronbach's α for the Papiamento test was .99.

2.2.4. Word decoding

Dutch word decoding was assessed through the *Drie-minuten-toets* [Three Minutes Test] (Leysen et al., 2009). This test consists of three reading cards. Card 1 consists of simple structured single-syllable words (*150 CVC words*). Card 2 simple structured single-syllable words with consonant cluster in various positions (*150 CC words*). Finally, Card 3 consists of words that are multi-syllabic (*120 Polysyllabic words).* Per card, the children were asked to correctly

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read (aloud) as many words as possible in one minute. Each correctly read word was rewarded with one point. The total of points for the three reading cards were summed up and formed the end score for Dutch word decoding. The reliability (Cronbach's α) of the three cards in Dutch are reported to be good to excellent, sequentially, .87, .92, and .91 (Verhoeven et al., 2011). For Papiamento word decoding, a parallel word-decoding test was developed (Severing, 1997, 2018). This test also consisted of 3 reading cards with increasing difficulty (Card 1: *150 CVC words*, Card 2: *150 CVC words*, Card 3: *120 Polysyllabic words*). The reliabilities (Cronbach's α's) for the three cards in Papiamento in our sample were all excellent, sequentially, .99, .98, and .98.

2.2.5. Reading comprehension

Reading comprehension was measured through four tests of Progress in International Reading Literacy Study (PIRLS) (International Association for the Evaluation of Educational Achievement, 2011). PIRLS assessment includes narrative or informative texts with multiple-choice and open questions related to: the retrieval of explicitly stated information, the making of straightforward inferences, interpreting and integrating of ideas information, and examination of content, language and textual elements. All four texts used in this study were narrative texts with multiple choice questions and one "put into the correct sequence" item. Children received one point for every correctly answered question. Two of the used PIRLS texts in this study contained between 850 to 1000 words accompanied by 13 to 15 questions ("An unbelievable night" and "Macy and the red hen"), while the other two PIRLS texts ("Brave Charlotte" and "The lonely giraffe") contained between the 500 and 600 words accompanied by 15–19 questions. The latter two texts form part of the PIRLS Literacy texts, which are less difficult versions of PIRLS texts (i.e., shorter texts, with less difficult questions). There was a comparable distribution of the question types classified by PIRLS (e.g., around the same proportion of interpretive questions) between the two PIRLS texts, and also between the two PIRLS Literacy texts. Moreover, the readability of the texts were comparable as assessed by the Flesch reading ease readability formula (scores ranged from 0 (most difficult) to 100 (most easy) (Klare et al., 1969). The quantity of word types, the quantity of polysyllabic words and sentence lengths were analyzed, and showed comparable readability for the PIRLS texts ("An unbelievable night": 68.2, and "Macy and the red hen": 68.9) and for the PIRLS Literacy texts ("Brave Charlotte": 87.6, and "The lonely giraffe": 84.3). After the readability analyses, the texts were assigned randomly to Papiamento and Dutch. The Cronbach's α for the Dutch reading comprehension test ("De eenzame giraaf/The lonely giraffe" and "Een ongelooflijke nacht/ An unbelievable night") was 0.90, showing good reliability. Moreover, The Cronbach's α for the Papiamento and reading comprehension test ("Lili tin kurashi/Lili tin curashi" and "Maya i e galiña kòrá/Maya i e galiya cora") ["Brave Charlotte" and "Macy and the red hen"] was 0.77, showing acceptable reliability. In the analyses of this study, percentage correct scores were used to correct for the uneven number of items.

2.3. Procedure

Before conducting this study, we received approval (including human subject approval) from the Ethics Committee of our University (Faculty of Social Sciences; ECSW-2018-006R2). During our research we followed the guidelines of the National Code of Ethics for Research in the Social Behavioural Sciences. A combination of active and passive consent was used. Passive consent was only sent to the parents who did not react to the letter of active consent (48.49%). In the first round of data collection the following tests were administered in both L1 and L2: basic vocabulary, word decoding, grammatical ability, and reading comprehension. In the second round of data collection, reading vocabulary and reading comprehension were administered in both L1 and L2. Finally, in the third round of data collection, L1 and L2 reading comprehension were administered. The same L1 and L2 reading comprehension tests were administered across the three measurement points. In this way growth could be measured. A retest effect was not expected, as no feedback was given in-between and the tests were separated by one school year. The tests of word decoding and grammatical ability were conducted individually (in a separate room), while the tests of basic vocabulary, reading vocabulary and reading comprehension were conducted in a classroom setting. The tests were administered by the first author and several bilingual test leaders (former school teachers), who were trained on how to execute each test.

2.4. Data analyses

All analyses were conducted using IBM SPSS Statistics 27 and LISREL 8.54 (Cziráky, 2004). The development of L1 and L2 word decoding was analyzed through general linear model repeated measures analyses (2x3 design). The within subject variables were: 1) Language (L1, L2) and 2)Time (RC measurement 1, RC measurement 2 and RC measurement 3). The between-subject variable was Group (language of decoding instruction). To analyze the integrated development of reading comprehension in Papiamento (L1) and Dutch (L2), the interdependencies between cognitive-linguistic precursors and these developments, and possible language interdependency, LISREL autoregressive cross-lagged (lag-2) models were run (Jöreskog & Sörbom, 1996). These analyses were run based on list-wise deletion, as a result of non-random ($X2$ (280) = 347.43, p = .004) structural missing values attained mainly from wave 3 (COVID 19). The maximum likelihood estimator (ML estimator) was used to estimate the parameters of our models. The ML estimator has been found to be robust when univariate skewness is lower than 2 and the univariate kurtosis is lower than 7 (Curran et al., 1996; Ryu, 2011). Three steps were followed when executing these developmental analyses: 1) separate developmental paths were run for L1 reading comprehension and L2 reading comprehension from Grades 4 to 6, 2) cognitive-linguistic factors were added to the two models, 3) linguistic interdependency specification between reading comprehension in L1 and reading comprehension in L2 (over time) were run. All our 5 models were *just identified models (that is saturated models;* model fit: $\chi2$ (0) = 0.00, p = 1.00, RMSEA = 0.00) (Little, 2003). *However, because we were only interested in the autoregression coefficients this was not problematic.*

3. Results

In Table 1, the means and standard deviations for reading comprehension across measurement points and their cognitive-linguistic precursors, in general and per language of decoding instruction are presented. The skewness of the measures were between −1.31 and 0.57, while the kurtosis were between −0.95 and 1.70, showing a normal distribution among all measures (Tabachnick & Fidell, 2013). As described in van der Elst-Koeiman et al. (2022), the

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Table 1. Descriptive statistics for children's reading comprehension across time, basic vocabulary, reading vocabulary, grammatical ability and word decoding in Papiamento (L1) and Dutch (L2), presented for all children (general, N = 180) and per group (L1 alphabetization, N = 74 vs L2 alphabetization, N = 106)

		Papiamento		Dutch	
Reading measures		*M*	*SD*	*M*	*SD*
Reading comprehension MP1	General	64.75	14.42	56.85	18.55
	L1 Alphabetization	65.68	14.98	51.30	18.65
	L2 Alphabetization	64.10	14.05	60.71	17.54
Reading comprehension MP2	General	72.30	15.06	63.73	21.01
	L1 Alphabetization	71.54	15.73	57.57	22.31
	L2 Alphabetization	72.83	14.63	68.03	19.00
Reading comprehension MP3	General	74.76	15.98	69.03	20.15
	L1 Alphabetization	75.41	16.42	64.29	23.05
	L2 Alphabetization	74.31	15.73	72.34	17.20
Predictor measures					
Basic vocabulary	General	31.30	4.92	21.92	7.09
	L1 Alphabetization	31.27	4.90	20.86	7.48
	L2 Alphabetization	31.32	4.96	22.65	6.74
Reading vocabulary	General	24.32	7.67	15.78	5.78
	L1 Alphabetization	23.45	8.19	15.04	5.76
	L2 Alphabetization	24.93	7.26	16.29	5.76
Grammatical ability	General	32.27	4.87	18.80	8.65
	L1 Alphabetization	33.66	4.99	17.49	9.36
	L2 Alphabetization	31.29	4.55	19.72	8.03
Word decoding	General	152.04	53.71	180.14	58.50
	L1 Alphabetization	161.39	55.81	169.39	55.11
	L2 Alphabetization	145.51	51.46	187.65	59.87

Note. MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3. For the reading comprehension tests, percentage correct scores are presented instead of raw scores, due to the uneven number of items between L1 and L2 tests.

children scored higher on all cognitive-linguistic factors in their L1, except for word decoding. This study additionally showed children to also be better in L1 reading vocabulary compared to L2 vocabulary ($t(179) = 15.80$, $p < .001$, $d = 1.26$).

3.1. Differences in reading comprehension development in Papiamento and Dutch

The first research question was related to the differences in reading comprehension development in L1 versus L2 and the possible impact of language of decoding instruction. The results showed main effects of time, language, and group. Additionally, interaction effects between language and group, and between time and language were found (See Table 2). Regarding the language* group interaction, post-hoc *t*-tests consistently showed that, across Grade 4 to 6, children who learned to decode words in L2 scored significantly higher on reading comprehension in L2 (Grade 4: $M_{diff.} = -9.41$, $t(178) = -3.45$, $p < .001$, $d = .52$; Grade 5: $M_{diff.} = -10.45$, $t(140.61) = -3.28$, $p = .001$, $d = .50$; Grade 6: $M_{diff.} = -8.05$, $t(127.39) = -2.55$, $p = .012$, $d = .40$). No differences between the groups were found regarding L1 reading comprehension. Moreover, for children who learned to decode words in L1, a larger difference was found between their L1 reading comprehension and L2 reading comprehension scores, than for children who learned to decode words in L2 ($M_{diff.} = 29.30$, $t(132.89) = 4.52$, $p < .001$, $d = .70$) (see Figure 1). Regarding the time * language interaction, it was found that the increase in reading comprehension between MM2 (Grade 5) and MM3 (Grade 6) was larger for L2 (Dutch) than for L1 (Papiamento) ($t(179) = -2.72$, $p = .007$,

Table 2. Results of Repeated Measures GLM for the development of reading comprehension with time (MP1, MP2, MP3), language (L1, L2) and group (L1decoding instruction, L2 decoding instruction)

Measurement	Comparison	Results		
		F	*p*	η_p^2
Reading Comprehension	Time	112.91	< .001***	.388
	Language	52.77	< .001***	.229
	Group	4.18	.042*	.023
	Time*Group	1.39	.250	.008
	Language*Group	22.24	< .001***	.111
	Time*Language	3.29	.040*	.018
	Time*Language*Group	0.41	.659	.002

Note. MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3.
*$p \leq .05$
**$p < .01$
***$p < .001$

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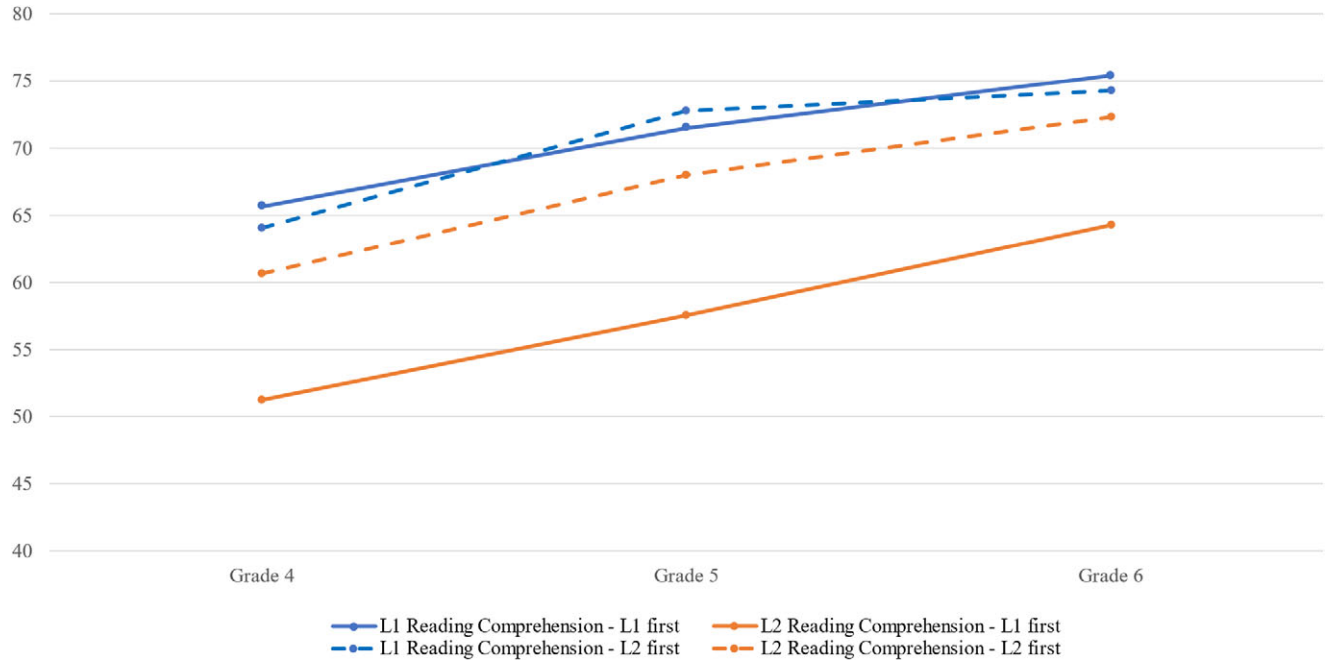

Figure 1. Reading comprehension L1 Papiamento and L2 Dutch across grades 4–6 per initial language of decoding instruction.

d = .25). No difference was found between MP1 and MP2 ($t(179)$ = .555, p = .580, d = .05). The results are depicted in Figure 1.

3.2. Predicting reading comprehension development

The second research question was related to the development of L1 and L2 reading comprehension and the effect of children's cognitive and linguistic abilities on these developments. High correlations were found among all three reading comprehension measures for L1 and L2 reading comprehension (see Table 3). Moreover, all cognitive-linguistic predictors correlated to all L1 and L2 reading comprehension measurements (Grades 4–6). Finally, all L1 reading comprehension measures correlated with all L2 reading comprehension measures. The development model of L1 reading comprehension showed relations between all measurement points, with high autoregression between Grade 4 and 5, and Grade 5 and 6, and moderate autoregression between Grade 4 and 6. The standardized coefficients of the model are presented in Figure 2 (upper panel). Also, for the development model of L2 reading comprehension, we found relations between all measurement points, with high autoregression between Grade 4 and 5, and Grade 5 and 6, and moderate autoregression between Grade 4 and 6 (see Figure 2, lower panel).

When adding the cognitive-linguistic predictors to the L1 reading comprehension model, significant paths were found from L1 word decoding, L1 grammatical ability and, L1 reading vocabulary to L1 reading comprehension at the end of Grade 4. No relationship was found between basic vocabulary and reading comprehension. For L1 reading comprehension in Grade 5, reading vocabulary showed a significant relationship with reading comprehension over and above the autoregressions. Finally, for Grade 6, no significant paths were found from the L1 cognitive-linguistic predictors to L1 reading comprehension. The significant standardized coefficients for this model are presented in Figure 3 (upper panel). When adding the cognitive-linguistic predictors to the L2 reading comprehension model, significant paths were found from L2 word decoding, L2 grammatical ability, L2 reading vocabulary, and L2 basic vocabulary to L2 reading comprehension at the end of Grade 4. Just as we found for L1 reading comprehension in Grade 5, here also L2 reading vocabulary showed a significant relationship with reading comprehension over and above the autoregressions. Finally, for Grade 6, again, no significant paths were found from the L2 cognitive-linguistic predictors to L2 reading comprehension. The significant standardized coefficients for this model are presented in Figure 3 (lower panel).

3.3. Linguistic interdependencies in reading comprehension development

The third research question was related to evidence of linguistic interdependencies between reading comprehension in Papiamento (L1) and reading comprehension in Dutch (L2). Linguistic interdependency specifications between languages were specified, from L1 reading comprehension in Grade 4 to L2 reading comprehension in Grade 5, and from L1 reading comprehension in Grade 5 to L2 reading comprehension in Grade 6. The same specifications were also made from L2 to L1, but the other way around. We found a moderate effect from L2 reading comprehension in Grade 4 to L1 reading comprehension in Grade 5 and vice versa. We also found a moderate effect from L2 reading comprehension in Grade 5 to L1 reading comprehension in Grade 6. The significant standardized coefficients are depicted in Figure 4.

4. Discussion

The present research studied L1 and L2 reading comprehension in the primary education of a post-colonial context (Aruba, Bonaire, and Curaçao) by researching the development of L1 (Papiamento) and L2 (Dutch) reading comprehension, and the effect of decoding instruction language and cognitive-linguistic skills, on this development. The results showed that children became more proficient in reading comprehension in *both* L1 and L2 over the years (from

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Table 3. Correlations between predictor measures (that is basic vocabulary, reading vocabulary, grammatical ability, word decoding) and reading comprehension

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Reading comprehension L1 MP1	-													
2. Reading comprehension L1 MP2	.715***	-												
3. Reading comprehension L1 MP3	.653***	.782***	-											
4. Basic vocabulary L1	.195**	.184*	.152*	-										
5. Reading vocabulary L1	.546***	.622***	.562***	.315***	-									
6. Grammatical ability L1	.394***	.303***	.236**	.126	.261***	-								
7. Word decoding L1	.326***	.249**	.271***	.061	.256**	.175*	-							
8. Reading comprehension L2 MP1	.515***	.482***	.403***	.092	.435***	.164*	.115	-						
9. Reading comprehension L2 MP2	.502***	.575***	.544***	.081	.476***	.109	.076	.745***	-					
10. Reading comprehension L2 MP3	.493***	.521***	.583***	.059	.448***	.097	.168*	.706***	.826***	-				
11. Basic vocabulary L2	.253**	.235**	.177*	.210**	.301***	.149*	−.029	.592***	.458***	.468***	-			
12. Reading vocabulary L2	.340***	.330***	.320***	.048	.446***	.171*	.062	.567***	.598***	.545***	.483***	-		
13. Grammatical ability L2	.316***	.259***	.176*	.039	.186*	.414***	−.025	.605***	.537***	.525***	.555***	.532***	-	
14. Word decoding L2	.269***	.205**	.220**	−.027	.171*	.095	.587***	.360***	.276***	.328***	.168*	.232**	.252***	-

Note. MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3.
*$p \leq .05$
**$p < .01$
***$p < .001$

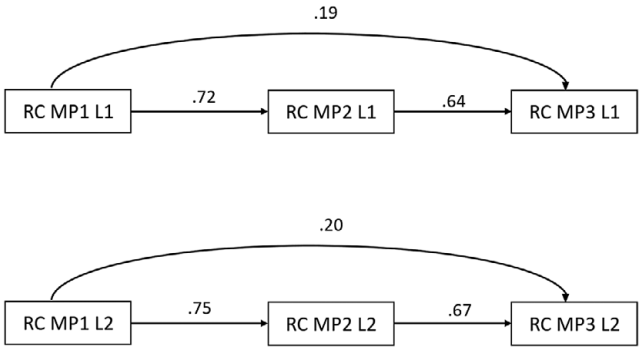

Figure 2. Development model of L1 (Papiamento) and L2 (Dutch) reading comprehension across grades 4–6.
Note. RC = Reading comprehension; MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3; L1 = Papiamento; L2 = Dutch.

Grade 4 to Grade 6). Moreover, children had higher scores in L1 reading comprehension compared to L2 reading comprehension, irrespective of language of decoding instruction. Interestingly, for L2 reading comprehension, more substantial growth was found between Grades 5 and 6 than for L1 reading comprehension. Furthermore, L2 reading comprehension development was influenced by language of decoding instruction, while L1 reading comprehension was not. We also found that cognitive-linguistic skills were related to reading comprehension in both languages for Grade 4 and 5. Finally, bidirectional evidence of linguistic interdependencies was found.

4.1. Differences between L1 and L2 reading comprehension

Our first research question concerned the differences in reading comprehension development in Papiamento (L1) versus Dutch (L2) and the impact of the initial language of decoding instruction on this development. In line with earlier research (Severing, 1997; van der Elst-Koeiman et al., 2022), we found that across all grades (Grades 4–6), *both groups* were better in reading comprehension in Papiamento (L1), than reading comprehension in Dutch (L2). This shows the strong position of the mother tongue among these children regarding text comprehension. Furthermore, we found growth for both L1 and L2 reading comprehension across grades. Each year children become better at comprehending text in both languages. However, between Grade 5 and Grade 6, more substantial growth was found for L2 than L1. This finding contrasts with the study of Farnia and Geva (2013), who found that L2 readers' reading comprehension growth decelerated across primary education while the L1 readers' growth stayed stable, and the study of Raudszus et al. (2021), who found no differences in growth. This difference in growth could be explained by the different contexts. Contrary to the Canadian and Dutch context in which the mentioned studies took place, in the current post-colonial context extra attention is given to the L2 language in Grade 5 as preparation for secondary education where the instruction language is solely in L2. Moreover, as preparation for the Grade 6 exams (in L1 and L2), schools tend to focus extensively on developing the L2 language, with the idea that for Papiamento, less practice is needed. Another explanation could be that in the studies of Farnia and Geva (2013) and Raudszus et al. (2021), the L1 reading growth and L2 reading growth were measured between two groups of children (i.e., monolingual versus bilingual). In our study, L1 and L2 reading comprehension growth concern the same group of children (which

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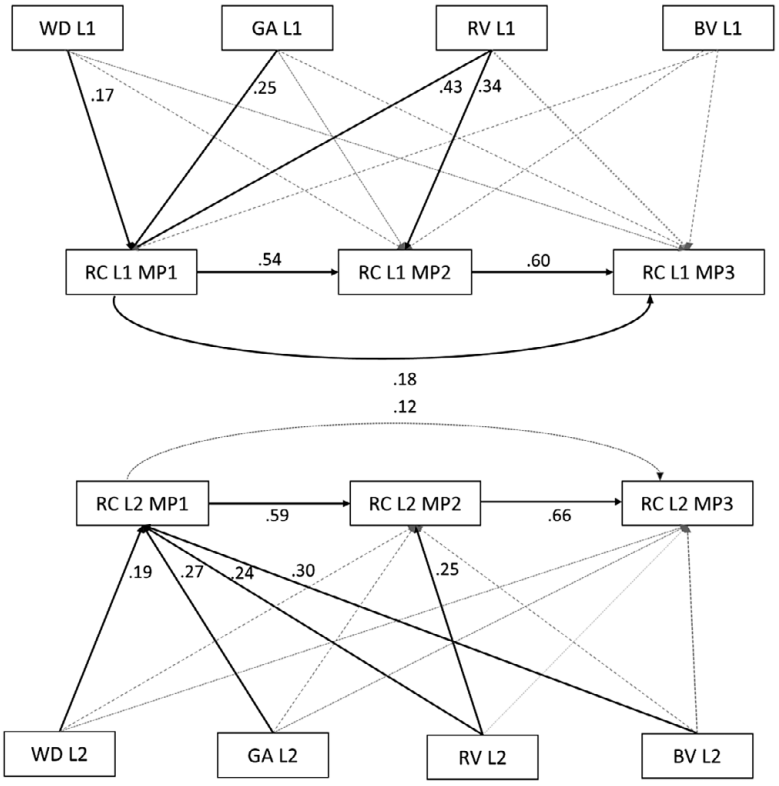

Figure 3. Model of L1 and L2 reading comprehension development predicted by cognitive-linguistic factors.
Note. WD = Word decoding; GA = Grammatical ability; RV = Reading vocabulary; BV = Basic vocabulary; RC = Reading comprehension; MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3; L1 = Papiamento; L2 = Dutch.

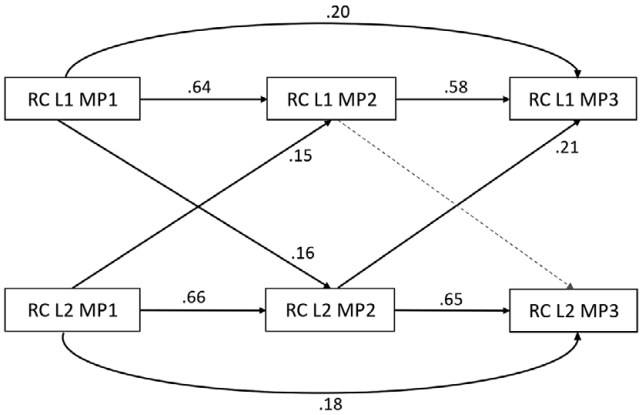

Figure 4. Model of linguistic interdependencies in the development of reading comprehension in L1 and L2.
Note. RC = Reading comprehension; MP1 = Measurement point 1; MP2 = Measurement point 2; MP3 = Measurement point 3; L1 = Papiamento; L2 = Dutch.

is barely researched). Moreover, the schools in our study have to make decisions on how to divide teaching time between L1 and L2, but the schools in the studies mentioned above only focus on one language. This difference could influence the growth pattern between L1 reading comprehension and L2 reading comprehension. Regarding the language of decoding instruction, we found that children who learn to read in L2 score higher in L2 reading comprehension compared to their peers who learn to read in L1. This shows that learning to read in Papiamento (with the current curriculum) can have costs for the *early development* of Dutch reading comprehension. This difference between the groups, however, decreases across grades. The structural separation of the languages in the reading (and language) curriculum can be a reason why pupils do not benefit sufficiently from their L1 on to their L2 (Cummins, 2017). Not actively and structurally using existing L1 language and literacy knowledge to teach L2 reading, and paying limited attention to the similarities and differences between the languages, can disturb children from using their L1 language knowledge to develop their L2 reading skills. People namely learn by pasting new information to old (Bransford et al., 2000), moreover, bilingual reading is part of *one* general psycholinguistic system (Jessner, 2006; Vogel & García, 2017). Nevertheless, it is also possible that learning to read in L2 Dutch helps to develop L2 vocabulary of children as byproduct, which is an important predictor of reading comprehension. Moreover, it could also be the case that the schools who first teach decoding instruction in Dutch have more attention for Dutch language lessons (writing, vocabulary, oral skills), which translates to L2 reading comprehension skills. Additionally these children receive more oral input in the L2 language, which could also positively effect their L2 language comprehension.

Additionally, the particular type of bilingual decoding program (decoding instruction in L1 followed by decoding instruction in L2) used in these schools could be negatively influencing the development of L2 reading comprehension (e.g., Rolstad et al., 2005). Longitudinal research shows that the best way to attain L2 reading comprehension skills is by learning to read in L1 and L2 at the same time (Rolstad et al., 2005; Soltero-González et al., 2016; Thomas & Collier, 2002). When two linguistic systems are taught at the same time, children develop processing ability (in speed and accuracy),

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enabling higher cognitive processing skills (by differentiating between languages), which have advantages for the development of L1 and L2 reading development (Bialystok et al., 2008). However, it should be taken into account that in the studies mentioned above, the L2 learners also hear the L2 language regularly outside of schools, which is not the case on the islands. Finally, the lack of structural teaching materials and reading books in L1 Papiamento may also be an additive reason for this finding. Due to a lack of L1 reading materials, it is possible that the L1 language cannot develop enough, to fully facilitate L2 reading skills (Severing & Weijer, 2008).

4.2. Effect of cognitive-linguistic skills on L1 and L2 reading comprehension development

Our second research question concerned the effect of children's cognitive and linguistic abilities on the development of L1 and L2 reading comprehension. The results showed high autoregression effects between Grades 4–6 for both L1 and L2 reading comprehension development. For the development of L1 reading comprehension, L1 word decoding, L1 reading vocabulary, and L1 grammatical ability were relevant factors for Grade 4, while only L1 reading vocabulary was relevant for Grade 5. For the development of L2 reading comprehension, L2 word decoding, L2 basic vocabulary, L2 reading vocabulary, and L2 grammatical ability were relevant factors for Grade 4, while only L2 reading vocabulary was relevant for Grade 5. These findings are in line with the Reading System Framework (Perfetti & Stafura, 2014), showing that word decoding, vocabulary, and grammatical ability are important factors of reading comprehension. Furthermore, the fact that only reading vocabulary was related to L1 and L2 reading comprehension in Grade 5 is in line with research, showing the decrease in the importance of word decoding over time for reading comprehension and the increase of the importance of vocabulary (e.g., Droop & Verhoeven, 2003; Lervåg et al., 2017). In the upper grades, as word decoding skills are automatized, mental resources are freed up and used mainly for language comprehension (e.g., vocabulary), which then begins to explain a larger proportion of reading comprehension (e.g., Storch & Whitehurst, 2002).

Finally, it is remarkable that basic vocabulary was only related to L2 reading comprehension (Grade 4) and not L1 reading comprehension (Grade 4). Given the fact that Dutch is a foreign language, it takes children more time to attain the Dutch basic vocabulary compared to the Papiamento basic vocabulary (their mother tongue). Since children are still developing their basic Dutch vocabulary, this measure relates to L2 reading comprehension in Grade 4, showing the importance of vocabulary in regard to reading comprehension (Droop & Verhoeven, 2003; Lexical quality theory, Perfetti, 2017).

4.3. Linguistic interdependencies in L1 and L2 reading comprehension development

Our third research question concerned evidence of linguistic interdependencies in L1 and L2 reading comprehension development. Conforming with the language transfer theory (Cummins, 1991), evidence of linguistic interdependencies from Grade 4 to 5 were found from L1 reading comprehension to L2 reading comprehension and vice versa. Furthermore, for Grade 5, we *only* found linguistic interdependency from L2 reading comprehension to L1 reading comprehension. It could be that the extra amount of attention given to the L2 language in the final grades (i.e., more effective instruction due to, e.g., end exams) facilitates this latter relationship. On the other hand, the lack of transfer from L1 reading comprehension in Grade 5 to L2 reading comprehension in Grade 6 may be due to the reduced focus on the L1 language in the higher grades. This study showed that the development of L1 reading comprehension has decelerated between Grade 5 and 6, which could have impeded the transfer from L1 to L2. The conclusion can be drawn that linguistic interdependencies in a bilingual reading curriculum may be bidirectional, not only from the stronger language (i.e., Papiamento) to the weaker language (i.e., Dutch), but also the other way around, if sufficient input in the curriculum is provided (see Cummins, 1991, 2000). Future research is nevertheless needed to broaden the transfer paradigm while including a broader range of variables.

4.4. Strengths, limitations and further research

As a basic strength, the present study expands the scarce research on bilingual reading development in a post-colonial setting with evidence from Creole Papiamento as L1 and ex-colonial Dutch as a foreign language (L2) in the upper grades of primary education in the Caribbean. Importantly, children's reading comprehension in L1 and L2 is predicted from initial language of decoding instruction, cognitive and linguistic child factors and linguistic interdependencies in one and the same design. It should also be recognized that this study used extensive measures for child characteristics, as word decoding, basic vocabulary, reading vocabulary and grammatical abilities were taken into account. Limitations apply to the study as well. Firstly, the pandemic of COVID-19 negatively influenced our sample size, which reduced the statistical power in the present study (see method section). Secondly, the current study lacks more qualitative data on the detailed use of Papiamento and Dutch in the classroom. Gaining more insight into the didactical approaches used in the schools may give more insight into the profitability of dual-language programs in this particular setting.

4.5. Practical implications

Different implications for educational practice can be made based on the results of this research. Firstly, it is shown that Papiamento fits well in primary education, as our results show significant reading development over the years in this Creole language which is still in development itself. This study also shows that dual-language programs that first start with Papiamento are less sufficient for the *early development* of L2 reading comprehension. To foster reading comprehension in L2 with no cost for the development of reading comprehension development in L1, an evaluation of the current dual-language program is needed. In this evaluation, flexible instructional strategies among L1 and L2, where similarities and differences between the languages are structurally taught, should take a central place (Jessner, 2006; Vogel & García, 2017).

The present study also evidenced that the development of reading comprehension in L2 is highly dependent on (1) early language of decoding instruction and (2) vocabulary size in that language. Therefore, it is important to foster L2 vocabulary and early literacy in kindergarten and first grade and to give it a prominent place in the reading curriculum throughout the middle and upper grades. More research is also needed to find out whether a combined L1-L2 initial language of decoding instruction leads to better reading comprehension outcomes in the two languages (see Rolstad et al., 2005; Soltero-González et al., 2016; Thomas & Collier, 2002). Finally, the present study highlights that there are opportunities for linguistic transfer in

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language an literacy development in L1 and L2 throughout the grades (see Cummins, 1991), *again* showing the importance of researching the attuning of the reading instruction in L1 and L2 languages in the classroom. In further research the possible dynamic between the effect of dual language reading instruction and its connection to language transfer should be detangled.

5. Conclusion

The present study extended previous research on L1 and L2 reading comprehension by studying reading development in Papiamento (L1) and Dutch (L2) in the upper grades of primary education in a post-colonial context (Aruba, Bonaire, and Curaçao). Throughout the grades, better reading comprehension proficiency in L1 Papiamento was found compared to L2 Dutch. This shows the strong position of the mother tongue among these children regarding reading comprehension. The development of L2 reading comprehension was found to be dependent on initial language of decoding instruction. Children who started decoding instruction in L2 had higher proficiency in L2 reading comprehension compared to children who started decoding instruction in L1. Furthermore, word decoding, reading vocabulary, and grammar were related to L1 and L2 reading comprehension in Grade 4, while L2 reading comprehension was additionally related to basic vocabulary. Moreover, reading vocabulary was related to L1 and L2 reading comprehension development across the grades. Finally, linguistic interdependencies in the development of reading comprehension in L1 and L2 were found from L1 to L2, and the other way around. All by all, these results primarily show the importance of the mother tongue in the reading curriculum in a post-colonial setting. Secondly, these results show that for bilingual reading development more comes to play than cognitive-linguistic factors, as the language in which children learn to read and interdependencies between languages have also proven to be relevant.

Data availability statement. The data that support the findings of this study are available from the corresponding author, [M.M.J.V.K], upon reasonable request.

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Declarations of interest. none.

Ethical approval. Before starting our data collection we received approval from the ethics committee of the Faculty of Social Sciences of the Radboud University. Human subject approval was included in this approval. Our faculty follows the guidelines of the National Code of Ethics for Research in the Social Behavioral Sciences. See: https://www.nethics.nl/Gedragscode-Ethical-Code/

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