# Reading and writing development of low-achieving adolescents 

The roles of linguistic knowledge, fluency, and metacognitive knowledge

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## The roles of linguistic knowledge, fluency, and metacognitive knowledge

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## Chapter 1

## General introduction

### 1.1 Background

Education poses strong demands on youngsters' reading and writing skills. On one hand, reading and writing are goals of education. On the other hand, written language is used as a medium to transfer content knowledge (Chall, 1996; Graham \& Perin, 2007). Because of the important part that reading and writing play in education, students with limited reading and writing skills may face huge challenges in their educational careers, not only in language courses, but also in other school subjects (Alvermann, 2001). In addition, due to the rapid shift towards digital means of communication, the ability to read and write is increasingly demanded in everyday life, for example in communication with various kinds of public agencies and authorities. Likewise, in jobs that students are prepared for, the competency required in written communication keeps going up.

Whereas school and society pose high demands on youngsters' reading and writing skills, many adolescents experience difficulties in understanding what they read (Dutch Education Inspectorate, 2008; Hacquebord, Linthorst, Stellingwerf, \& De Zeeuw, 2004; Kamil, 2003; OECD, 2003; Perie, Grigg, \& Donahue, 2005) and in expressing their thoughts in comprehensible texts (e.g., Alliance for Excellent Education, 2006; Dutch Education Inspectorate, 2008; Greenwald, Persky, Campbell, \& Mazzeo, 1999; Persky, Daane, \& Jin, 2003; Salahu-Din, Persky, \& Miller, 2008). Especially in the lower educational tracks, students experience problems in reading comprehension and writing proficiency (Dutch Education Inspectorate, 2008). In addition, students from language-minority backgrounds make up a large proportion of these students struggling with reading and writing (e.g., Dagevos, Gijsberts, \& van Praag, 2003; Driessen, 2009; Gijsberts \& Herweijer, 2009). Given the importance of well-developed reading and writing skills in modern society, poor readers and writers would substantially benefit from improvement in their reading and writing skills.

Although research focusing on low-achieving adolescents could yield outcomes beneficial to teaching reading and writing to this population, the focus on low-achieving students is rather scarce in academic research on reading and writing (Braze, Tabor, Shankweiler, \& Mencl, 2007; Juzwik et al., 2006; Klassen, 2002). This is the background which led to the study presented in this dissertation. It has been conducted in the context of a larger research project, namely the SALSA-project (an acronym for Study into Adolescent Literacy of Students At-Risk). The main aim of the SALSA-project was to investigate low-achieving adolescents' reading and writing
development from different angles, and to provide insights in how individual differences in literacy that exist within the population of low-achieving adolescents (vmbo students in the Netherlands) can be accounted for. ${ }^{1}$ The project comprised three longitudinal studies in a relatively small sample, and one cross-sectional study in a larger sample. The cross-sectional study of Van Steensel (2014) aimed to test predictions, formulated by the other studies, on the most important contributing factors of low achievers' reading comprehension and writing proficiency. The longitudinal study by De Milliano (2013) focused on school context variables, the study by Van Kruistum (2013) on students' media use in the out-of-school context. In contrast, the study presented in the current dissertation focuses on the roles of linguistic knowledge, fluency, and metacognitive knowledge in explaining individual differences in low-achieving students' (development in) reading comprehension and writing proficiency.

### 1.2 Low-achieving adolescents

One of the unique features of this study is that it focuses on individual differences in reading comprehension and writing proficiency within the population of lowachieving adolescents. By low-achieving students we mean: students who do not suffer from specific learning or behavioral disorders, but nonetheless show a lower academic performance in general, across school subjects. Up till now many studies into reading and writing were directed towards younger students, student populations with particular disorders, or heterogeneous groups of adolescents. This dissertation adds to the knowledge about differences in reading comprehension and writing proficiency between high- and low-achieving adolescents, in particular through its focus on a sample of low-achieving students. These students may be particularly in need of educational interventions directed at improving their reading and writing skills.

In the Netherlands, after sixth grade, students are streamed into several educational tracks, according to their academic abilities. Not surprisingly, especially in the lower educational tracks (the basisberoepsgerichte leerweg and kaderberoepsgerichte leerweg of the vmbo), relatively many students experience problems with reading comprehension and writing proficiency (Dutch Education
${ }^{1}$ The SALSA-project was financially supported by NWO, The Netherlands Organisation for Scientific Research. The following researchers were involved, either as investigators, principle investigators, or thesis supervisors: Marriëtte de Haan, Ilona de Milliano, Jan Hulstijn, Paul Leseman, Ron Oostdam, Peter Sleegers, Mirjam Trapman, Amos van Gelderen, Claudia van Kruistum, and Roel van Steensel.

Inspectorate, 2008). Students enrolled in these tracks of education form the population of interest of this dissertation.

Adolescents from a language-minority background require specific attention in research on reading comprehension and writing proficiency of low-achieving students. In the Randstad, a conglomeration of four large cities in the Netherlands around which we concentrated our study, many pupils are from immigrant backgrounds (Hartgers, 2007). Although most of these pupils were born in the Netherlands, in many cases they grew up using another language than (or besides) Dutch. As a consequence they received less Dutch language input in comparison with their native-Dutch peers. On average, they lag behind their native peers in elementary-school success (Tesser \& ledema, 2001). In secondary education too, language-minority students form a large proportion of students struggling with reading and writing (e.g., Dagevos, Gijsberts, \& van Praag, 2003; Driessen, 2009; Gijsberts \& Herweijer, 2009). The scientific literature provides no uniform terminology for students from language-minority backgrounds who are educated in the majority language. Some studies speak of 'L2' or 'bilingual students', others of 'immigrant students', or 'language-minority students'. Henceforward we will refer to these students as 'language-minority students'.

### 1.3 The role of linguistic knowledge, fluency, and metacognitive knowledge in adolescents' reading and writing

Reading comprehension and writing proficiency are both complex processes. They are considered to be interactive: several types of knowledge and fluency (speed) interact (Bereiter \& Scardamalia, 1987; Chenoweth \& Hayes, 2001; Kintsch, 1988, 1998; LaBerge \& Samuels, 1974; McCutchen, 2006; Perfetti, 1999). First of all, reading and writing require linguistic knowledge, such as knowledge of vocabulary, grammar, and orthography. When faced with a text a skilled reader fluently applies this linguistic knowledge to build a mental representation of a text (Anderson \& Freebody, 1979; Gough \& Tunmer, 1986; Kintsch, 1998; Perfetti, Landi, \& Oakhill, 2005). Similarly, a skilled writer uses linguistic knowledge to formulate adequately (Beers \& Nagy, 2009; Chenoweth \& Hayes, 2001; Crossley, Weston, McLain, Sullivan, \& McNamara, 2011; Hayes, 1996; Nagy \& Scott, 2000; Torrance \& Galbraith, 2006). Second, reading and writing require the ability to apply linguistic resources in an efficient way (Hayes, 2006; Kellogg, 1999; Kirby \& Savage, 2008; LaBerge \& Samuels, 1974; McCutchen, 2011; 2012; Perfetti, 1999). Fluent access to linguistic knowledge is assumed to lower the cognitive processing load in reading and writing. For example, if decoding of words is not fluent, key information that has been read may have decayed by the time subsequent information is decoded by the reader (Kirby \&

Savage, 2008). Similarly, when in writing words are not retrieved quickly enough or when spelling is too slow, ideas that have not been written down can decay or even be forgotten by the writer during the writing process (Berninger, 1999; Graham, Harris, \& Fink-Chorzempa, 2002). Therefore, it has been suggested that many wordlevel and sentence-level processes need to be automated before readers and writers can pay efficient attention to text-level characteristics (Deane et al., 2008; LaBerge \& Samuels, 1974; McCutchen, 1996; Perfetti, 1999; Torrance \& Galbraith, 2006). Third, reading and writing directed at larger parts of the text require metacognitive knowledge, that is, knowledge of global text characteristics and knowledge about effective reading and writing strategies (e.g., Berninger \& Swanson, 1994; Perfetti, Landi, \& Oakhill, 2005).

Among adolescents substantial individual differences exist with respect to level of reading comprehension and writing proficiency. These individual differences appear to be related to differences in linguistic knowledge, fluency, and metacognitive knowledge, as has been shown by numerous studies in heterogeneous samples. For example, in a seminal study, conducted in the Netherlands using almost 400 secondary-school students, individual differences in reading comprehension and writing proficiency were found to be substantially related to individual differences in adolescents' knowledge of vocabulary and grammar, and metacognitive knowledge, whereas associations with word-level fluency, such as speed of lexical retrieval or speed of word recognition were found to be very small to non-significant (Schoonen et al., 2003; Van Gelderen et al., 2004). In other words, whereas in general the more skilled adolescent readers and writers possessed more knowledge of vocabulary and grammar, and metacognitive knowledge than poorer readers and writers, at the word-level the better readers and writers were not more fluent. This does not mean though that these word-level fluency aspects do not play a role in adolescent reading and writing. In fact, they may even be indispensable in the reading and writing process. It just indicates that individual differences in these components are not associated with individual differences in reading comprehension or writing proficiency.

The extent to which individual differences in knowledge and fluency are associated with individual differences in reading comprehension or writing proficiency may differ per population. Although there is substantial evidence for the importance of differences in components for explaining differences between more and less proficient readers and writers, less evidence exists about the explanatory value of these components within the group of low-achieving adolescents. In addition there may exist differences between native-Dutch and language-minority students with respect to the explanatory power of linguistic knowledge, fluency, and metacognitive knowledge in reading comprehension and writing proficiency.

Such information is extremely relevant for reading and writing education directed at (language-minority) low-achieving adolescents. Although knowledge of such relations between components and reading comprehension and writing proficiency does not directly lead to successful educational interventions, it is certainly informative for educational experiments directed at improving low-achieving adolescents' reading comprehension and writing proficiency. The study reported in this thesis examined, in a group of around 60 vmbo students, whether individual differences in knowledge and fluency were associated with differences in reading and writing proficiency.

### 1.4 Development in reading comprehension and writing proficiency

The second major object of the current study was concerned with the development of reading and writing proficiency over a period of two years. The literature of research conducted among heterogeneous samples of adolescents, has shown that - fortunately and not surprisingly - reading comprehension and writing proficiency were found to develop (e.g., Beitchman et al., 2008; Catts et al., 2008; Farnia \& Geva, 2011; Farr, Hughes, Robbins, \& Greene, 1990; Smith, 2011). An issue addressed by this study is whether substantial growth rates exist in low-achieving adolescents' reading comprehension and writing proficiency between Grades 7 and 9. This is not a trivial issue. On one hand, low-achieving seventh-grade adolescents might have developed poor literacy habits, for example because of a prolonged period of failure in reading and writing (e.g., Juel, 1988; Stanovich, 1986), which could lead to limited development or even stagnation. On the other hand, substantial progress is possible, because the low achievers start at relatively low levels and there is simply much to gain by teachers' efforts to enhance these students' literacy achievement in the first three years of secondary education.

In addition to addressing mere development in reading comprehension and writing proficiency of low-achieving adolescents, the current study has one more unique feature. It is the first study to investigate whether individual differences in reading and writing development between low-achieving adolescents can be predicted by (development in) linguistic knowledge, fluency, and metacognitive knowledge. This is of particular importance, because it may provide information relevant for education directed at reading and writing for this group of students. Results will show whether development in the linguistic and metacognitive components in three years of schooling of low-achieving adolescents explains reading comprehension and writing proficiency development. Thereby, it gives
strong indications whether growth in these components may be conditional upon a positive development in reading and writing for our target population.

### 1.5 Goals and outline of this thesis

Reading comprehension and writing proficiency are crucial for students' school careers and, consequently, students' future perspectives. Therefore, students who suffer from limited reading and writing skills deserve support in order to enhance their reading and writing skills. Although research focusing on low-achieving adolescents could yield outcomes relevant for teaching reading and writing to this population, the focus on low-achieving students is rather scarce in the research literature on reading and writing (Braze et al., 2007; Juzwik et al., 2006; Klassen, 2002). This thesis aims to contribute to this limited body of knowledge. The goals of this dissertation are twofold. The first goal is to provide insights into low-achieving adolescents' reading comprehension and writing proficiency, and the role of linguistic knowledge, fluency and metacognitive knowledge in explaining differences between students' levels of reading comprehension and writing proficiency. The second goal is to provide insights into low-achieving students' development in reading comprehension and writing proficiency in the first three years of secondary education, and to establish to what extent individual differences in development are associated with differences in students' (development in) linguistic knowledge, fluency, and metacognitive knowledge.

Chapter 2 reports on a study investigating the relative contributions of linguistic knowledge, fluency and metacognitive knowledge on seventh-grade low achievers' reading comprehension. Chapter 3 also addresses this issue, but focuses on the period covering Grade 7 to 9 . In addition, this chapter addresses development in reading comprehension from Grade 7 to 9 , as well as relative contributions of the components on this development. In both Chapters 2 and 3, differences between native-Dutch and language-minority students are analyzed. In Chapter 4, both level and development of writing proficiency are investigated from Grade 7 to 9 in association with (development in) linguistic knowledge, fluency, and metacognitive knowledge. Finally, Chapter 5 provides an overview of the findings and discusses suggestions for future research into low-achieving adolescents' reading and writing development. That chapter also discusses the potential relevance of the findings for educational practice and provides some recommendations. Because Chapters 2, 3 and 4 were written as independent journal papers, a certain amount of information overlap across chapters could not be avoided.

# Chapter 2 <br> Linguistic knowledge, fluency and metacognitive knowledge as components of reading comprehension in adolescent low achievers: Differences between nativeDutch and language-minority students ${ }^{2}$ 


#### Abstract

In this study we investigate the role of linguistic knowledge, fluency and metacognitive knowledge in Dutch reading comprehension of native-Dutch and languageminority adolescent academic low achievers in the Netherlands. Results show that these components are substantially associated with reading comprehension. However, their role appears to be different for the native-Dutch and languageminority low achievers. There are interactions between knowledge and fluency components with membership of the native and language-minority group of low achievers, indicating that knowledge is more important in explaining reading comprehension of language-minority adolescents, whereas fluency is more important in explaining the native-Dutch students' reading comprehension. Explanations of this difference between both groups of low achievers are discussed.


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### 2.1 Introduction

Reading comprehension is one of the most important skills that adolescents need for their careers, both at school and in their later lives. However, many secondary school students struggle with reading tasks they have to perform for school (e.g., Kamil, 2003; OECD, 2003; Perie, Grigg, \& Donahue, 2005). For example, $25 \%$ of the Grade 8 students in the United States do not reach the 'basic' level of reading on the National Assessment of Educational Progress (National Center for Ecuation Statistics, 2003). In the Netherlands, 20-30\% of the students in the first years of secondary education (Grades 7-10) seem to lack sufficient reading skills to understand texts in their school books (Hacquebord, Linthorst, Stellingwerf, \& De Zeeuw, 2004). For about 60\% of the Grade 7 students in the lowest tracks of Dutch secondary education, reading comprehension ability is severely limited (Dutch Education Inspectorate, 2008). Adolescents with immigrant backgrounds form a large part of this group, which is also the case in other countries (Dagevos, Gijsberts, \& van Praag, 2003; Elley, 1992; National Center for Education Statistics, 2003; OECD, 2001; Soussi, Broi, Moreau, \& Wirthner, 2004).

Despite the severity of the problem, still little is known about the factors affecting the reading comprehension ability of adolescent academic low achievers. Far more research attention has been paid to reading difficulties of younger children, although recently the amount of research into adolescent literacy has increased (e.g., Hock et al., 2009; Hulslander, Olson, Willcutt, \& Wadswordt, 2010; National Center for Education Statistics, 2003; Snow, 2002). In this study, we examine which individual literacy-related components are related to adolescent low achievers' reading comprehension. We define low achievers as those students who are in the lowest 30-percentile of general academic skills, as measured by an academic aptitude test prior to entry into secondary education, consisting of reading, language and mathematics. It is likely that these students' poor reading skills have a substantial impact on their academic lives.

Comprehending text is a complex process. When faced with a text, a skilled reader fluently applies knowledge of linguistic forms, meaning and text characteristics to build a mental representation of a text. The reading comprehension process is considered to be interactive: the knowledge and fluency (speed) components influence each other (Kintsch, 1988, 1998; LaBerge \& Samuels, 1974; Perfetti, 1999; Walczyk, 2000). The knowledge and efficiency (or fluency) with which this knowledge can be accessed and processed are important in both first language (L1) and second language (L2) reading comprehension (Koda, 1996; Segalowitz, 1986; Van Gelderen, Schoonen, Stoel, De Glopper, \& Hulstijn, 2007). Insufficient fluency prevents a reader
to devote enough (working memory) resources to building a mental representation of the text necessary for successful text comprehension (Kintsch, 1988, 1998).

Knowledge and speed components can be directed to lower and higher-order text processing. With lower-order processes we refer to letter and word recognition required for lexical access. Processes ranking higher on the continuum are directed to the grammatical form of words and sentences, the meaning of words and sentences and comprehension of larger parts of the text (paragraphs or the text as a whole) requiring knowledge of text characteristics, and use of global reading strategies.

Word recognition is a lower-order process, which requires both knowledge and fluency. It is the ability to transform written code into a phonetic code using the alphabetic principle (Perfetti, 1985), that is, converting letters and letter combinations into the corresponding phonemes (Stanovich, 1986). According to LaBerge and Samuels (1974) and Perfetti (1999), fluency of the lower-order processes enables a reader to devote attention resources to higher-order processes, which leads to better understanding of a text. Although fluent word recognition is necessary for efficient higher-order text processing, it is not sufficient for a reader's text representations (Aarnoutse, Mommers, Smits, \& Van Leeuwe, 1986; Aarnoutse \& Van Leeuwe, 1988; Carver, 1993; Gough \& Tunmer, 1986; Hoover \& Gough, 1990). Higher-order processes directed to grammatical form (morpho-syntax) and meanings of words and sentences are needed for text comprehension as well (Aarnoutse \& Van Leeuwe, 1988; Anderson \& Freebody, 1981; Cain \& Oakhill, 2006; Nation, Clarke, Marshall, \& Durand, 2004; Van Gelderen et al., 2007).

The highest-order processes of text comprehension are directed at the comprehension of larger parts of the text, such as recognizing global text characteristics, making inferences about text contents and predicting text content on the basis of several features of the text (title, headings, lay out and pictures). Poor readers often have difficulty drawing inferences from texts (Oakhill, Cain, \& Bryant, 2003) and monitoring their text comprehension, that is, detecting and resolving comprehension problems (Baker, 1989; Ehrlich, Remond, \& Tardieu, 1999; Oakhill, Hartt, \& Samols, 2005). Furthermore, they appear to have less knowledge about effective reading strategies and text characteristics than more proficient readers (e.g., Biancarosa \& Snow, 2006; Van Gelderen et al., 2003; Van Gelderen et al., 2007).

Alderson (2000) points out that the role of different processes of reading comprehension may differ for different populations. There are indications that the importance of the processes varies with literacy experience. The relation of word recognition with reading comprehension is stronger for young (beginning) than for adolescent readers (Aarnoutse \& Van Leeuwe, 1988; Adams, 1990, Francis, Fletcher, Catts, \& Tumblin, 2005; Hoover \& Gough, 1990; Perfetti, 1985, 1999). Although the contribution of fluent word recognition decreases in the later years of primary
education, fluent word recognition remains necessary for adolescents' efficient higher-order text processing.

Higher-order processes, on the other hand, may be more important for reading comprehension of adolescent readers, compared to younger readers (Tilstra, McMaster, Van den Broek, Kendeou, \& Rapp, 2009). In the cross-sectional study by Tilstra et al. (2009), the so called 'simple view of reading' (Gough \& Tunmer, 1986; Hoover \& Gough, 1990), was tested, which states that reading comprehension consists of two parts: word recognition and oral language comprehension. The contribution of word recognition and listening comprehension to the explanation of English reading comprehension of fourth, seventh and ninth graders was examined. The contribution of word recognition to reading comprehension was large for elementary-school children but smaller for older students. This finding suggests that other types of knowledge or skill, for example, knowledge of reading strategies and text characteristics, become more important as students get older. In a Dutch study by Van Gelderen et al. (2007) it was demonstrated that for adolescent students from Grade 8-10 there were strong relations between metacognitive knowledge and reading comprehension, but the relation with word-recognition skills was not significant.

Not only age but also proficiency in reading comprehension is an important factor to consider. Processes that contribute to the reading comprehension of low achievers can be different from the processes that are important for reading comprehension of more proficient adolescents' reading comprehension. However, studies into the importance of linguistic knowledge and fluency specifically directed to reading comprehension of adolescent low achievers are lacking. Nevertheless, we do know something about the importance of various components for more heterogeneous samples of adolescents. Van Gelderen et al. (2003) and Van Gelderen et al. (2007) found that metacognitive knowledge and vocabulary knowledge had unique significant contributions to reading comprehension skill of students from Grades 8-10 in Dutch secondary education, whereas there was no significant relation between reading comprehension and word-recognition speed. A similar finding is reported by Cromley and Azevedo (2004), who investigated the role of background knowledge, vocabulary, inference making, reading strategy use, and word recognition on English text comprehension among Grade 9 students. Vocabulary knowledge and the ability to draw inferences were the best predictors of reading comprehension, whereas word-recognition speed only correlated moderately with reading comprehension. For the specific subpopulation of adolescent low achievers it is possible that word recognition is more important, because for these students fluency in word recognition is underdeveloped. A substantial part of the lowachieving adolescents may be less involved in reading and less motivated to read,
because they have a history of reading failure. For this reason, we can expect that word-recognition fluency is still an important predictor of reading comprehension of low-achieving adolescents. In a similar vein, it can be expected that low-achieving readers have not yet developed any sophisticated metacognitive knowledge about reading and thus that they cannot apply that type of knowledge. This might reduce the importance of such knowledge for predicting reading comprehension proficiency in the group of low-achieving adolescents.

In addition, there may be differences between native students and languageminority students with respect to the role of reading comprehension components. Basing her work on previous research on adolescent and adult L2 learners, Bernhardt (1991, 2000) considers reading comprehension in an L2 to be a function of both general literacy ability (i.e., knowledge and skills needed to read and write, which are not language-specific) and L2-specific knowledge (L2 vocabulary and grammar knowledge). Many adult and adolescent bilingual readers have acquired general literacy abilities in their L1 and Bernhardt assumes that readers access these skills when reading in an L2. Since many language-minority students have limited knowledge of vocabulary and grammar in the language of education, this limited language-specific knowledge might be a serious impediment to text comprehension. In many studies of L2 reading (e.g., Bossers, 1992), the participants acquired L1 literacy before becoming literate in their L2. However, in the Netherlands as well as in other immigrant countries, in many cases, language-minority students, despite being bilingual orally and coming from an immigrant family background, typically have first learned to read and write in their L2 (Dutch) without being literate in their native tongue. For native-Dutch as well as language-minority students in our study, Dutch is the first language they learned to read and write in. Whether the group of language-minority students differs from their native peers with respect to the role of reading comprehension components is largely unknown. Possibly limited knowledge of L2 vocabulary and grammar plays a role. It is therefore worthwhile to investigate differential roles of reading comprehension components for native students and language-minority adolescents.

Native students and language-minority students have been found to perform differently on tasks that tap proficiency in reading comprehension components. Language-minority students often have smaller and weaker vocabularies and less knowledge of grammar than their native peers (e.g., Aarts \& Verhoeven, 1999; Oller, Pearson, \& Cobo-Lewis, 2007). Limited language knowledge leads to limited text comprehension, as has been shown by several studies (Clarke, 1980; Horiba, 1996; McLaughlin, Rossman, \& MacLeod, 1983; Riley, 1993). On other components, however, differences between language-minority and native students are less pronounced. For instance, in studies conducted in the Netherlands, Verhoeven
(1990) found less fluent word recognition for Turkish immigrant children compared to their Dutch peers in first and second grade, but Droop and Verhoeven (2003) found no differences in word-recognition efficiency between language-minority children and their native peers in Grades 3 and 4. Similarly, Wagner (1993) found that Grade 5 Berber-speaking children in Morocco attained the same levels of wordrecognition efficiency in standard Arabic as their peers who are native speakers of Moroccan Arabic. Van Gelderen et al. (2003) reported native and language-minority adolescents in Grade 8 in the Netherlands to be equally fluent on Dutch word recognition. Other skills, such as metacognitive knowledge, were also found to be comparable across native and language-minority readers (Van Gelderen et al., 2003). Therefore, we may predict that language-minority low-achieving adolescent readers on average possess less linguistic knowledge compared to their native peers, but that these two groups do not differ in word-recognition efficiency and fluency and metacognitive knowledge.

For language-minority low-achieving adolescents, L2 linguistic knowledge determines the degree of access to word and sentence meanings in texts (as explained in the literature about L2 reading). Given that our target group of lowachieving language-minority students may have both poor reading proficiency and poor linguistic knowledge, we expect that linguistic knowledge is a relatively important predictor of reading comprehension of language-minority adolescents. With respect to fluency and efficiency of word recognition we have no reason to expect differences in performance between both groups, based on the above studies. However, for our target group of low-achieving adolescents, the role of fluency may be different for native and language-minority students, because of the limited access that language-minority students have to linguistic knowledge. It may therefore be that word-recognition fluency is less powerful for predicting languageminority students' reading comprehension.

To our knowledge, the relative contributions of components of reading comprehension have not been investigated in adolescent low achievers and may be educationally relevant. Given that the role of components of reading comprehension is largely unknown for the present subpopulation of low-achieving adolescents, the following research questions were posed.
(RQ1) To what extent can reading comprehension ability of low-achieving adolescent readers be explained by knowledge and fluency constituted by the following components: knowledge of grammar and word meanings, metacognitive knowledge, fluency and efficiency of word recognition, and fluency in understanding sentence meanings?

Given that a substantial part of the low achievers consists of language-minority students, the roles of the components in both native-Dutch and language-minority adolescents were compared, leading to the following question:
(RQ 2) To what extent do the contributions of these components of reading comprehension differ between native-Dutch and language-minority adolescent low achievers?

In addition to the components of reading comprehension distinguished, some more general skills can be identified as contributing to reading comprehension. A reader makes use of working memory resources and reasoning abilities to construe meanings from a text. While reading a text, words are recognized. Simultaneously, the reader must remember what has been read and relate new incoming information to existing knowledge. Retention of information while processing new incoming information and retrieving information from long-term memory requires working memory capacity (Baddeley, 2003; Daneman \& Carpenter, 1980; Lesaux, Lipka, \& Siegel, 2006; Siegel, 1994; Siegel \& Ryan, 1988). Working memory capacity has been identified as a predictor of reading comprehension ability of both children and adults (Daneman \& Carpenter, 1980; Seigneuric, Ehrlich, Oakhill, \& Yuill, 2000). Finally, although some studies do not find significant relations between nonverbal cognitive ability and children's reading comprehension (Evans, Floyd, McGrew, \& Leforge, 2001), logical reasoning abilities also play a role in drawing inferences and in constructing a coherent model of a text, that is, relating new incoming information to existing knowledge (McGrew, 1993). For these reasons, we will study whether these general abilities can explain remaining variance in reading comprehension on top of the more specific components mentioned above.

### 2.2 Method

### 2.2.1 Participants

Nine schools for prevocational secondary education in urban areas in the western part of the Netherlands volunteered to participate in this study. In the Netherlands, students in the two lowest prevocational tracks are among the $30 \%$ lowest achieving on a national academic aptitude test, containing reading, language and mathematical skills.

We recruited students from Grade 7 (mean age about 13 years). To select students, two types of data were used. First, information from the school records (school aptitude test scores, IQ scores and information on the prevalence of learning or behavioral disorders) enabled us to select a sample of low achievers not suffering
from diagnosed learning or behavioral disorders that could have a confounding effect on our analyses. Furthermore, immigrant children who had attended a Dutch primary school for less than three years were excluded in order to keep the languageminority sample homogeneous with respect to previous schooling experiences and the related occasions for acquisition of Dutch.

Second, data about the ethnic and linguistic backgrounds (country of birth of student and parents and frequency of use of different languages spoken at home) of the students were obtained by means of a questionnaire that had to be filled out by the students themselves. Students were selected for the native-Dutch group if both parents were born in the Netherlands, ${ }^{3}$ if they were native speakers of Dutch, and if Dutch was their dominant home language (i.e., most language contacts within the home were in Dutch). Students were selected for the language-minority group if both parents were born outside the Netherlands and if they frequently spoke another home language than Dutch. This decision was based on information about the language spoken in interactions with father and/or mother (they spoke mostly another language than Dutch with their parents or as much Dutch as another language). Most students in the language-minority group ( 24 students) also learned, to some extent, to read and write in the other home language. However, the first language they learned to read and write in was Dutch. ${ }^{4}$

The final sample consisted of 60 students from 10 classes in 9 different schools, of whom 30 students had a native-Dutch background ( 14 boys; 16 girls). The other 30 students were language-minority students ( 21 boys; 9 girls). From each of the 10 classes native-Dutch and language-minority students were selected. The languageminority students had various ethno-linguistic backgrounds. Most of them were of Moroccan or Turkish descent, the remainder had Surinamese, Antillean, Cape

[^1]Verdean, and Chinese backgrounds. ${ }^{5}$ All but five of the language-minority students were born in the Netherlands; most students are thus second-generation immigrants.

### 2.2.2 Instruments

We measured the following reading comprehension component skills roughly ordered from lower to higher levels: word-recognition efficiency and speed, knowledge of grammar, knowledge of word meanings, fluency in understanding sentence meanings, and metacognitive knowledge. Furthermore, working memory span and nonverbal cognitive ability were measured.

Reading comprehension. The reading comprehension test (Van Steensel, Oostdam, \& Van Gelderen, 2013) was specifically designed for students in the lowest tracks of secondary education. It consisted of nine tasks comprising one or two texts and comprehension questions about those texts (multiple-choice and short-answer formats). The texts cover four different genres: narrative, argumentative, expository, and instructive. They were selected from four media types which students are likely to come across in their daily lives: (school) books, newspapers and magazines, official documents, and the internet. With respect to text format, a distinction was made between continuous texts and discontinuous texts (containing also graphs, pictures and figures). The topics of the texts were selected on the basis of their relevance within students' socio-cultural and educational realities. They cover personal issues (negative stereotyping, self-confidence), school subjects (history), human interest, social issues (crime, the environment), rules and regulations and leisure time activities. The test items were based on the distinction between lower, intermediate and higher levels of understanding, labeled as 'retrieving', 'interpreting', and 'reflecting', respectively (OECD, 2003; Van Steensel et al., 2013). The test consists of 65 items and the Cronbach's alpha for this test in our sample is .79. A one-factor model for all types of items had a good fit with the data (using confirmatory factor analysis with SEM).

Word-recognition efficiency. To test the students' word-recognition efficiency, we used a subtest of the so-called Three Minutes Test (Drie-Minuten-Toets, Verhoeven, 1995), a standardized test frequently used in the Netherlands. This subtest consists of a list of 120 multi-syllabic words. The words increase in length and difficulty as the students proceed through the test. However, all are high-frequency words assumed to be

[^2]familiar to the students. Students are asked to read aloud as many words as they can in 1 minute. The score on the task is the number of words that a student reads aloud correctly; it thus measures a combination of speed and accuracy (hence efficiency).

Speed of written word recognition. We tested speed of word recognition by means of a computer-administered lexical decision task, based on the test from Van Gelderen et al. (2003) and Van Gelderen et al. (2007). The stimuli consisted of 119 letter strings (three to eight letters), 59 of which were existing (well-known) words; the remainder consisted of phonologically correct pseudo-words. Students were asked to decide as quickly as possible whether the item was an existing word or not and press the corresponding key on the keyboard. Responses were automatically coded in terms of both accuracy and latencies (from the onset). The mean accuracy was $94 \%$. The latency measure was computed using only correct responses to existing words (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alpha for this speed test was .94. ${ }^{6}$

Grammatical knowledge. In this 50-item paper-and-pencil test, based on the grammatical knowledge test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007), students had to complete sentences containing a word-gap with the correct form of verbs, adjectives, anaphora, comparatives and articles, and they had to put words or phrases into the correct order, taking into account the correct form for number, time, aspect, and agreement. There were both fill-in-the-blanks and multiple-choice items in this test. The Cronbach's alpha for this test was . 72.

Receptive vocabulary. This paper-and-pencil test, based on the receptive vocabulary test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007), consisted of 73 multiple-choice questions, testing the knowledge of nouns, verbs, adjectives, and adverbs belonging to the 23,000 words in a dictionary for junior high school students (see Hazenberg \& Hulstijn, 1996, for details). Each item consisted of a neutral carrier sentence with a target word in bold print. The students had to choose between four options, printed underneath, one of which represented a correct synonym of the target word. The Cronbach's alpha coefficient for this test was .87.

Speed of sentence verification. Speed of sentence verification was measured using the same lexical decision paradigm as described for word-recognition speed. It was a computer-administered task. The task was based on the sentence-verification speed test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). A sentence was displayed on the screen as a whole. Students decided as quickly as possible

[^3]whether the sentence made sense or not. Half of the 72 items made sense (e.g., The man went to bed because he wanted to sleep), the other half did not make sense (e.g., Most bicycles have seven wheels). The sentences referred to common knowledge that Grade 7 students can be assumed to have. The average accuracy on the true assertions was $98 \%$. Responses were automatically coded in terms of both accuracy and latencies (from the onset). The latency measure was computed only on the basis of the correct responses to the 36 true assertions (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alpha coefficient for this test was .95. ${ }^{7}$

Metacognitive knowledge. Metacognitive knowledge was measured by means of a paper-and-pencil questionnaire consisting of statements about text characteristics, reading and writing strategies. It was based on the metacognitive knowledge test used by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). For the reading part, students were asked to respond with a text in mind they were reading in for example newspapers or schoolbooks. Students had to tick whether they agreed or disagreed with a statement. For example:
a. When you read, it is sensible to put most effort into memorizing details. (incorrect)
b. It is sensible to think beforehand why you are going to read a text. (correct)

The test had 45 items and the Cronbach's alpha coefficient was .55 . This relatively low reliability was probably caused by the difficulty of the task for our participants (the average score being 28 , whereas the expected score that would be obtained by purely guessing is 22.5 ).

Nonverbal cognitive ability. Nonverbal cognitive ability was measured by means of sets A, B, C and D (in total 48 items) of the Raven's Standard Progressive Matrices. Because of the expected difficulty of set E for the students in our sample, we decided not to include this part. Reliability of the test was rather low, due to items that were too difficult or too easy for our students. After eliminating these items (13 in total), Cronbach's alpha coefficient for the 35 -items test was 61 .

Sentence span. A sentence-span task based on Daneman and Carpenter (1980) was used to assess working-memory span. Although Daneman and Carpenter used written stimuli, we chose to use spoken stimuli (e.g., Swanson, 1999) in order to avoid effects of large differences in reading speed on the span-task score. Participants listened to a sentence and had to decide whether a sentence made sense or not by pointing to a green card with yes or a red card with no printed on it. Subsequently, the next sentence

[^4]was presented. After having listened and responded to a set of sentences (increasing in number from two to five sentences), participants had to repeat the last word of each sentence in that set, using the right order. The task contained 12 sentence sets: three sets of two, three sets of three, three sets of four and four sets of five sentences. The task was interrupted when a student failed on two or more sets at a level. The split half correlation coefficient was . 60.

### 2.2.3 Procedure

All tests, except the nonverbal cognitive ability test, were administered in FebruaryJune 2008. The Raven's Progressive Matrices test was administered in November 2008 (students were in Grade 8 by then). Due to drop-out, only 56 of 60 students completed this test. The word-recognition efficiency test and the sentence span task were administered individually. The reading comprehension test was administered to whole classes in three sessions of 45 minutes (the target students' classmates also took the test as part of a validation study, Van Steensel et al., 2013). The reading comprehension test sessions were also attended by a teacher to assist in maintaining order. The other tests were administered to small groups in three to four sessions of 45 minutes. We scheduled no more than two sessions per day in order to avoid test fatigue. All sessions were introduced by a researcher or a trained test assistant.

### 2.2.4 Analyses

The 60 students taking part in this study came from 10 different classes. So, in the analyses, intra-class correlations should be taken into account. Therefore, we started by checking whether there is a significant proportion of class-level variance in reading comprehension and other test scores. ${ }^{8}$ To establish this, we used the program MLwiN (Rasbash et al., 2000).

Means and standard deviations were computed for all tests for the whole sample, but also for the native-Dutch and language-minority students separately. To examine possible differences between native and language-minority students' test scores we used regression models with language background as predictor.

In order to carry out multiple regression analysis with reading comprehension we had to reduce the number of independent variables in order to increase the statistical power of the regression analysis. ${ }^{9}$ The reduction was based on a principal component analysis (PCA), which resulted in two distinct factors: knowledge and

[^5]fluency. We used the obtained factor scores in the remainder of our analyses. The multiple regression analysis was carried out with language background and gender as controlling variables. In general, girls obtain higher scores on reading than boys (e.g., Chiu \& McBride-Chang, 2006; Mullis, Martin, Gonzalez, \& Kennedy, 2003). Therefore, we decided to check for the influence of gender before examining the relative contributions of linguistic knowledge and fluency.

After we included the predictor variables (knowledge and fluency), we entered the interactions between language background and the predictors in the analyses. We included this step in order to determine whether the predictors had different relations with reading comprehension dependent on group membership (native-Dutch or language-minority). We tested the above relations with a one-tailed test for significance (alpha = .05) based upon our expectations.

Finally, we entered verbal working memory and nonverbal cognitive ability to check whether they explained some of the remaining variance of reading comprehension ability and whether their inclusion showed significant change in the roles of the other predictors.

### 2.3 Results

First, we investigated whether the data have a multi-level structure, that is, whether there is variance in the reading comprehension scores that is attributed to the school or class the students are in, rather than to merely individual differences. A model with only student level has a $-2 * \log$ likelihood of $413.1(N=60)$. Adding the class level gives a model with a -2 *loglikelihood of 401.4. The difference between the $-2^{*} \log$ likelihoods of both models is $11.7, d f=1, p<.001$ (see Table 2.1). Thus, a model

Table 2.1
Results of multi-level analyses. Dependent variable is 'reading comprehension'. Analyses to establish the multi-level structure.

that includes a class level above the student level is better than a model with only student level. Therefore, we performed the remaining analyses on reading comprehension ability multi-level with two levels: class and student.

Means and standard deviations of reading comprehension and the components tested are presented in Table 2.2. In order to test whether language background had a significant effect on test performances, we first established for each of the individual components whether a multi-level structure was present. This was the case for grammatical knowledge and receptive vocabulary. For the other components a uni-level structure was sufficient. Native-Dutch students outperformed the language-minority students on reading comprehension $(t)(58)=$ $-1.9, p<.05)$, grammatical knowledge ( $t(58)=-4.3, p<.001$ ), receptive vocabulary ( $t$ (58) = -4.3, $p<.001$ ) and metacognitive knowledge ( $t$ (58) = 2.72, $p<.01$ ). In Appendix A, the correlations between the individual variables are presented.

In order to reduce the number of predictor variables for our multiple regression analyses (given our sample size this should not exceed six predictors) we used a principal component analysis with oblique rotation (Direct Oblimin) on the six components. This analysis indicated that the components can be reduced to two factors with eigenvalues greater than 1 (see Table 2.3). These two factors explained $70 \%$ of the variance in the original six variables. ${ }^{10}$

Table 2.2
Means (and standard deviations) of all students, native-Dutch, and language-minority students.

|  | Max. <br> score | Total |  | Native-Dutch |  | Language- <br> minority |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
|  |  | $(N=60)$ |  | $(n=30)$ |  | $(n=30)$ |  |
| Reading comprehension | 65 | 40.1 | $(7.6)$ | 42.3 | $(5.9)$ | 37.9 | $(8.6)$ |
| Word-recognition efficiency | 120 | 80.6 | $(14.5)$ | 82.0 | $(13.2)$ | 79.3 | $(15.8)$ |
| Word recognition (ms) |  | 832.0 | $(126.0)$ | 842.0 | $(129.0)$ | 822.8 | $(123.7)$ |
| Grammatical knowledge | 50 | 33.4 | $(5.6)$ | 36.2 | $(4.3)$ | 30.7 | $(5.6)$ |
| Receptive vocabulary | 73 | 49.4 | $(9.0)$ | 53.7 | $(7.0)$ | 45.2 | $(8.9)$ |
| Sentence verification (ms) |  | 4351 | $(745)$ | 4205 | $(757)$ | 4498 | $(714)$ |
| Metacognitive knowledge | 45 | 27.4 | $(4.3)$ | 28.9 | $(4.0)$ | 26.0 | $(4.1)$ |
| Nonverbal cognitive ability | 35 | 26.2 | $(3.5)$ | 26.0 | $(3.0)$ | 26.4 | $(3.9)$ |
| Sentence span | 12 | 4.3 | $(2.0)$ | 4.6 | $(1.7)$ | 4.1 | $(2.3)$ |

[^6]Table 2.3
Summary of the principal component analysis for six predicting variables ( $N=60$ ).

| Predictor | Rotated factor loadings |  |
| :--- | :---: | :---: |
|  | Knowledge | Fluency |
| Receptive vocabulary | .88 | -.17 |
| Grammatical knowledge | .83 | -.33 |
| Metacognitive knowledge | .83 | -.06 |
| Sentence-verification speed | -.19 | .91 |
| Word-recognition speed | -.04 | .83 |
| Word-recognition efficiency | .29 | -.68 |
| Initial eigenvalues | 2.56 | 1.64 |
| Percentage of variance |  | $42.6 \%$ |

The variables that load highly on the first factor are knowledge variables (receptive vocabulary, grammatical knowledge and metacognitive knowledge). We refer to this factor as the 'knowledge factor'. The variables loading highly on the second factor are the variables that assess fluency, so we will refer to this factor as 'fluency factor'. In the remainder of the analyses factor scores (Direct Oblimin) for knowledge and fluency were used.

The multi-level regression analysis, which is presented in Table 2.4, was carried out entering language background and gender first (Model 1). Results indicate that gender has a significant effect on reading comprehension (favoring girls over boys) while language background has not. In the next step (Model 2) the factors knowledge and fluency were entered. Results indicate that knowledge contributes significantly to the prediction of reading comprehension, but that fluency does not. However, possible differences between native students and language-minority students are not taken into account yet, so this model should be interpreted with care. Therefore, as a final step (Model 3), the interactions between knowledge and language background and between fluency and language background were entered to examine differences between the contributions of knowledge or fluency to reading comprehension for the native-Dutch and the language-minority students. The two groups differ with respect to the role of the components of reading comprehension. The interaction of the knowledge factor (i.e., grammatical knowledge, receptive vocabulary and metacognitive knowledge) with language background is significant ( $t(53)=3.0, p<.01$ ). So, knowledge does play a role in the prediction of reading comprehension ability of language-minority students (who are coded as 1 on the language background variable), but not of that of native-Dutch students (coded 0 on that variable). Fluency and the
interaction between language background and fluency are both significant $(t)(53)=2.4$, $p<.01$ and $t(53)=1.7, p<.05$ respectively). The coefficient of the main effect of fluency is -2.4. Higher fluency (shorter reaction times) coincides with better reading comprehension. However, this main effect of fluency has to be interpreted in the context of the interaction effect of language background and fluency. The coefficient of this interaction is 2.4. This means that for the native-Dutch students (who are coded as 0 on the language background variable) fluency made a unique significant contribution to the prediction of reading comprehension, but that for the languageminority students this is not the case. The effect of fluency for the language-minority adolescents approaches zero. ${ }^{11}$

In a separate analysis, we checked whether there were unique contributions of nonverbal cognitive ability or sentence span. Nonverbal cognitive ability does not have a unique significant contribution when knowledge, fluency and the two interaction variables are included in the model $(t)(48)=1.2)$. The contribution of sentence span is not significant either $(t(52)=1.8)$. These findings suggest that sentence span and nonverbal cognitive ability do not explain remaining variance in reading comprehension over and above the explanatory power of gender, the more specific components (knowledge and fluency) and their interactions with language background.

[^7]Table 2.4
Results of multi-level analyses. Dependent variable is 'reading comprehension', predictors are gender ( $0=$ male, $1=$ female), background ( $0=$ native-Dutch, 1 = language-minority), knowledge and fluency ( $N=60$ ).

| 60 students in 10 classes | 0 | 1 | 2 | 3 |
| :---: | :---: | :---: | :---: | :---: |
| class | 20.1 (11.9) | 9.7 (7.0) | 0.9 (2.8) | 0.0 |
| Variance student | 37.0 (7.4) | 33.7 (6.7) | 29.4 (5.9) | 25.9 |
| total | 57.1 | 43.5 | 30.4 | 25.9 |
| class | 35.3\% | 22.4\% | 3.0\% | 0.0\% |
| Distribution of variance student |  |  | $97.0 \%$ | $100.0 \%$ |
| class |  | 51.6\% | 90.7\% | 100.0\% |
| Explained variance student |  | 8.8\% | 12.8\% | 11.9\% |
| total |  | 23.9\% | 30.1\% | 14.8\% |
| Intercept | 40.3 (1.6) | 39.3 (1.8) | 38.2 (1.3) | 39.8 (1.3) |
| Main effects | 0 | 1 | 2 | 3 |
| Gender |  | 4.9*** 1.8 ) | $3.7{ }^{* *}(1.6)$ | 3.6 ** (1.5) |
| Language background |  | -2.3 (1.6) | 0.8 (1.6) | -0.1 (1.6) |
| Knowledge |  |  | $4.0 * * * 0.9)$ | 0.6 (1.4) |
| Fluency |  |  | -0.8 (0.7) | $-2.4^{* *}(1.0)$ |
| Interactions | 0 | 1 | 2 | 3 |
| Knowledge*language background |  |  |  | $5.1^{* * *}(1.7)$ |
| Fluency*language background |  |  |  | $2.4 *$ (1.4) |
| Fit (-2*loglikelihood) | 401.4 | 391.4 | 374.9 | 365.6 |
| difference |  | 10.0*** | $16.5^{* * *}$ | $9.3{ }^{* * *}$ |
| difference $d f$ |  | 2 | 2 | 2 |
| compared to model |  | 0 | 1 | 2 |

Notes. ${ }^{*}=p<.05 ; \quad{ }^{* *}=p<.01 ; \quad{ }^{* * *}=p<.001$.

### 2.4 Discussion

The present study aimed at investigating the role of a number of components of reading comprehension of native-Dutch and language-minority academic low achievers in Grade 7, selected on the basis of language background, academic aptitude and the absence of specific learning and behavioral disorders. The components comprised in the study were efficiency and speed of word recognition, grammatical knowledge, knowledge of word meanings, fluency of understanding sentence meanings and metacognitive knowledge. The components appeared to be reducible to two factors in a principal components analysis. The first factor assessed knowledge (vocabulary, grammar and metacognitive knowledge). The second factor assessed fluency (efficiency and fluency of word recognition and sentence verification). The contributions of these factors to the explanation of reading comprehension ability were investigated. In addition, we examined to what extent the contributions of the components differed between the native-Dutch and language-minority students in the sample.

A substantial part of the variance in reading comprehension ability of lowachieving adolescents can be explained by the variables included in this study. In total, in the regression analyses with the six predictors (gender, language background, knowledge, fluency and the interactions between knowledge and language background, and fluency and language background), $55 \%$ of the variance in reading comprehension ability can be explained. Gender explains significant variance in all regression models, therefore all following conclusions are valid after controlling for the effect of gender on reading comprehension.

When we consider only the main effects of knowledge and fluency in the regression analyses we see that knowledge, but not fluency contributes significantly to the prediction of reading comprehension ability. The finding that linguistic and metacognitive knowledge is important for reading comprehension is in line with other studies conducted among adolescents in the whole range of secondary school students (e.g., Van Gelderen et al., 2003; Van Gelderen et al., 2007). The finding that fluency does not contribute significantly to the explanation of individual differences in reading comprehension of low-achieving adolescents is in line with previous research into the role of decoding skills of adolescent readers. Word-recognition fluency and efficiency are essential components in the reading process, but their predictive power decreases with age. This power is much smaller for adolescent reading than for beginning reading (Aarnoutse \& Van Leeuwe, 1988; Adams, 1990; Francis et al., 2005; Hoover \& Gough, 1990; Perfetti, 1998). That does not mean, however, that fluent and efficient word recognition and sentence reading is not important for adolescents' reading comprehension. It merely indicates that other
components of reading comprehension have become more important for explaining differences between these readers. It is of interest that for the specific population of low achievers in Grade 7, individual differences in fluency seem to be unrelated with individual differences in reading comprehension. This could lead to the conclusion that, for low-achieving adolescent readers, gains in fluency do not matter for gains in reading comprehension. Nevertheless, as discussed below, such a strong conclusion is premature and conceals a more complex pattern, different for nativeDutch and language-minority low achievers.

Concerning differential roles of the components for native-Dutch students and language-minority students, we can conclude that components of reading comprehension differ between both groups. For the native low achievers, reading comprehension is significantly predicted by the fluency measures: the speed with which they are able to recognize words and understand sentences matters. Faster readers attain higher reading comprehension scores. However, the knowledge variables do not have unique significant contributions for the native-Dutch adolescents when fluency is included in the model. For the language-minority struggling readers, a reverse pattern emerges. Although language-minority and native students performed equally well on the fluency measures, fluency does not contribute significantly to reading comprehension in the case of language-minority students. In contrast, the knowledge factor (consisting of grammar, vocabulary and metacognitive knowledge), strongly predicts the language-minority adolescents' reading comprehension.

The finding that, for native adolescent low achievers, fluency explains reading comprehension corresponds with findings by Shankweiler, Lundquist, Dreyer, \& Dickinson (1996) among ninth-grade middle-level classroom students. It is in line with the assumption that efficient and fast word recognition enables readers to devote more attention to higher-order reading components, leading to better understanding (LaBerge \& Samuels, 1974; Perfetti, 1999), although in other studies directed at heterogeneous samples of adolescents this effect is not found (Aarnoutse \& van Leeuwe, 1988; Van Gelderen et al., 2003, 2004). The fact that we found a significant effect of fluency in our sample of native-Dutch adolescent low achievers, can indicate that for this specific group problems with reading comprehension are related with insufficient automaticity of decoding processes.

The lack of predictive power of knowledge in native-Dutch adolescent low achievers' reading comprehension is unexpected on the basis of findings of other researchers (e.g., Cain \& Oakhill, 2006; Van Gelderen et al., 2003). Although the standard deviations of most of the language-minority students' knowledge components (vocabulary and grammatical knowledge) are relatively small (see Table 2.1), there are no indications that ceiling effects or restriction of range play a role.

It is possible that the reading comprehension test did not contain sufficiently challenging grammar and vocabulary for the native-Dutch group, whereas the words and sentences might have been more difficult for students in the language-minority group. An alternative explanation is that effects of knowledge on native students' reading comprehension are masked by other variables not included in our analysis. From several studies we know that motivational aspects and attitudes towards reading influence reading comprehension ability (e.g., Guthrie, Wigfield, Metsala, \& Cox, 1999). Such variables might account for substantial amounts of additional variance in reading comprehension in the native-Dutch group and inclusion of such variables might reveal a larger role for knowledge. This is the case when, for example, motivation has a positive influence on reading comprehension and when the nativeDutch students scoring high on knowledge are hardly motivated while students with less linguistic knowledge are more motivated. Controlling for motivation could give a different picture of the role knowledge plays in low-achieving adolescents' reading comprehension. Future research in which motivational aspects are included must shed light on this issue.

Our findings with respect to the role of fluency in language-minority students' reading comprehension were neither completely unexpected, given that for the language-minority subgroup access to L2 linguistic knowledge may be severely hampered. Results of additional analyses we performed on data of Van Gelderen et al. (2003) and Schijf (2009) show a similar pattern. We performed new analyses using their data, including only the students in the prevocational track, which is comparable to our sample. In both cases, it appeared that there were significant (but low) correlations between reading comprehension and fluency measures (speed and efficiency of word recognition) for the native-Dutch subgroup, but not for the language-minority subgroup. Nevertheless, the small sample sizes in the subgroups of these studies - as in our own study - call for caution in generalizing these conclusions to the whole group of language-minority adolescent low achievers. Future research is certainly needed to corroborate our findings concerning the interactions found.

In general, the different roles found for the component skills of the nativeDutch and the language-minority students can be evaluated in the context of the finding that, on average, the language-minority students possess less grammar and vocabulary knowledge than their native peers, while among the language-minority students there is more variation in knowledge of grammar and vocabulary. Poor knowledge of vocabulary and grammar hampers access to the meaning of a text, whereas more knowledge generally produces better text comprehension. Therefore, a substantial part of the language-minority students' reading comprehension can be explained by grammar and vocabulary knowledge. On the other hand, fluency in
word recognition and sentence comprehension enables readers to devote more resources to comprehension processes. Nevertheless, fluency did not explain reading comprehension of language-minority low achievers while it did make a significant contribution for the native students. Our explanation for this difference is that limited knowledge of grammar and vocabulary of the language-minority lowachieving readers prevents them from profiting from fluent word recognition and sentence comprehension. Reading comprehension benefits from efficient and fast word recognition and sentence reading, if readers possess sufficient knowledge of grammar and vocabulary to understand the meanings of words and sentences well. Language-minority readers who have not acquired sufficient knowledge of grammar and vocabulary, will not profit from efficient or fluent word-recognition skills. A language-minority student with slower word recognition therefore may not have poorer reading comprehension than a language-minority student with faster word recognition, because both ran into similar problems on the word and sentence meaning level. This may therefore explain why fluency plays a different role in the explanation of reading comprehension in the two groups of low-achieving adolescents in this study.

In summary, the results of this study indicate that although knowledge (grammar, vocabulary and metacognitive knowledge) is the most important factor of reading comprehension of adolescent low achievers, there are important differences between the native and language-minority subgroups. Grammar, vocabulary and metacognitive knowledge are important in the explanation of the language-minority students' reading comprehension. For the native students, however, knowledge appears not to be reliably related to reading comprehension skill. Furthermore, fluency contributed significantly to the native students' reading comprehension, whereas for the language-minority students this was not the case. Given the limited sample size of our study, however, replication of these results in other samples of low-achieving adolescents is certainly needed.

## Chapter 3

## Reading comprehension level and development in native and language-minority adolescent low achievers: Roles of linguistic and metacognitive knowledge and fluency ${ }^{12}$


#### Abstract

In a longitudinal design, 50 low-achieving adolescents' reading comprehension development from Grade 7 to 9 was measured. There were 26 native-Dutch and 24 language-minority students. In addition, the roles of (i) linguistic knowledge, (ii) metacognitive knowledge, and (iii) reading fluency in predicting both the level and growth of reading comprehension were assessed. Students improved in reading comprehension, the language-minority students more so than the native-Dutch students. Level of reading comprehension could be explained by linguistic and metacognitive knowledge, while most fluency related predictors appeared of minor importance. Growth in reading comprehension could hardly be explained by the predictors. Nevertheless, a significant interaction was found indicating that growth in vocabulary explained growth in reading comprehension for the language-minority students. This finding seems to suggest that language-minority students profit from gains in vocabulary, more so than the native students.


[^8]
### 3.1 Introduction

Substantial numbers of adolescents do not have sufficient reading skills at their disposal for the tasks they are faced with (Dutch Education Inspectorate, 2008; Hacquebord, Linthorst, Stellingwerf, \& De Zeeuw, 2004; Kamil, 2003; OECD, 2003; Perie, Grigg, \& Donahue, 2005). Especially low-achieving adolescents experience problems in reading comprehension. Although it is acknowledged that the lack of sufficient reading skills is a serious problem among low-achieving adolescents, studies focusing on explaining individual differences in reading comprehension within the population of low-achieving adolescents are scarce (Braze, Tabor, Shankweiler, \& Mencl, 2007). Therefore, the current study focuses on low-achieving adolescents' reading comprehension, in particular by addressing the question to what extent individual differences in reading comprehension can be explained by individual differences in students' knowledge and fluency.

Students from language-minority backgrounds make up a large proportion of low-achieving adolescents. (e.g., Dagevos, Gijsberts, \& Van Praag, 2003), and they require specific attention in examining reading comprehension in this target population. Language-minority students' linguistic abilities in the target language are often less developed than those of their native peers. For example, August and Hakuta (1997) indicate that, in the US, young Hispanic children who acquire English literacy in primary school have lower levels of reading and oral skills in English than their peers. They need four to seven years to approach the grade-level standards in literacy achievement and two to five years to reach grade-appropriate oral skills (Collier, 1987; Cummins, 1991; Hakuta, Butler, \& Witt, 2000). In adolescence too, differences between native speakers and language-minority students' language skills are apparent. For example, Spanish-speaking language-minority adolescents in US schools still have lower oral proficiency in English than their native peers (Carlo, August, McLaughlin, et al., 2004; Proctor, Carlo, August, \& Snow, 2005) and are reported to have lower reading comprehension (Kieffer, 2008; National Center for Education Statistics, 2009) and smaller vocabularies (Biemiller, 1999; Farnia \& Geva, 2011; Garcia 1991, Jean \& Geva, 2009; Lesaux \& Kieffer 2010). Similar differences between native and language-minority students (third to sixth grade) were found in the Netherlands (Aarts \& Verhoeven, 1999; Verhoeven, 1990).

In some studies, it was observed that, although language-minority adolescents performed worse on oral proficiency, reading comprehension, and vocabulary tasks than their native peers, they performed at an equal level on other reading-related measures, such as decoding fluency. Crosson and Lesaux (2010) showed that, while fifth-grade language-minority students performed below the national norms for English reading comprehension, vocabulary and listening comprehension, they
performed close to or even above the national norms on tests of decoding fluency and decoding accuracy. This discrepancy between knowledge- and fluency-oriented reading measures roughly corresponds to findings in low-achieving seventh-grade adolescents in the Netherlands (Chapter 2). The native-Dutch students outperformed the language minority students on knowledge measures, but not on fluency in Dutch. Since language-minority students lag behind their native peers with respect to linguistic knowledge, but not with respect to fluency-related skills, it has been suggested that language-minority students' lower levels of reading comprehension could be attributed to these students' limited linguistic knowledge.

Explaining reading comprehension level. A reader applies linguistic knowledge, such as vocabulary and grammar, to build an appropriate mental representation of a text (Anderson \& Freebody, 1979; Gough \& Tunmer, 1986; Kintsch, 1998; Perfetti, Landi, \& Oakhill, 2005). In addition, fluency in word recognition plays an important part in reading comprehension (LaBerge \& Samuels, 1974; Perfetti, 1999). Correlational studies have shown that individual differences in reading comprehension in heterogeneous samples of adolescents are associated with differences in knowledge of vocabulary and grammar (e.g., Van Gelderen et al., 2004). However, the predictive power of word recognition fluency on adolescents' reading comprehension has been found to be small or negligible (Ouellette \& Beers, 2010; Tilstra, McMaster, Van den Broek, Kendeou, \& Rapp, 2009; Van Gelderen et al., 2004; Verhoeven \& Van Leeuwe, 2008). This suggests that adolescents are efficient in their word recognition to such an extent that this process no longer constrains reading comprehension.

Between different adolescent populations the explanatory power of linguistic knowledge and fluency for reading comprehension may vary. For instance, in several studies the association between vocabulary knowledge and reading comprehension is found to be stronger in language-minority students than in their monolingual native peers (Babayigit, 2014; Droop \& Verhoeven, 2003; Geva \& Farnia, 2012; Gottardo \& Muller, 2009), also in low-achieving adolescents (Chapter 2). Furthermore, the explanatory power of fluency might differ between native and language-minority students. The contribution of word- and sentence-level reading fluency on Dutch reading comprehension was found to be larger in low-achieving native-Dutch students than in their language-minority peers in seventh grade (Chapter 2). Results of Buly and Valencia (2002), Jenkins, Fuchs, Van den Broek, Espin, and Deno (2003), and Crosson and Lesaux (2010) point in the same direction. Buly and Valencia (2002) showed that poor reading comprehension was related to weaknesses in fluency and decoding in a subsample of students who failed a fourth-grade reading proficiency test. Interestingly, language-minority students were underrepresented in this subsample of readers. The amount of explained variance in reading comprehension by both word-level and text-
level reading fluency was found to be larger in native students ( $71 \%$ found in Jenkins et al., 2003) than in language-minority students ( $20 \%$ found in Crosson \& Lesaux, 2010). In addition, the relationship between text-level reading fluency and reading comprehension in the study of Crosson and Lesaux (2010) was moderated by an interaction. For language-minority students with more developed oral language skills (scoring at or above the $75^{\text {th }}$ percentile on a listening-comprehension test), text-level reading fluency and reading comprehension were strongly related. In contrast, for the language-minority students with poorly developed English as a Second Language (ESL) listening comprehension skills (scoring at or below the $25^{\text {th }}$ percentile), fluent text reading did not explain reading comprehension. This suggests that, in order to profit from fluency, language-minority readers have to attain a certain level of linguistic knowledge. Language-minority students who have mastered more linguistic knowledge may be better able to benefit from text reading fluency in text comprehension. In addition, as suggested by Alderson (1984) and Bernhardt (2000), language-minority readers have to acquire a minimal level of linguistic knowledge to be able to use reading strategies (the so-called threshold hypothesis; for a review, see Hulstijn, 2015).

Apart from linguistic knowledge and fluency, metacognitive knowledge is of great importance for comprehending texts (Perfetti, Landi, \& Oakhill, 2005). Metacognitive knowledge has been found to be related to reading comprehension of adolescents (Baker \& Brown, 1984; Biancarosa \& Snow, 2006; Van Gelderen, Schoonen, Stoel, et al., 2003; Van Gelderen, Schoonen, Stoel, De Glopper, \& Hulstijn, 2007). We define metacognitive knowledge as knowledge about useful strategies for forming text representations and knowledge about text characteristics. Van Gelderen et al. (2007) conducted a longitudinal study into the role of several knowledge and fluency variables on reading comprehension of adolescents. The findings indicated that reading comprehension ability in Grade 8 was related to (i) metacognitive knowledge (knowledge of text characteristics and knowledge of reading and writing strategies), (ii) linguistic knowledge (knowledge of grammar and vocabulary) and (iii) speed of sentence processing. In the consecutive years (Grades 9-10), metacognitive knowledge and vocabulary knowledge were still significantly related to reading comprehension level when performance on previously measured reading comprehension (in Grade 8 and 9) was accounted for. These components thus had additional explanatory power for reading-comprehension proficiency in Grades 9-10, which was not the case for fluency measures. In the analyses in the study by Van Gelderen et al. (2007) associations between the knowledge and fluency variables and level of reading comprehension were investigated within the same grades. Therefore, the outcomes did not establish the explanatory power of growth in the predictors for (growth in) reading comprehension.

Explaining development of reading comprehension. With respect to the question of whether growth in linguistic and metacognitive knowledge and fluency can explain growth in low-achieving adolescents' reading comprehension, the empirical literature has produced no findings hitherto. This question is particularly of interest in addition to the explanatory value of the knowledge and fluency components for low-achieving adolescents' reading comprehension at different moments in time, because it pertains to the importance of growth in the components of reading comprehension in specific time periods. It is important to find out whether low-achieving adolescents' reading development may profit from growth in any of the mentioned components in more or less specified educational periods (e.g., from Grade 7 to 9). Reading comprehension develops from the very first of reading experiences of young children. Some studies have been conducted in which English native speakers were followed from childhood to adolescence (Francis, Shaywitz, Stuebing, Shaywitz, \& Fletcher, 1996; Catts, Bridges, Little, \& Tomblin, 2008). These studies demonstrated that children's reading comprehension growth rates slow down over time. In a study conducted among 445 students (of whom 84\% were Caucasian) in the US, Francis et al. (1996) report a plateau in reading comprehension growth near sixth grade. Catts et al. (2008) report faster growth between second and fourth grade than in later grades (fourth to tenth grade).

In addition, different findings are reported for the growth patterns of reading comprehension for native speakers and language-minority speakers. Francis et al. (1996) reported that the growth pattern of language-minority students' (from Grade 1 to Grade 9) reading comprehension was rather similar to the natives' readingcomprehension growth pattern. Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou and Snow (2011) also found that, in a group of middle-school language-minority speakers, reading comprehension was still developing between fifth and seventh grade reading, but that the growth rate slowed down over time, which is in line with the findings of Francis et al. (1996) and Catts et al. (2008). However, Kieffer (2008) found that growth rate in language-minority students (from kindergarten to Grade 5) slowed down more than that of their native peers, suggesting that the gap between these populations increases.

On the basis of previous findings we may expect growth in reading comprehension in an adolescent population, although one might expect that this growth is smaller than for younger students. On the other hand, in the case of lowachieving students, it is not quite clear what to expect. On one hand there are predictions that poor adolescent readers have developed poor reading habits, because of a prolonged period of reading failure in their educational history (e.g., Stanovich, 1986), which would lead to arrested development of reading comprehension. On the other hand, for the group of low-achieving students we can expect more progress than in the more heterogeneous samples of the studies just
reviewed, because they start at a lower level, and there is simply more to gain. Similarly, whether differences in growth rates exist between native students and language-minority low-achieving students is an open question. On one hand, in accordance to Kieffer's (2008) results, the language-minority students may display less growth than their native peers. However, if their initial proficiency in reading comprehension is lower, this would give more opportunity for growth.

In this study, we examine to what extent reading-comprehension proficiency of a sample of low-achieving students progresses in the first three years of secondary school (Grades 7-9). Second, we investigate the explanatory power of level and development in linguistic and metacognitive knowledge and fluency for level and development in reading-comprehension proficiency. This analysis allows us not only to determine which components are important in explaining reading comprehension proficiency of low-achieving adolescents, but also to determine how the components relate to development in reading comprehension from Grade 7 to 9 . Furthermore, we investigate whether there are differences between native-Dutch and languageminority low-achieving adolescents in their development of reading comprehension and in the roles of linguistic and metacognitive knowledge, and fluency.

## Research questions

(RQ 1) Do low-achieving language-minority students and native-Dutch students in Grades 7 to 9 differ in their levels of reading comprehension proficiency, linguistic and metacognitive knowledge, and fluency?
(RQ 2) Does reading-comprehension proficiency of adolescent low achievers improve from Grade 7 to 9 and do native-Dutch and language-minority students develop similarly?
(RQ 3) To what extent is reading comprehension level and development from Grade 7 to 9 of adolescent low achievers related to level and development of component skills: linguistic and metacognitive knowledge, and fluency?
(RQ 4) To what extent are these relations different for native-Dutch and languageminority students?

Note that, while research questions 3 and 4 form the main questions, research questions 1 and 2 are preliminary to the main research questions of this study.

### 3.2 Method

### 3.2.1 Participants

Eleven schools for prevocational secondary education in urban areas in the western part of the Netherlands volunteered to participate in this study. In the Netherlands, students in the lowest prevocational track are among the 30 percent lowest achieving on a national school aptitude test of reading, language and mathematical skills. This group of students also contains the poorest readers in the population. A detailed description of the language curriculum that these students received is given by De Milliano (2013)

We recruited students from seventh-grade classes (mean age about 13 years), which is the first year of secondary education in the Netherlands. For student selection, two types of data were used. First, information from the school records enabled us to select a sample of students not suffering from diagnosed learning or behavioral disorders. Furthermore, immigrant students who had visited a Dutch primary school for less than three years were excluded in order to keep the language-minority sample homogeneous with respect to previous schooling experiences and related opportunities for acquisition of Dutch.

Second, data about the ethnic and linguistic backgrounds (country of birth of students and parents, languages spoken at home, and frequency of use of these languages in contacts at home) of the students were obtained by means of a questionnaire that was filled out by the students themselves. Students were selected for the native-Dutch group if both parents were born in the Netherlands, ${ }^{13}$ if they were native speakers of Dutch, and if Dutch was their dominant home language (i.e., most language contacts within the home had to be in Dutch). Students were selected for the language-minority group if both parents were born outside the Netherlands and if students spoke another language than Dutch with their parents for half of the time or more. This decision was based on information about the language spoken in interactions with father and/or mother. Most students in the language-minority group (21 students) had learned to read and write in the other home language to some extent. However, the first language they had learned to read and write in was Dutch.

Most of these 26 language-minority students had Moroccan (9) or Turkish (7) backgrounds, the remainder had Surinamese (3), Antillean (3), Cape Verdean (3), and

[^9]Chinese (1) backgrounds. ${ }^{14}$ All but five of the language-minority students were born in the Netherlands; most students are thus second generation immigrants.

In the first year of the longitudinal study, the sample consisted of 63 students ( 36 boys and 27 girls) from 10 classes in 9 different schools, of whom 32 students had a native-Dutch background. Of 50 of these 63 students (in Grade 9 divided over 11 schools) we have complete data in Grades 7, 8 and $9 .{ }^{15}$ For our analyses we chose to investigate only the data of students with complete data: 28 boys and 22 girls, of whom 24 were of a native-Dutch and 26 of a language-minority background. The two groups, i.e., the native-Dutch and the language-minority students, did not differ significantly in nonverbal cognitive ability as measured by the Raven's Standard Progressive Matrices.

### 3.2.2 Instruments

We measured reading comprehension and its components receptive vocabulary, grammatical knowledge, metacognitive knowledge, word-recognition efficiency, wordrecognition speed and sentence-verification speed. All assessments were in Dutch.

Reading comprehension. Reading comprehension was assessed by the reading part of the SALSA Literacy Test (Van Steensel, Oostdam, \& Van Gelderen, 2013). The test consists of nine assignments covering different genres from several media types. The topics of the texts were selected on the basis of their relevance for the students' socio-cultural and educational environment. The test items were based on the distinction between lower, intermediate and higher levels of understanding, labeled as 'retrieving', 'interpreting', and 'reflecting', respectively. The test consisted of 65 items and the Cronbach's alphas for this test were .77 (Grade 7), .82 (Grade 8) and .82 (Grade 9) for these 50 students. Students were given sufficient time to complete the test.

Receptive vocabulary. This paper-and-pencil test, based on the receptive vocabulary test of Van Gelderen et al. (2003), consisted of 73 multiple-choice questions, testing the knowledge of the meaning of nouns, verbs, adjectives, and

[^10]adverbs belonging to the 23,000 words in a dictionary for junior-high-school students (see Hazenberg \& Hulstijn, 1996, for details). Each item consisted of a neutral carrier sentence with a target word in bold print. The students had to choose between four options, one of which represented a correct synonym of the target word. The Cronbach's alpha coefficients for this test were .85 (Grade 7), . 88 (Grade 8) and . 86 (Grade 9).

Grammatical knowledge. In this 50-item paper-and-pencil test, based on the grammatical-knowledge test of Van Gelderen et al. (2003), students completed sentences containing a word gap with the correct form of verbs, adjectives, anaphoric references, comparatives, and articles, and they had to put words or phrases into the correct order, taking into account the correct form for number, tense, aspect, and agreement. There were both fill-in-the-blanks and multiplechoice items in this test. The Cronbach's alphas for this test were .72 (Grade 7), .81 (Grade 8) and . 66 (Grade 9).

Metacognitive knowledge. Metacognitive knowledge was measured by means of a paper-and-pencil questionnaire consisting of statements about text characteristics, and about reading and writing strategies. It was based on the metacognitive knowledge test used by Van Gelderen et al. (2003). Items consisted of correct or incorrect statements. Students had to tick whether they agreed or disagreed with a statement. The test consisted of 45 items and the Cronbach's alpha coefficients were .50 (Grade 7), 61 (Grade 8) and . 55 (Grade 9). These relatively low reliabilities were probably caused by the difficulty of the task for our population (the average score being 28,28 and 30 , with a guessing score of 23 ).

Word-recognition efficiency. To test the students' word-recognition efficiency we used a subtest of the so-called Three Minutes Test (Drie-Minuten-Toets, Verhoeven, 1995), a standardized test frequently used in the Netherlands. This subtest consists of a list of 120 multisyllabic words. The words increase in length and difficulty as the students proceed through the test. However, all are highfrequency words assumed to be familiar to the students. Students are asked to read aloud as many words as they can in one minute. The score on the task is the number of words that a student reads aloud correctly; it thus measures a combination of speed and accuracy.

Speed of written word recognition. Speed of word recognition was tested by means of a computer-administered lexical-decision task, identical to the format used by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). The stimuli (a selection from the test used by Van Gelderen et al.) consisted of 119 letter strings (3-8 letters), 59 of which were existing (well-known) words; the remainder consisted
of phonologically correct pseudo-words. Students were asked to decide as quickly as possible whether the stimulus was an existing word or not and press the corresponding key on the keyboard. Responses were automatically coded in terms of both accuracy and latencies (from the onset). The mean accuracy was 94\%. The latency measure was computed using only correct responses to existing words (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alphas for this speed test were .82 (Grade 7), . 89 (Grade 8) and . 81 (Grade 9).

Speed of sentence verification. Speed of sentence verification was measured using the same lexical-decision paradigm as described for word-recognition speed. This computer-administered task was identical to the test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). All words of a sentence were displayed at once on the screen. Students decided as quickly as possible whether the sentence made sense or not by pressing one of two keys. Half of the 72 items made sense, the other half did not make sense. The sentences referred to common knowledge that seventh-grade students can be assumed to have. An example of a sensible item is The man went to bed because he wanted to sleep. An example of a nonsensical item is Most bicycles have seven wheels. The average accuracy on the true assertions was $98 \%$. Responses were automatically coded in terms of both accuracy and latencies. Latencies were measured from the onset of the stimulus. The latency measure was computed only on the basis of the correct responses to the 36 true assertions (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alphas for this speed test were . 95 (grade 7), . 95 (grade 8) and . 96 (grade 9).

### 3.2.3 Procedure

All tests were administered three times: in Grade 7 (February-June 2008), in Grade 8 (January-May 2009) and in Grade 9 (January-April 2010). The word-recognition efficiency test was administered individually, the reading comprehension test was administered in whole classes in three sessions of 45 minutes, and the other tests were administered to small groups of three or four students in three to four sessions of 45 minutes. We scheduled no more than two sessions per day in order to minimize test weariness. All sessions were introduced by a researcher or a trained test assistant. The reading comprehension classroom sessions were also attended by a teacher.

### 3.2.4 Analyses

To answer the first research question, it was tested by means of (multi-level) regression analyses whether language background significantly explained reading comprehension or any of the predictors. We checked whether these analyses should include a school level or whether a uni-level analysis would suffice by testing whether models including the school level explained significant variance of each predictor and reading comprehension. It was necessary to perform these regression analysis multi-level for 4 of the 21 comparisons. Therefore, we included the school levels in these four analyses (see Table 3.1).

To answer the second research question, we first checked for school-level variance in reading-comprehension development School level turned out to be not necessary for explaining reading development. Therefore a repeated-measures ANOVA was used to estimate reading-comprehension development. In order to investigate differences in development between native-Dutch and languageminority students, an interaction between grade and language background was tested using a factorial repeated-measure ANOVA.

To answer the third research question we checked whether the analysis should include a school level for multi-level regression analysis of growth in reading comprehension. Including a school level did not significantly improve model fit. Therefore, multi-level models were fitted with a student level (variance between students) and an occasion level (variance within students between times of measurement) (cf. Rasbash, Brown, Goldstein, et al. 2000). In these analyses the three repeated measures for the dependent variable and three repeated measures for each of the predictors are nested within students. For appropriate estimates of student- and occasion-level variance, time of measurement was included in the model as a predictor as suggested by Hox (2010).

To test whether the relation between reading comprehension and the components of reading comprehension differed for native-Dutch and languageminority students (the fourth research question), interaction effects between language background and each of the repeatedly measured components were estimated. For these analyses interaction variables were created consisting of the product of language background (language-minority or not) and the continuous variables measuring the six components; they were included (one by one) as predictors.

### 3.3 Results

Means and standard deviations of reading comprehension and the predictors are presented for each occasion (Grade 7-9) in Appendix B. To answer research question 1, regression analyses were conducted with language background as predictor. Table 3.1 presents the results of these regression analyses. These analyses show that, in Grade 7, native-Dutch and language-minority students differed significantly on reading comprehension, grammatical knowledge, receptive vocabulary, metacognitive knowledge and sentence-verification speed. On all aforementioned variables native-Dutch students performed better than language-minority students. No significant differences were found in Grade 7 for word-recognition efficiency and word-recognition speed. In Grade 8 an almost similar pattern of results was obtained. The only difference with the results in Grade 7 is that reading comprehension did not differ significantly between native-Dutch and language-minority students. In Grade 9, native-Dutch and language-minority students did not differ significantly in reading comprehension, word-recognition efficiency, word-recognition speed and metacognitive knowledge, indicating that differences between both groups diminished over time from Grade 7 to 9 .

Table 3.1
Significant effects of language background on students' $(N=50)$ performance on reading comprehension and the six predictors.

|  | Grade 7 | Grade 8 | Grade 9 |
| :--- | :---: | :---: | :---: |
| Reading comprehension | $* a$ | - | - |
| Receptive vocabulary | $* * *$ | $* * *$ | $* * *$ |
| Grammatical knowledge | $* * * a$ | $* * a$ | $* * a$ |
| Metacognitive knowledge | $*$ | $*$ | - |
| Word-recognition efficiency | - | - | - |
| Word-recognition speed (ms) | - | - | - |
| Sentence-verification speed (ms) | $*$ | $*$ | $*$ |
| Notes. ${ }^{*}=p<.05 ;{ }^{* *}=p<.01 ;{ }^{* * *}=p<.001 ;$ a $=$ with school level included. |  |  |  |

The repeated-measures ANOVAs performed to answer the second research question show a general significant improvement in reading comprehension ( $F_{(2,96)}$ $\left.=38.35 ; p<.001 ; \eta^{2}{ }_{p}=.44\right)$. Given that a partial eta ${ }^{2}$ value of .14 is considered a large effect (Cohen, 1988), this effect size can be called very large. The improvement is significant for both intervals (Grade 7 to $8, p<.01$; Grade 8 to $9, p<.001$, with Bonferroni adjustment). Also a significant interaction effect was obtained between language background and growth in reading comprehension $\left(F_{(2,96)}=3.66 ; p<.05\right.$, $\eta^{2}{ }_{p}=.07$ ), meaning that language-minority students' improvement on reading comprehension was larger than that of native-Dutch students (see Figure 3.1).



Figure 3.1
Reading comprehension mean scores for native-Dutch and language-minority students from Grade 7 to 9 .

To answer the third research question, we used multi-level growth models with a student level and an occasion level. Results are presented in Table 3.2. While Model 0 includes only time of measurement, Model 1 also includes language background. In models $2 a$ to $2 f$ predictors are included one at a time and in Model 2 g all predictors are included simultaneously. Model 2 a to 2 g are each compared to Model 1. Predictors explain different proportions of student and occasion variance. The amount of explained student variance (see explained variance in the upper half of Table 3.2) indicates to what extent predictors explain the differences between students in reading comprehension proficiency level. The amount of explained occasion variance indicates to what extent differences in growth of the predictors (repeatedly measured) explains differences in reading comprehension development (repeatedly measured).
Table 3.2
Table 3.2
Results of multilevel analyses. Dependent variable is reading comprehension (repeatedly measured). Predictors are the 6 components ( 3 repeated
measurements of knowledge and fluency), time of measurement and language background ( $N=50$ ). measurements of knowledge and fluency), time of measurement and language background ( $N=50$ ).

| 50 students, <br> 3 times of m | rement | 0 | 1 | 2a | 2b | 2c | 2d | 2 e | $2 f$ | 2g |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Variance | student | $\begin{gathered} 44.5 \\ (9.9) \end{gathered}$ | $\begin{aligned} & 42.2 \\ & (9.4) \end{aligned}$ | $\begin{aligned} & 25.5 \\ & (6.2) \end{aligned}$ | $\begin{aligned} & 28.9 \\ & (6.8) \end{aligned}$ | $\begin{aligned} & 35.8 \\ & (8.1) \end{aligned}$ | $\begin{gathered} 42.8 \\ (9.5) \end{gathered}$ | $\begin{aligned} & 40.5 \\ & (9.1) \end{aligned}$ | $\begin{gathered} 39.3 \\ (8.8) \end{gathered}$ | $\begin{aligned} & 16.7 \\ & (4.3) \end{aligned}$ |
|  | occasion | $\begin{gathered} 14.4 \\ (2.0) \end{gathered}$ | $\begin{gathered} 14.4 \\ (2.0) \end{gathered}$ | $\begin{gathered} 15.4 \\ (2.2) \end{gathered}$ | $\begin{gathered} 15.0 \\ (2.1) \end{gathered}$ | $\begin{gathered} 14.0 \\ (2.0) \end{gathered}$ | $\begin{gathered} 14.3 \\ (2.0) \end{gathered}$ | $\begin{gathered} 13.9 \\ (2.0) \end{gathered}$ | $\begin{aligned} & 14.7 \\ & (2.1) \end{aligned}$ | $\begin{gathered} 14.4 \\ (2.1) \end{gathered}$ |
|  | total | 58.9 | 56.6 | 40.9 | 43.9 | 49.8 | 57.1 | 54.4 | 54.0 | 31.1 |
| Distribution of variance | student | 75.6\% | 74.6\% | 62.3\% | 65.8\% | 71.9\% | 75.0\% | 74.4\% | 72.8\% | 53.7\% |
|  | occasion | 24.4\% | 25.4\% | 37.7\% | 34.2\% | 28.1\% | 25.0\% | 25.6\% | 27.2\% | 46.3\% |
| Explained variance | student | - | 5.2\% | 39.6\% | 31.5\% | 15.2\% | - | 4.0\% | 6.9\% | 60.4\% |
|  | occasion | 42.6\% | - | - | - | 2.8\% | 0.7\% | 3.5\% | - | - |
|  | total | 10.9\% | 3.9\% | 27.7\% | 22.4\% | 12.0\% | - | 3.9\% | 4.6\% | 45.1\% |
| Intercept |  | $\begin{gathered} 40.4 \\ (1.1) \end{gathered}$ | $\begin{gathered} 42.0 \\ (1.4) \end{gathered}$ | $\begin{aligned} & 23.7 \\ & (4.3) \end{aligned}$ | $\begin{gathered} 28.1 \\ (3.9) \end{gathered}$ | $\begin{gathered} 32.0 \\ (3.3) \end{gathered}$ | $\begin{gathered} 43.2 \\ (4.4) \end{gathered}$ | $\begin{gathered} 49.2 \\ (3.5) \end{gathered}$ | $\begin{gathered} 45.9 \\ (3.9) \end{gathered}$ | $\begin{aligned} & 20.7 \\ & (7.6) \end{aligned}$ |


| Main effects | 0 | 1 | 2a | 2b | 2c | 2d | 2e | 2f | 2g |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time of measurement | $\begin{aligned} & 3.3^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 3.3^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 2.4^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 2.8^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 2.9^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 3.4^{* * *} \\ & (0.5) \end{aligned}$ | $\begin{aligned} & 2.9^{* * *} \\ & (0.4) \end{aligned}$ | $\begin{aligned} & 2.9^{* * *} \\ & (0.5) \end{aligned}$ | $\begin{gathered} 1.3^{*} \\ (0.6) \end{gathered}$ |
| Language background |  | $\begin{aligned} & -3.1 \\ & (1.9) \end{aligned}$ | $\begin{aligned} & -0.10 \\ & (1.7) \end{aligned}$ | $\begin{aligned} & -1.3 \\ & (1.7) \end{aligned}$ | $\begin{aligned} & -2.2 \\ & (1.8) \end{aligned}$ | $\begin{aligned} & -3.1 \\ & (2.0) \end{aligned}$ | $\begin{aligned} & -3.0 \\ & (1.9) \end{aligned}$ | $\begin{aligned} & -2.5 \\ & (1.9) \end{aligned}$ | $\begin{gathered} 1.8 \\ (1.5) \end{gathered}$ |
| Receptive vocabulary |  |  | $\begin{aligned} & 0.34^{* * *} \\ & (0.08) \end{aligned}$ |  |  |  |  |  | $\begin{aligned} & 0.27^{* * *} \\ & (0.07) \\ & \hline \end{aligned}$ |
| Grammatical knowledge |  |  |  | $\begin{aligned} & \hline 0.39^{* * *} \\ & (0.10) \end{aligned}$ |  |  |  |  | $\begin{gathered} 0.27^{*} \\ (0.10) \end{gathered}$ |
| Metacognitive knowledge |  |  |  |  | $\begin{aligned} & 0.35^{* * *} \\ & (0.11) \\ & \hline \end{aligned}$ |  |  |  | $\begin{gathered} 0.32^{* *} \\ (0.10) \\ \hline \end{gathered}$ |
| Word-recognition efficiency |  |  |  |  |  | $\begin{aligned} & -0.014 \\ & (0.049) \end{aligned}$ |  |  | $\begin{aligned} & -0.029 \\ & (0.04) \end{aligned}$ |
| Word recognition (ms) |  |  |  |  |  |  | $\begin{aligned} & -0.008^{*} \\ & (0.004) \\ & \hline \end{aligned}$ |  | $\begin{aligned} & \hline-0.007 \\ & (0.004) \end{aligned}$ |
| Sentence verification (ms) |  |  |  |  |  |  |  | $\begin{aligned} & -0.001 \\ & (0.001) \\ & \hline \end{aligned}$ | $\begin{aligned} & -0.001 \\ & (0.001) \\ & \hline \end{aligned}$ |
| Fit(-2*loglikelihood) | 941.9 | 939.5 | 925.0 | 928.0 | 929.3 | 939.4 | 934.5 | 938.5 | 901.0 |
| difference |  | 2.4 | $14.5{ }^{* * *}$ | $11.5^{* * *}$ | $10.2^{* *}$ | 0.1 | 5.0* | 1.0 | 38.5 *** |
| difference $d f$ |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| compared to model |  | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Notes. $\quad *=p<.05 ; \quad * *=p<.01 ; \quad * * *=p<.001$.

Table 3.2 shows that in Model 0 (no predictors) $75.6 \%$ of the variance in reading comprehension pertained to the level of students, while the remaining variance (24.4\%) pertained to the level of occasion (development independent of betweenstudent variance). In addition, Table 3.2 shows that in Model 1, level of and growth in reading comprehension were not significantly predicted by language background. Four of the six repeatedly measured predictors (see models $2 \mathrm{a}-2 \mathrm{f}$ ) appear to be significant predictors of reading comprehension. These are: receptive vocabulary, grammatical knowledge, metacognitive knowledge and word-recognition speed. The proportions of explained between-student variance in reading comprehension (student level) range from 0\% (word-recognition efficiency, Model 2d) to 39.6\% (receptive vocabulary, Model 2a). The proportions of explained variance in reading at the occasion level are nihil or very low (metacognitive knowledge: $2.8 \%$; word-recognition speed: $3.5 \%$ ). The main predictors of level of reading comprehension appear to be receptive vocabulary (39.6\%) and grammatical knowledge (31.5\%). The contribution of metacognitive knowledge to the prediction of reading comprehension level is also substantial (15.2\%), while word-recognition speed has a quite low predictive power (4.0\%). Wordrecognition efficiency and sentence-verification speed did not significantly predict reading comprehension (level and growth).

The last column of Table 3.2 contains a model $(2 \mathrm{~g})$ in which all predictors are included in the model. This model shows that in the multiple regression still five variables made significant contributions to reading comprehension proficiency (total explained variance $45.1 \%$ ). This means that all predictors combined explained almost half of the variance in reading comprehension level and growth. Of the total variance in student level, $60.4 \%$ is explained by the predictors. Of the total variance in reading comprehension growth nothing is explained by all predictors together. Although some of the predictors in the combined model $(2 \mathrm{~g})$ do not exhibit significant contributions, this does not mean that they are unimportant for the explanation. Their predictive power is however limited in this model because of intercorrelations between the 7 predictors. Nevertheless, it seems that the knowledge variables (receptive vocabulary, metacognitive knowledge, and grammatical knowledge) have quite strong predictive power in comparison to the other predictors. On the basis of the results of the models with singular predictors ( $2 \mathrm{a}, 2 \mathrm{~b}$ and 2 c ), it seems that almost all variance explained by these knowledge variables is on the student level $(39.6 \%$, $31.5 \%$ and $15.2 \%$ ), while the explanation on occasion level is negligible.

Table 3.3
Results of multilevel analyses. Dependent variable is reading comprehension (repeatedly measured). Predictors are time of measurement, language background, receptive vocabulary (repeatedly measured) and the interaction variable created by receptive vocabulary and language background.

| 50 students, 3 measurements | 0 | 1 | 2 | 3 |
| :---: | :---: | :---: | :---: | :---: |
| Variance | 44.5 (9.9) | 42.2 (9.4) | 25.5 (6.2) | 24.9 (5.9) |
|  | 14.4 (2.0) | 14.4 (2.0) | 15.4 (2.2) | 12.9 (1.8) |
|  | 58.9 | 56.6 | 40.9 | 37.8 |
| Distribution of variance | 75.6\% | 74.6\% | 62.3\% | 65.9\% |
|  | 24.4\% | 25.4\% | 37.7\% | 34.1\% |
| Explained variance |  | 5.2\% | 39.6\% | 2.4\% |
|  |  | - | - | 16.2\% |
|  |  | 3.9\% | 27.7\% | 7.6\% |
| Intercept | 40.4 (1.1) | $42.0 \quad$ (1.4) | $23.7 \quad(4.3)$ | 42.4 (5.5) |
| Main effects | 0 | 1 | 2 | 3 |
| Time of measurement | 3.3 *** | 3.3 *** | $2.4 * * *$ | $2.5 * *$ |
|  | (0.4) |  | (0.4) | (0.4) |
| Language background |  | -3.1 | -0.1 | $-31.1^{* * *}$ |
|  |  | (1.9) | (1.7) | (6.8) |
| Receptive vocabulary |  |  | $0.34^{* * *}$ | 0.01 |
|  |  |  | (0.08) | (0.10) |
| Language background*receptive vocabulary |  |  |  | $0.58{ }^{* * *}$ |
|  |  |  |  | (0.13) |
| Fit (-2*loglikelihood) | 941.9 | 939.5 | 925.0 | 904.9 |
| difference |  | 2.4 | $14.5{ }^{* * *}$ | $21.1^{* * *}$ |
| difference $d f$ |  | 1 | 1 | 1 |
| compared to model |  | 0 | 1 | 2 |

Furthermore, we investigated whether there is a difference between nativeDutch and language-minority students in the predictive power of the components (research question 4). Almost none of the analyses showed significant interaction. The only significant interaction found was between language background and receptive vocabulary (see Table 3.3). In this table, Model 0 includes no predictors, except time of measurement, Model 1 includes the main effect of language background, Model 2 includes the main effects of both language background and receptive vocabulary and Model 3 includes both main effects and the interaction of language background and receptive vocabulary. Almost all explained variance of the interaction (see Model 3) is on the occasion level of reading comprehension (16.2\%). The regression weights of receptive vocabulary (0.01) and the interaction variable ( 0.58 ) in this model indicate that the effect of receptive vocabulary on reading comprehension growth is much larger for language-minority students (coded as 1) than for native-Dutch students (coded as 0). Additional regression analyses on the difference scores (both for reading comprehension and for vocabulary between Grades 7 and 9) indicate that the reading comprehension growth in the language-minority students is significantly related to vocabulary growth ( $R^{2}=.15, b=.39, t=2.1, p=.05$ ) but not to level of vocabulary. Thus we can conclude that the effect is an effect of growth in vocabulary, not the level of receptive vocabulary skill.

### 3.4 Discussion

In this study we investigated the role of several components of reading comprehension of low-achieving adolescents (Grade 7 to 9). In addition, we investigated whether there are differences between native-Dutch and language-minority students with respect to the contribution of these components. We first investigated whether native-Dutch and language-minority students differed in their levels of reading comprehension, linguistic and metacognitive knowledge and fluency and whether the development of the two groups in reading comprehension from Grade 7 to 9 was similar (research questions 1 and 2). These research questions were preliminary and served as background for our main research questions which focused on the prediction of reading-comprehension level and development from Grade 7-9 by the level and development of the components (linguistic and metacognitive knowledge and fluency) and whether there were differences in this prediction between native-Dutch and language-minority students (research questions 3 and 4). We will first discuss the results for our first two research questions.

It was found that native-Dutch low achievers significantly outperformed their language-minority peers in the Grades 7-9 in receptive vocabulary, grammatical
knowledge and sentence-verification speed. Native-Dutch students also had significant advantages in reading comprehension and metacognitive knowledge, but these were limited to Grade 7 level (reading comprehension) or to grades 7 and 8 (metacognitive knowledge). There were no significant differences in word-recognition efficiency or speed in any of the three grades between the two groups. These results are similar to findings in other studies into differences between native and language-minority students in the Netherlands (Aarts \& Verhoeven, 1999; Droop \& Verhoeven, 2003; Van Gelderen et al., 2003; Verhoeven, 1990). Nevertheless, the finding that reading comprehension of the low-achieving language-minority students is not significantly lower than that of the native-Dutch students in Grades 8 and 9 , is somewhat surprising. There appeared to be some catching up going on in these later years for this group of language-minority low achievers. This picture is also apparent when we look at metacognitive knowledge through the years. Mastery of this component, which appeared exceptionally important for predicting reading comprehension in the study of Van Gelderen et al. (2007), differed for both groups of low achievers in Grade 7, but in Grade 9 the difference had diminished.

Reading-comprehension ability of the low-achieving students significantly improved between Grade 7 and Grade 9. The growth has an effect size (partial eta²) of .44, which is large. In addition, native-Dutch as well as language-minority students significantly improved in reading comprehension in both of the one-year intervals. A first explanatory thought concerns the educational context of these low-achieving students. From a study of De Milliano (2013) directed to the same sample of students as we studied, the following picture of their literacy curriculum appears. In language arts lessons for the students a "strong focus on explicit skills instruction" (p. 72) exists directed merely at spelling, grammar and vocabulary. In social studies lessons, however, literacy practices were "predominantly content oriented and instrumental for learning subject matter" (p. 72). In addition, De Milliano found that in all lessons, group work for literacy practices did hardly occur, in contrast to whole class instruction and individual seat work. We cannot conclude from these observations that this type of reading education has caused the positive development in reading comprehension. Nevertheless, it is plausible that the sustained literacy practice in such lessons as language arts and social studies fulfills a positive function and may lead to lowachieving adolescents' growth in reading. From another study conducted with the same sample of low achievers we know that these students' out-of-school reading is very infrequently directed towards the 'traditional' epistemic reading goals favored in school (Van Kruistum, 2013). For that reason, it seems plausible that the substantial growth in reading comprehension observed in this study is more related to the reading these students do in the educational context of school than outside school. The fact that these low achievers are strongly improving in reading comprehension is
in contrast with pessimistic expectations uttered in other studies (Dutch Education Inspectorate, 2008). In line with the so-called Matthew effect, researchers have hypothesized that poor readers have poor prospects of growth in reading proficiency, because they are assumed to be caught in a vicious cycle of poor reading skills, leading to poor reading habits and therefore to stagnation or even decrease of reading skills (Stanovich, 1986). Empirical evidence for this effect, however, is quite inconclusive (see e.g., Bast \& Reitsma, 1998; Parrila, Aunola, Leskinen, et al., 2005) and our study shows that in our group of low-achieving adolescents in the Netherlands, such stagnation or decrease is certainly not apparent.

Another finding was that language-minority low achievers initially started at a lower level of reading comprehension than their native-Dutch classmates, but that they caught up by a faster growth rate from Grade 7-9. Although this difference in growth rate was not expected on the basis of earlier studies (Francis et al., 1996; Kieffer, 2008), we can speculate that the language-minority students succeed in catching up with their native peers by increasing their proficiency in the component skills analyzed in our study. ${ }^{16}$ Below, we will return to this issue.

The main questions of our study pertained to the contribution of (i) linguistic knowledge, (ii) metacognitive knowledge, and (iii) the fluency of word and sentence reading to the explanation of reading comprehension proficiency, both in level and in development (growth). Regarding the level of reading comprehension, our analyses indicate that grammatical knowledge, receptive vocabulary and metacognitive knowledge have large contributions, while the contributions of wordrecognition efficiency, word-recognition speed and sentence-verification speed (all fluency components) are negligible. These findings mean that, in particular, the knowledge-related components of reading (vocabulary, grammar and metacognitive knowledge) explain low achievers' proficiency in reading comprehension at a given moment in time. The fluency-related components do not appear to have an important role in explaining reading-comprehension proficiency level. These results confirm similar findings with adolescent readers of the same age (but from a more heterogeneous sample) published in Van Gelderen et al. (2004) and Van Gelderen et al. (2007). In those studies, knowledge variables such as vocabulary, grammar and metacognitive knowledge also had important roles in explaining reading-comprehension proficiency, while wordrecognition fluency had a negligible role. It seems therefore that the components explaining reading comprehension proficiency level for low achievers are nearly

[^11]the same as for adolescent readers in general and that these components are mainly knowledge related (both linguistically and strategically: knowledge of good strategies for reading and writing). The only exception to this generalization appeared to be sentence-verification speed, which was significantly related to reading comprehension in the heterogeneous group of adolescents (Van Gelderen et al., 2007) but not in the low-achieving group.

Regarding the growth of reading comprehension, however, our results show a quite different pattern. At first sight, it appears that the knowledge and fluency components are not important in explaining reading-comprehension growth in lowachieving students. However, we found an interesting interaction effect of language background and vocabulary knowledge on growth in reading comprehension. This interaction indicates that there is an effect of gains in vocabulary on gains in reading comprehension for the language-minority students, but not for the native-Dutch students. Findings from other studies (e.g., Babayigit, 2014; Geva \& Farnia, 2012) point towards a stronger association between level of vocabulary knowledge and level of reading comprehension in language-minority students than in their native peers. The results of this current study established that in addition to the association between level of vocabulary knowledge and level of reading comprehension, there are associations between development in vocabulary and development in reading in low-achieving adolescents.

Vocabulary of both groups improves substantially (partial eta ${ }^{2}=.31$, which is a large effect). This interaction effect may explain the fact that we found the language-minority students approaching the native-Dutch level in reading comprehension in Grade 9, despite the fact that their absolute level of vocabulary knowledge (and other component skills) remained lower than that of their nativeDutch peers. Apparently, the language-minority students profited more from gains in vocabulary than the native-Dutch students did for their reading comprehension. The mechanism behind this differential effect of vocabulary knowledge is, however, not quite clear. It may point to a so-called threshold of linguistic knowledge that has to be surpassed by the language-minority students (Alderson, 1984; Bernhardt, 2000). In that case, the language-minority students were below that 'threshold' at the start of the study in Grade 7, inhibiting their reading comprehension seriously, and crossed that threshold somewhere later on (in Grades 8-9). An alternative explanation may be that language-minority students make better strategic use of their increased vocabulary for text comprehension, for example because they become more meta-linguistically aware of the value of words because of their experience in learning a second language (see e.g., Bruno, 2001; Corder, 1979; Thomas, 1988). To our knowledge, no other studies have been published analyzing these longitudinal relationships between component skills on one hand and growth
in reading comprehension of low-achieving adolescents on the other. Therefore, comparing our results and possible explanations to other studies is not possible yet.

Vocabulary gains seem to explain growth in reading comprehension in the language-minority students. It is hard to decide whether the relation should be interpreted as reciprocal or causal. Although it is tempting to view growth in vocabulary as a condition for improving reading comprehension, an interpretation supported by the finding that vocabulary also explains individual differences in reading-comprehension proficiency, it is impossible to exclude reciprocity on the basis of our results. Therefore, we prefer to postpone a decision on this important question and leave room for both interpretations. Experimental interventions for adolescent struggling readers have shown positive effects on reading comprehension of training programs directed at vocabulary knowledge (Edmonds, Vaughn, Wexler, et al., 2009). Therefore, we may assume that causality in that direction (knowledge comes first) is involved. On the other hand, given the time span of two years of our study (much longer than most experimental intervention studies) it is at least plausible that causality in the other direction (from increased reading experience to gains in comprehension and vocabulary knowledge at the same time) also takes place. Gains in vocabulary have been shown to result from reading experience. For example, Cunningham and Stanovich (1991) found that amount of time spent on reading contributed significantly to vocabulary knowledge for students in Grades 4, 5 and 6. In addition, several studies estimate that large parts of students' vocabulary result from 'incidental word learning' while reading (Nagy, Herman, \& Anderson, 1985; Nagy, Anderson, \& Herman, 1987; Swanborn \& De Glopper, 1999).

Our analysis shows that many components used in our study significantly explain reading comprehension of the low-achieving adolescents. The components (together with language background) explain 45.1\% of the total variance of reading comprehension ( $60.4 \%$ at student level, and hardly any variance at the occasion level). In the study of Van Gelderen et al. (2004) total explained variance of reading comprehension with a similar set of components was $74 \%$ (in Grade 8). However, that study involved a heterogeneous sample of adolescents, containing both low and high achievers. Given that our sample was much more homogeneous in proficiency, the total amount of explained variance can be regarded as quite high, indicating that even in this group of low achievers individual differences in reading comprehension are large enough to be reliably explained by differences in (especially) knowledge components.

This study of low-achieving adolescents' reading comprehension has offered some valuable additions to our knowledge about reading comprehension in a more general sense (especially in heterogeneous samples). First, it has shown that for this group of low achievers, in contrast to what has been suggested in studies probing
the so-called Matthew effect, considerable improvement in reading comprehension is feasible (from Grade 7-9). Second, it demonstrates that the language-minority subgroup - although starting at a lower level of reading comprehension - appear to catch up in the two following years and profit more from growth in vocabulary than their native-Dutch classmates do. In addition, and more importantly, we have found that linguistic and metacognitive knowledge play substantial roles in the explanation of reading comprehension in the course of three years of schooling. Partially (particularly as regards the explanation of reading comprehension level), the findings for the low-achieving students are similar to findings in previous studies with heterogeneous groups of adolescent readers. Linguistic and metacognitive knowledge have relatively large contributions to the explanation of differences in reading comprehension, while the contributions of fluency-related components (word-recognition speed and efficiency, and sentence-verification speed) are negligible. Furthermore, the knowledge and fluency components do not generally explain growth in reading comprehension, except that in the language-minority students growth in vocabulary explains growth in reading comprehension.

Implications for future research. The fact that growth in reading comprehension cannot be explained by most components, suggests that for these low-achieving adolescents from Grade 7 to Grade 9 there is no additive effect of linguistic knowledge, metacognitive knowledge, and fluency on reading comprehension growth. Development (within-student variance) nor level (between-student variance) of the components could explain differences in reading comprehension growth in this study. Therefore, differences in reading comprehension between these low-achieving adolescents seem determined by differences in the components that already existed from the beginning of our study. Whether this is generally the case, however, will have to be determined in follow up studies using other - and preferably larger - samples of low-achieving adolescents, in order to be able to identify statistically smaller effects than was possible in our study.

The findings pose some challenging questions regarding the directionality of causation. Future research should be directed to this type of question, that can most profitably be studied in experimental intervention studies. However, given the present state of knowledge, the safest assumption for the relations between the component skills and reading comprehension is that they are not simply unidirectional. There is reason to believe that there are other paths of causation that could not be directly tested in our study. Gains in vocabulary may have quite a direct effect on poor readers' reading comprehension (as demonstrated in numerous intervention studies), but such gains can also be a result of increased experience in reading that lie at the basis of both gains in knowledge and reading comprehension.

Educational implications. Fluency did not explain individual differences in reading comprehension in low-achieving adolescents, suggesting that educational attention towards improving fluency for this group of students should not be prioritized. More beneficial effects can be expected from educational interventions emphasizing vocabulary, grammar and metacognitive knowledge involved in reading comprehension, given that these components did show substantive relations with reading proficiency of the low-achieving students. The fact that we did not find general effects of these knowledge variables on all students' growth in reading comprehension means that individual growth in the components is yet not productive in supporting reading development. However, the fact that inter-individual differences in level of linguistic and metacognitive knowledge explain differences in reading comprehension, indicates that there are many low-achieving students that would potentially profit from extra educational attention in these areas. Additionally, for language-minority students, growth in vocabulary knowledge appeared to be related to growth in reading comprehension. Educational interventions that enable these low-achieving students to enrich their vocabulary are therefore promising in helping these students improve their reading comprehension. Since, presumably, associations between vocabulary and reading comprehension are not unidirectional but reciprocal, interventions directed at improving vocabulary knowledge in direct connection with reading activities seem most promising. Finally, given the low frequency of reading for 'epistemic' functions outside school of these low-achieving students (Van Kruistum, 2013), our findings give ample support for the schools' function of compensating this lack of practice in reading by providing more time to read texts directed at academic knowledge acquisition, preferably within meaningful learning contexts and with strategic and linguistic support.

Limitation. A limitation of the current study concerns the small sample size ( $\mathrm{N}=50$ ). However, our study used a precisely defined and focused sample, in which we controlled for quite a lot of variables (see Section 3.2.1). For that reason we selected a small group of students from within classes, instead of selecting all students in those classes. This procedure has the advantage that the characteristics of students in our sample (for example the languages spoken at home) are much more sharply defined than usual in larger samples. Furthermore, testing of all predictors occurred in individual or small group sessions throughout the whole study (see Section 3.2.3) securing that students understood their tasks well and carried them out according to the instructions. In addition, the use of repeated measures analyses provided us much more statistical power using 150 instead of 50 data points for each variable. Therefore, although research to replicate our findings is highly recommended, we believe the current study has offered some valuable insights into reading comprehension and reading development of low achievers.

## Chapter 4

## Writing proficiency level and writing development of lowachieving adolescents: Roles of linguistic knowledge, fluency and metacognitive knowledge ${ }^{17}$


#### Abstract

In a longitudinal design, 51 low-achieving adolescents' development in writing proficiency from Grades 7 to 9 was measured. There were 25 native-Dutch and 26 language-minority students. In addition, the roles of (i) linguistic knowledge, (ii) metacognitive knowledge, and (iii) linguistic fluency in predicting both the level and development of writing proficiency were assessed. Low-achieving students improved in writing proficiency, the language-minority students more so than the native-Dutch students. Regarding the level of writing proficiency, individual differences between low-achieving adolescents could be accounted for by receptive vocabulary, grammatical knowledge, and speed of sentence verification, suggesting that these are important components in low-achieving adolescents' writing. Regarding development in writing proficiency, grammatical knowledge predicted variation between low-achieving students. Explanations and educational implications of these findings are discussed.


[^12]
### 4.1 Introduction

In present society, writing is of great importance. At school, when acquiring knowledge and sharing it with others, adolescents learn to apply their language skills to write comprehensible texts. Unfortunately, despite this educational effort, many adolescents face difficulties in their writing (Alliance for Excellent Education, 2006; Baumert, Klieme, Neubrand, et al., 2001; Dutch Education Inspectorate, 2008; Greenwald, Persky, Campbell, \& Mazzeo, 1999; Hofman, Spijkerboer, \& Timmermans, 2009; Kuhlemeier, Van Til, \& Van den Bergh, 2014; OECD, 2000; Persky, Daane, \& Jin, 2003; Salahu-Din, Persky, \& Miller, 2008)

Although it is acknowledged that many adolescents lack sufficient writing skills, low-achieving students' writing proficiency is not investigated thoroughly (Juzwik, Curcic, Wolbers, et al., 2006; Klassen, 2002). Several studies indicate aspects in which high-achieving adolescent writers differ from low achievers (e.g., Graham, 2006; Graham, Schwartz, \& McArthur, 1993; Saddler \& Graham, 2007), but studies focusing on important differences between low-achieving adolescent writers are scarce. These differences, however, are extremely relevant for educational interventions directed at this group. If differences in writing proficiency between low-achieving students can be explained, specific interventions can be adapted to the individual students' needs. Specifically, it is of interest to investigate the components involved in these students' writing proficiency. These components, for example vocabulary knowledge, metacognitive knowledge or linguistic fluency, can be of more or less importance in facilitating low-achievers' writing. Therefore, this study is directed at the role of linguistic and metacognitive components in explaining low-achieving adolescents' writing proficiency. In contrast to previous studies, we focus on individual differences within the group of low-achieving adolescents, instead of differences between high and low-achieving writers.

### 4.1.1 The role of linguistic and metacognitive components in the process of writing

The process of writing coherent text involves the use of different types of knowledge, the fluency in using this knowledge, switching between processes involved in using these types of knowledge, and monitoring these processes (Bereiter \& Scardamalia, 1987; Berninger \& Swanson, 1994; Chenoweth \& Hayes, 2001; Flower \& Hayes, 1981; Hayes, 1996; 2006; 2012; Hayes \& Flower, 1980; McCutchen, 2006). First of all, writers need to plan. They need to put a writing task into a plan, involving generating ideas, organizing these ideas, and setting goals. Writers have to be able to keep this plan in mind throughout the entire writing process. Next, writers need to generate text, which implies the formulation of a linguistic message (i.e., putting ideas into words, sentences, and larger discourse units) as well as the transcription of this linguistic message into writing. Knowledge of vocacabulary and grammar are
important for formulation processes, while knowledge of spelling is important for transcription. In addtion, writers need to review, that is, interrupt their writing to reread pieces of text written so far, evaluate the text (with respect to content and linguistic accuracy), and, if necessary, to revise. These three cycles, planning, formulating and reviewing, are not linearly ordered in time: Writers move back and forth between them (Hayes \& Flower, 1980; McCutchen, 2000; Torrance \& Galbraith, 2006).

To carry out the different processes effectively, writers need to call on cognitive resources stored in long-term memory (Chenoweth \& Hayes, 2001; Hayes, 1996; Schoonen, Van Gelderen, De Glopper, et al., 2003; Schoonen, Van Gelderen, Stoel, Hulstijn, \& De Glopper, 2011; Torrance \& Galbraith, 2006). These resources include linguistic and metacognitive knowledge. The most important parts of linguistic knowledge are vocabulary knowledge, grammar knowledge (both syntax and morphology) and orthographic knowledge (spelling) (Grabe \& Kaplan, 1996). Metacognitive knowledge includes knowledge of useful strategies for writing and for monitoring the writing process (Schoonen et al., 2003).

In addition, writers have to be able to apply resources in an efficient way, because they have to process them within the restrictions of limited working memory capacity (Hayes, 2006; Kellogg, 1999; McCutchen, 2011; 2012; Piolat, Olive, \& Kellogg, 2005). Fluent access to vocabulary, grammar or orthographic knowledge in long-term memory is assumed to lower the cognitive processing load. This may result in the freeing of working memory space for applying metacognitive knowledge to coordinate different writing processes (Deane, Odendahl, Quinlan, et al., 2008; McCutchen, 1996; Schoonen et al., 2003; Schoonen et al., 2011; Torrance \& Galbraith, 2006). Therefore, not only linguistic and metacognitive knowledge but also fluency in accessing linguistic knowledge can be considered important for writing proficiency (Schoonen et al., 2003).

### 4.1.2 Individual differences in adolescents' level of writing proficiency

Among adolescents, substantial individual differences exist with respect to level of writing proficiency. More proficient writers need less cognitive effort for the transcription components handwriting and spelling (Christensen, 2004; Graham, Berninger, Abbott, Abbott, \& Whitaker, 1997; Quinlan, 2004; Smith, 2011) and are able to use more varied lexicon and more complex grammar in their texts (Crossley, Weston, McLain, Sullivan, \& McNamara, 2011; Graham, 2006; Houck \& Billingsley, 1989; Myhill, 2008). More proficient writers also have more metacognitive knowledge about useful strategies for writing, about writing conventions, and about characteristics of text genres (Berninger \& Swanson, 1994; Schoonen et al., 2003). The superior metacognitive knowledge of more proficient writers also involves awareness
of important rhetorical aspects of writing in contrast with their less proficient peers who believe that handwriting and spelling are the main issues (Graham et al., 1993; Saddler \& Graham, 2007). Furthermore, more proficient adolescent writers devote more attention to such important processes as planning and revising of their texts than less proficient writers (Graham, 2006; Graham et al., 1993; Saddler \& Graham, 2007; Van Gelderen, 1997). Schoonen et al. (2003) showed that adolescents' writing proficiency (Grade 8) can be predicted to a considerable degree by linguistic knowledge (vocabulary, spelling and grammar), metacognitve knowledge, and linguistic fluency (speed of access to syntactic knowledge). All of these components of writing proficiency correlated substantially with writing performance measures. Correlations ranged from . 47 to .67. Thus, individual differences in adolescents' writing proficiency are strongly related to differences in linguistic and metacognitive knowledge, and fluency.

Although the studies above have provided evidence for the importance of differences in components of writing proficiency for explaining differences between more and less proficient writers, no such evidence exists about the explanatory value of these components within the group of low-achieving adolescents. However, this information is extremely relevant for writing education directed at this group of adolescents. If, for example, metacognitive knowledge about writing appears to explain not only differences between high and low-achieving students, but can also explain differences within the group of low achievers, this may lead to the conclusion that more attention should be given to the role of this type of knowledge in teaching writing to this population. Although knowledge of such relations between components and writing proficiency does not directly lead to successful educational interventions, it is certainly important for educational experiments directed at improving adolescents' writing proficiency (Schoonen et al., 2003; Snellings, Van Gelderen, \& De Glopper, 2004).

### 4.1.3 Adolescents' writing development

In a recent review, Camp (2012) discussed theories of writing development such as psychological models of intellectual development, based on Piaget (1959, 1967), situated learning theories, based on Vygotsky (1962, 1978), or ecological system theory, based on Bronfenbrenner (1979). These theories take into account that development does not take place in isolation, but that context and personal motivations are influential. In these theories, however, the roles of linguistic and metacognitive knowledge in wrtiting development remain unexplored. Writing development research focusing on the roles of linguistic and metacognitive development can be divided in two parts: (i) cross-sectional studies comparing younger writers with older writers and (ii) longitudinal studies in which cohorts of the same students are followed.

Cross-sectional studies. Several cross-sectional studies have shown that older students outperform younger students on spelling (Devonshire \& Fluck, 2010; Keuning \& Verhoeven, 2008), handwriting (Graham, Berninger, Weintraub, \& Schafer, 1998), vocabulary (Verhoeven \& Vermeer, 1992), and sentence construction (Myhill, 2008). These skills are necessary in the writing process, and presumably, a better mastering of these skills is important for improvement in writing. Furthermore, it may facilitate attention to rhetorical aspects of ideas in all types of writing processes (planning, formulation and revision) (Fayol, 1999; McCutchen 1996, 2000). In addition, older students were found to be more knowledgeable about the role of the audience (Holliway \& McCutchen, 2004) and about the complex nature of composing (Graham et al., 1993) than younger students

In several cross-sectional studies focusing on writing, written texts of several age groups are compared. Fayol (1991) studied stories by 6-10 years olds and found that older children made more use of several grammatical tools, such as textual organization clues, including the appropriate use of verbal tense, connectives and punctuation. Similar findings were obtained by Verhoeven and Van Hell (2008) in a comparison between 10 -year-olds and adult writers. Adults produced longer texts with greater syntactic complexity, and tended to use a broader range of causal markers in their texts. Between younger and older adolescents, differences in text characteristcs were found as well. Older adolescents were found to produce longer sentences and make use of a greater variety of sentence structures, subordinators and connectives than younger adolescents (Crossley et al., 2011, Grade 11 vs. 9; Myhill, 2008, Grade 10 vs. 8). In addition, older students' texts were found to be lexically more diverse and more dense (Berman, Nayditz, \& Ravid, 2011, 9-10 vs. 1314 years olds; Crossley et al., 2011; Johansson, 2009, 9-10, 12-13 and 16-17 years olds). Although the use of more complex language does not necessarily imply more linguistic knowledge (Applebee, 2000), these findings suggest that gains in lexical, grammatical and textual knowledge are important aspects of adolescent students' writing development.

Other cross-sectional studies focused at the relation between writing and its components in different age groups. Limpo and Alves (2013) compared two groups of Portugese students at two developmental points: Grades 4-6 and Grades 7-9, and investigated the role of transcription and self-regulation in writing quality. In Grades 4-6, students' transcription components (spelling and handwriting) were the strongest contributers to text quality, whereas in Grades 7-9, transcription contributed indirectly (via planning and self-efficacy) to students' writing proficiency. These results are in line with outcomes of cross-sectional studies by Berninger and colleagues in a sample of $4^{\text {th }}$ to $6^{\text {th }}$ graders (Berninger, Cartwright, Yates, Swanson, \& Abbott, 1994), and a sample of $7^{\text {th }}$ to $9^{\text {th }}$ grade students (Berninger, Whitaker,

Feng, Swanson, \& Abbott, 1996) in an English-speaking context. Variance explained by transcription was lower in Grades 7-9 (18\%) than in Grades 4-6 (42\%), suggesting that, when transcription is not fully mastered yet, it constrains text generation, but when transcription skills become more automated, writing quality suffers less from these constraints (Berninger, 1999; Graham et al., 1997). Efficient use of writing strategies is assumed to play a more dominant role in predicting writing proficiency when automization of transcription has taken place. In addition, automization of transcription skills enables a writer to free up working memory space to be devoted to rhetorical processes, such as paying attention to the needs of readers (Scardamalia \& Bereiter, 1986).

Longitudinal studies. In addition to the cross-sectional studies, longitudinal studies are necessary to investigate developmental patterns and relationships more precisely. However, few longitudinal studies about writing exist, and in those studies in which the same students were repeatedly tested, analyses are often conducted cross-sectionally, rather than longitudinally (Lerkkanen, Rasku-Puttonen, Aunola, \& Nurmi, 2004), that is, rather than investigating longitudinal relations, associations between variables are investigated at a specific point in time, and compared with the associations found at another time of measurement (see e.g. Berninger, Abbott, Swanson, et al., 2010, Juel, 1988, or Niedo, Abbott, \& Berninger, 2014). Longitudinal studies investigating writing proficiency in a longitudinal fashion may be directed at (i) development of writing proficiency, or at (ii) the relation between writing proficiency development and its constituting components, such as spelling, grammar, vocabulary and handwriting.

Smith (2011), who investigated the development of narrative writing in a heterogeneous sample of students from Grade 4 to Grade 6 in an English-speaking context in Canada, found that students' text quality improved significantly over time in this two-year interval. However, although there was significant individual variation in the growth patterns that students displayed, none of the included components of writing proficiency (vocabulary, syntax, phonological processing, (pseudo)word reading, and spelling) predicted individual differences in growth in writing proficiency.

Abbott, Berninger, and Fayol (2010) tracked two cohorts of students (Grade 1 to 5 , and Grade 3 to 7 ) in a longitudinal study into writing development in a heterogeneous sample of normally developing children. The authors modelled longitudinal relationships between handwriting, spelling, word reading, reading comprehension, and written composition. Their findings indicated that individual differences on these measures were relatively stable over time. Furthermore, above the autoregressive paths, there were significant longitudinal paths from spelling to
written composition, that is, taking into account the contribution of previous writing proficiency, individual differences in written composition were associated with individual differences in spelling in a previous grade. The contributions from spelling to written composition were present in each of the 1-year intervals in the study.

In a meta-analysis, Graham and Santangelo (2014) investigated the importance of spelling for writing. On one hand, they concluded that students (Grade 1-6) generalized gains in spelling (in their analysis these gains were a result of a formal spelling instruction intervention) to more correct spelling in their written texts. However, gains in spelling did not affect gains in overall text quality. Thus, whereas findings by Abbott et al. (2010) indicate that individual differences in students' gains in writing were related to individual differences in spelling level, Graham and Santangelo could not find siginificant effects of gains in spelling to gains in writing proficiency.

Schoonen et al. (2011) pays attention to adolescents' development (Grades $8-10$ ) in writing proficiency in relation to linguistic and metacognitive knowledge and fluency components of writing. Similar to the study by Abbott et al. (2010), the authors found that individual differences in writing proficiency remained stable over time. However, whereas Abbott et al. (2010) found significant contributions from spelling to writing development, no additional contributions of any of the included components were found explaining growth in writing from Grade 8 to 10 by Schoonen et al.

The current study adds to the above knowledge base. We analyze the development in writing proficiency of a group of low-achieving adolescents. Furthermore, we investigate the predictive values of knowledge and fluency components on writing proficiency level and writing proficiency development over a period covering three grades (7-9). Important differences with previous studies however are the following. First, we focus on low-achieving students instead of a group of adolescents that is more heterogeneous in terms of writing proficiency. Explaining individual differences within the population of low-achieving adolescents is relevant for the design of educational interventions directed at this group. Second, in our study we analyze not only the contributions of components of writing skill, but also the explanatory value of development of those components for writing development. This is an important addition, because it potentially shows whether development in the linguistic and metacognitive components in three years of schooling of low-achieving adolescents explains writing proficiency development. This is relevant information for education directed at writing for this group.

### 4.1.4 Language-minority students

Students from immigrant backgrounds constitute a substantial part of school populations in many Western countries. Among the low-achieving adolescents, these language-minority students are overrepresented (CBS, 2004; Dagevos, Gijsberts, \& Van Praag, 2003; Elley, 1992, OECD, 2001, Soussi, Broi, Moreau, \& Wirthner, 2004). Language-minority students on average are found to perform below their native peers in writing proficiency (Geva \& Genesee, 2006), as well as in several relevant components of writing proficiency, such as vocabulary and grammar knowledge, and in reading comprehension (Aarts \& Verhoeven, 1999; Ball, 2003; CBS, 2010; Farnia \& Geva, 2011; Garcia 1991, Kieffer 2008; Lesaux \& Kieffer 2010; National Center for Education Statistics, 2009; Verhoeven, 1990). It is therefore of interest in our study to account for possible differences in writing proficiency between low-achieving adolescents from native-Dutch and language-minority backgrounds.

### 4.1.5 Research questions

We investigate associations between the components of low-achieving adolescents' writing proficiency level and development. On one hand, we use measures for linguistic and metacognitive knowledge and fluency as predictors for students' writing proficiency level. On the other hand we use repeated measures for the aforementioned predicting variables for the prediction of writing development over three grades (7-9). The following research questions are posed:
(RQ 1) To what extent are individual differences in writing proficiency level of lowachieving adolescents predicted by linguistic and metacognitive knowledge, and fluency?
(RQ 2) To what degree does the level of writing proficiency of low-achieving adolescents improve from Grade 7-9? And are there differences between native-Dutch and language-minority students?
(RQ 3) To what extent is development in writing proficiency from Grade 7 to 9 predicted by linguistic and metacognitive knowledge and fluency repeatedly measured?
(RQ4) To what extent do the predictions of writing proficiency level and development differ for native-Dutch and language-minority students?

Of these, research questions 1 and 3 are the most important ones, because very few studies have probed the predictive value of level and development in writing components for level and development in writing proficiency of adolescents. Question 2 is of interest because it provides background to the issue of writing
development of low-achieving students of native-Dutch and language-minority backgrounds. Question 4 is directed to the possibility of differential roles of the components in each of the groups of low-achieving students.

### 4.2 Method

### 4.2.1 Participants

Eleven schools for prevocational secondary education in urban areas in the western part of the Netherlands volunteered to participate in this study. In the Netherlands, students in the lowest prevocational track are among the 30 percent lowest achieving on a national school aptitude test of reading, language and mathematical skills. This group of students also contains the poorest readers and writers in the population.

We recruited students from seventh-grade classes, which is the first year of secondary education in the Netherlands. For student selection two types of data were used. First, information from the school records enabled us to select a sample of students not suffering from diagnosed learning or behavioral disorders. Furthermore, immigrant students who had visited a Dutch primary school for less than three years were excluded in order to keep the language-minority sample homogeneous with respect to previous schooling experiences and related opportunities for acquisition of Dutch.

Second, data about the ethnic and linguistic backgrounds (country of birth of student and parents, languages spoken at home, and frequency of use of these languages in contacts at home) of the students were obtained by means of a questionnaire that was filled out by the students themselves. Students were selected for the native-Dutch group if both parents were born in the Netherlands, ${ }^{18}$ if they were native speakers of Dutch, and if Dutch was their dominant home language (i.e., most language contacts within the home had to be in Dutch). Students were selected for the language-minority group if both parents were born outside the Netherlands and if students spoke another language than Dutch with their parents for half of the time or more. This decision was based on information about the language spoken in interactions with father and/or mother. Most students in the language-minority group (21 students) had learned to read and write in the other home language to some extent. However, the first language they had learned to read and write in was Dutch.

[^13]Most of these 26 language-minority students had Moroccan (9) or Turkish (7) backgrounds, the remainder had Surinamese (3), Antillean (3), Cape Verdean (3), and Chinese (1) backgrounds. ${ }^{19}$ All but five of the students with a minority background were born in the Netherlands; most students are thus second generation immigrants.

In the first year of the longitudinal study, the sample consisted of 63 students ( 36 boys and 27 girls) from 10 classes in 9 different schools, of whom 32 students had a native-Dutch background. For 51 of these 63 students (in Grade 9 divided over 11 schools) we have complete data in Grades 7, 8 and $9 .{ }^{20}$ For our analyses we chose to investigate only the data of students with complete data: 29 boys and 22 girls, of whom 25 were of a native-Dutch, and 26 of a language-minority background.

### 4.2.2 Instruments

Writing proficiency. The writing proficiency test consisted of three writing assignments. Each assignment specified a realistic communicative task (assumedly) connected to young people's daily lives. The three assignments covered instructive, argumentative and narrative text types. In Assignment 1, students wrote a letter to two students from Belgium who were visiting the Netherlands as part of an exchange project. Their task was to describe the program for a day out in Amsterdam and provide instructions on where to meet, what to bring, et cetera. In Assignment 2, students were asked to imagine they were taking part in a competition for which they were saving coupons on candy bar wrappers in order to receive two free cinema tickets. However, they were unable to find enough wrappers with coupons. Students wrote a letter to the candy bar factory, arguing that it was not their fault that they were not able to send the required number of coupons and convincing the recipient to send them the cinema tickets. In Assignment 3, students wrote a sequel to a story they had read about a very poor boy, who once dressed up like a very rich man. Start and closing sentence of the story were given.

Each assignment was rated by two independent raters using a primary trait scoring procedure (Lloyd-Jones, 1977). For each assignment, the central objective -

[^14]the primary trait - was formulated. On the basis of this primary trait, a set of rating criteria were specified (e.g., 'letter conventions', 'line of reasoning', 'consistency with original story'). The raters used these criteria to assign each student a single score. To arrive at this score, the raters used a scale of five benchmark texts. This scale was separately developed using forty randomly sampled texts rated by two independent raters, following a procedure based on Blok (1986) and adopted in Schoonen et al. (2011). The five points of the rating scale represented the $10^{\text {th }}, 25^{\text {th }}$, $50^{\text {th }}, 75^{\text {th }}$, and $90^{\text {th }}$ percentiles of the forty texts. The interrater reliability of the scores was satisfactory: For Task 1, $r=.89, .86$, and .65 in year 1,2 , and 3 , respectively; for Task $2, r=.85, .85$, and .74 in year 1,2 , and 3 , respectively; and for Task $3, r=.85, .89, .73$ in year 1 , 2 , and 3 , respectively. Across all three years, one rater remained the same in order to avoid differences in severity of rating and to make the ratings across years comparable. The reliability of the measurement of writing proficiency (Cronbach's alpha over 3 assignments) for the sample of 51 students was 65 in Grade 7, . 67 in Grade 8 and . 51 in Grade 9. Correlations between the tasks are reported in Appendix C.

Receptive vocabulary. This paper-and-pencil test, based on the receptive vocabulary test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007), consisted of 73 multiple-choice questions, testing the knowledge of nouns, verbs, adjectives, and adverbs belonging to the 23,000 words in a dictionary for junior high school students (see Hazenberg \& Hulstijn, 1996, for details). Each item consisted of a neutral carrier sentence with a target word in bold print. The students had to choose between four options, printed underneath, one of which represented a correct synonym of the target word. The Cronbach's alpha coefficients for this test were .85 (Grade 7), . 88 (Grade 8) and . 86 (Grade 9).

Grammatical knowledge. In this 50-item paper-and-pencil test, based on the grammatical knowledge test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007), students had to complete sentences containing a word-gap with the correct form of verbs, adjectives, anaphora, comparatives, and articles, and they had to put words or phrases into the correct order, taking into account the correct form for number, time, aspect, and agreement. There were both fill-in-the-blanks and multiple-choice items in this test. The Cronbach's alphas for this test were . 71 (Grade 7), 80 (Grade 8) and .67 (Grade 9).

Orthographic knowledge. The orthographic knowledge of the students was assessed by means of a paper-and-pencil test of 68 multiple-choice questions. The test was based on the orthographic knowledge test by Schoonen et al. (2003) and Schoonen et al. (2011). Sentences were presented in which one word contained a gap. Students
had to choose which letter or letter combination, presented underneath, should be used to fill that gap. The Cronbach's alpha coefficients for this test were . 64 (Grade 7), 74 (Grade 8) and .71 (Grade 9).

Metacognitive knowledge. Metacognitive knowledge was measured by means of a paper-and-pencil questionnaire consisting of statements about text characteristic and reading and writing strategies. It was based on the metacognitive knowledge test used by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). Items consisted of correct or incorrect statements. Students had to tick whether they agreed or disagreed with a statement. An example of an (incorrect) statement is The order in which you present the information in your text is usually not relevant. The test had 45 items and the Cronbach's alpha coefficients were .50 (Grade 7), . 60 (Grade 8) and . 54 (Grade 9). These relatively low reliabilities were probably caused by the difficulty of the task for our population (the average score being 28,28 and 30 , with a guessing score of 23 ).

Speed of written word recognition. Speed of word recognition was tested by means of a computer-administered lexical decision task, based on the test from Van Gelderen et al. (2003). The stimuli consisted of 119 letter strings (3-8 letters), 59 of which were existing (well-known) words; the remainder consisted of phonologically correct pseudo-words. Students were asked to decide as quickly as possible whether the stimulus was an existing word or not and press the corresponding key on the keyboard. Responses were automatically coded in terms of both accuracy and latencies (from stimulus onset). The mean accuracy was $94 \%$. The latency measure was computed using only correct responses to existing words (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alphas for this speed test were .83 (Grade 7), .90 (Grade 8) and . 82 (Grade 9).

Speed of lexical retrieval. In the lexical retrieval task (based on Schoonen et al., 2003, and Schoonen et al., 2011), participants were asked to "name" pictures of objects as quickly as they could. They did this by pressing the first letter of the target word on the keyboard of a laptop computer. Only reaction times on correct responses were used in the analyses. The test consisted of 38 easy words that can be expected to be known to all students. There were ten trial items before the test started. In order to be able to correct for typing fluency, we also administered a test for this skill. Students had to type a letter as quickly as possible after it was shown on the computer screen. ${ }^{21}$ Typing fluency was used as a control variable for lexical retrieval

[^15]in such a way that we used the difference between the lexical retrieval speed and the typing speed in the analyses. The Cronbach's alpha coefficients for the lexical retrieval test were 85 (Grade 7), 83 (Grade 8) and . 84 (Grade 9).

Speed of sentence verification. Speed of sentence verification was measured using the same lexical decision paradigm as described for word-recognition speed. It was a computer-administered task. The task was based on the sentence-verification speed test by Van Gelderen et al. (2003) and Van Gelderen et al. (2007). A sentence was displayed on the screen as a whole. Students decided as quickly as possible whether the sentence made sense or not. Half of the 72 items made sense (e.g., The man went to bed because he wanted to sleep), the other half did not make sense (e.g., Most bicycles have seven wheels). The sentences referred to common knowledge that seventh-grade students can be assumed to have. The average accuracy on the true assertions was $98 \%$. Responses were automatically coded in terms of both accuracy and latencies (from the onset). The latency measure was computed only on the basis of the correct responses to the 36 true assertions (hits). Extremely fast or extremely slow responses were coded as missing values, following the scoring instructions described for this test in Van Gelderen et al. (2004). The Cronbach's alphas for this speed test were .95 (both in Grade 7 and 8) and . 96 (Grade 9).

### 4.2.3 Procedure

The tests were administered in February-June 2008 (seventh grade), February-June 2009 (eighth grade), and February-June 2010 (ninth grade). The writing assignments were administered to whole classes in one session of forty minutes ( 2 assignments) and one session of twenty minutes (1 assignment). The other tests were administered to small groups of about three students in three different sessions. We scheduled no more than two sessions per day in order to minimize test fatigue. All sessions were introduced by a researcher or a trained test assistant. The writingproficiency classroom-test sessions were also attended by a teacher to assist in maintaining order.

### 4.2.4 Analyses

In order to establish the relative contributions of students' knowledge and fluency to writing proficiency level and development, several regression analyses were performed (using MLwiN 2.16, Rasbash, Steele, Brown, \& Goldstein, 2009). First, we checked whether the multi-level regression analyses should include a class level. We found a significant proportion of class level variance (see Appendix D). Therefore, in addition to a student level (variance between students) and an occasion level (variance within students between times of measurement) (cf. Rasbash, et al., 2009),
a class level was included in the models. ${ }^{22}$ For appropriate estimates of class-, student- and occasion-level variance, time of measurement ${ }^{23}$ (Grades 7, 8 and 9), was also included in the model as a predictor (Hox, 2010).

To determine which components contributed to the explanation of writing proficiency level and development, we added the components to the model (one at a time) and we estimated proportions of explained class, student (first research question) and occasion level variance (third research question) respectively. In these analyses we corrected for students' background. ${ }^{24}$ To determine whether there is an improvement in writing proficiency (second research question), we estimated the regression coefficient of time of measurement. We also investigated possible differences in improvement in writing proficiency between native-Dutch students and language-minority students by verifying whether the interaction effect between background and time of measurement is significant.

To test whether the relation between writing proficiency level and development on one hand and the components of writing proficiency on the other hand differed between native-Dutch students and language-minority students (fourth research question), interaction effects between background and each of the repeatedly measured components were included (one by one) as predictors in the regression equation.

### 4.3 Results

Means and standard deviations of writing proficiency and the predictors are presented for each occasion (Grade 7-9) in Appendix E. For descriptive purposes, we analyzed raw differences between native-Dutch and language-minority students for all variables involved. Appendix F presents an overview of the significant differences between the two groups found. The native-Dutch students outperformed the language-minority students on receptive vocabulary, grammatical knowledge, lexical-retrieval speed and sentence verification speed. The language-minority students started at a lower level than their native-Dutch peers on a number of variables, i.e., writing proficiency, orthographic knowledge and metacognitive knowledge, but differences between both groups diminished over time.

Results regarding research questions 1 and 3 are presented in Table 4.1. Each column represents a model. Model 0 has only time of measurement as predictor. In

[^16]Model 1 the variable background is included. In Models 2 a to 2 g the knowledge and fluency components are added (each separately) to the regression equation.

Table 4.1 shows that according to Model $020.0 \%$ of the variance in level of writing proficiency is on the class level, $38.8 \%$ on the student level and the remaining variance (41.2\%) is on the occasion level (within-student variance). In the lowest part of the table it is shown whether each consecutive model makes a significant improvement of fit compared to the previous model (see difference -2 *loglikelihood). Inclusion of background, in Model 1, does not significantly improve the model fit. Compared to Model 1 , only Models $2 \mathrm{a}, 2 \mathrm{~b}$ and 2 g have significantly better model fit (values for difference-2*loglikelihood ( $d f=1$ ) are 7.8, 19.4 and 8.8 respectively). The repeatedly measured knowledge and fluency components (see models $2 \mathrm{a}-2 \mathrm{~g}$ in Table 4.1) that appear to be a significant predictor of writing proficiency variance (the total of class, student and occasion level) are therefore receptive vocabulary, grammatical knowledge and sentence-verification speed.

In order to answer research question 1, we examined the predictors that explain variance on the student level, which are receptive vocabulary (16.4\%), grammatical knowledge (12.6\%) and sentence-verification speed (46.1\%) (Models $2 \mathrm{a}, 2 \mathrm{~b}$ and 2 g ). The other knowledge (orthographic and metacognitive knowledge) and fluency (word-recognition and lexical retrieval speed) components do not explain differences in writing proficiency between students.
Table 4.1
Multilevel analyses with writing proficiency (repeatedly measured) as dependent variable. Predictors are the 7 components (repeated measurements of knowledge and fluency), time of measurement (coded as 0,1 and 2), and language background (coded as 0 and 1).

| 51 students, 10 classes, <br> 3 times of measurement |  | 0 | 1 | 2a | 2b | 2c | 2d | 2e | 2 f | 2g |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Variance | class | $\begin{aligned} & 1247.4 \\ & (864.8) \end{aligned}$ | $\begin{gathered} 987.1 \\ (742.9) \end{gathered}$ | $\begin{gathered} 472.1 \\ (478.7) \end{gathered}$ | $\begin{gathered} 39.3 \\ (291.7) \end{gathered}$ | $\begin{gathered} 900.3 \\ (700.9) \end{gathered}$ | $\begin{aligned} & 882.7 \\ & (684.1) \end{aligned}$ | $\begin{gathered} 1050.3 \\ (749.4) \end{gathered}$ | $\begin{aligned} & 926.7 \\ & (692.4) \end{aligned}$ | $\begin{gathered} 1008.1 \\ (657.1) \end{gathered}$ |
|  | student | $\begin{gathered} 2425.9 \\ (734.8) \end{gathered}$ | $\begin{gathered} 2374.5 \\ (723.7) \end{gathered}$ | $\begin{gathered} 1984.6 \\ (641.8) \end{gathered}$ | $\begin{gathered} 2075.5 \\ (645.8) \end{gathered}$ | $\begin{gathered} 2351.8 \\ (719.7) \end{gathered}$ | $\begin{gathered} 2255.0 \\ (700.0) \end{gathered}$ | $\begin{aligned} & 2129.9 \\ & (672.6) \end{aligned}$ | $\begin{gathered} 2128.3 \\ (673.6) \end{gathered}$ | $\begin{gathered} 1280.0 \\ (503.2) \end{gathered}$ |
|  | occasion | $\begin{aligned} & 2575.7 \\ & (360.7) \end{aligned}$ | $\begin{aligned} & 2575.7 \\ & (360.7) \end{aligned}$ | $\begin{gathered} 2620.4 \\ (367.0) \end{gathered}$ | $\begin{gathered} 2450.5 \\ (343.1) \end{gathered}$ | $\begin{gathered} 2585.4 \\ (362.1) \end{gathered}$ | $\begin{gathered} 2605.6 \\ (365.0) \end{gathered}$ | $\begin{gathered} 2600.6 \\ (364.1) \end{gathered}$ | $\begin{gathered} 2644.5 \\ (371.0) \end{gathered}$ | $\begin{aligned} & 2787.5 \\ & (390.9) \end{aligned}$ |
|  | total | 6249.0 | 5937.3 | 5077.1 | 4565.3 | 5837.5. | 5743.3 | 5780.8. | 5699.5 | 4075.6 |
| Distribution of variance | class | 20.0\% | 17.2\% | 9.3\% | 0.9\% | 15.4\% | 15.4\% | 18.2\% | 16.3\% | 24.7\% |
|  | student | 38.8\% | 41.4\% | 39.1\% | 45.5\% | 40.3\% | 39.3\% | 36.8\% | 37.3\% | 31.4\% |
|  | occasion | 41.2\% | 41.4\% | 51.6\% | 53.7\% | 44.3\% | 43.6\% | 45.0\% | 46.4\% | 43.9\% |
| Explained variance | class |  | 20.9\% | 52.2\% | 96.0\% | 8.8\% | 10.6\% | - | 6.1\% | - |
|  | student |  | 2.1\% | 16.4\% | 12.6\% | 1.0\% | 5.0\% | 10.3\% | 10.4\% | 46.1\% |
|  | occasion |  | - | - | 4.9\% | - | - | - | - | - |
|  | total |  | 5.0\% | 14.5\% | 23.1\% | 1.7\% | 3.3\% | 2.6\% | 4.0\% | 31.4\% |
| Intercept |  | 237.3 | 250.3 | 107.1 | 46.4 | 215.0 | 210.5 | 306.9 | 248.5 | 388.6. |
|  |  | (14.7) | (16.2) | (49.7) | (42.9) | (55.4) | (41.2) | (42.0) | (15.8). | (42.1). |


| Main effects | 0 | 1 | 2a | 2b | 2c | 2d | 2 e | 2 f | 2g |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time of measurement | $\begin{gathered} 33.3^{* * *} \\ (5.0) \end{gathered}$ | $\begin{aligned} & 33.3^{* *} \\ & (5.0) \end{aligned}$ | $\begin{aligned} & 25.9^{* * *} \\ & (5.6) \end{aligned}$ | $\begin{gathered} 26.1^{* * *} \\ (5.1) \end{gathered}$ | $\begin{gathered} 32.4^{* *} \\ (5.2) \end{gathered}$ | $\begin{gathered} 31.7^{* *} \\ (5.3) \end{gathered}$ | $\begin{aligned} & 30.4^{* *} \\ & (5.4) \end{aligned}$ | $\begin{aligned} & 33.2^{* *} \\ & (5.1) \end{aligned}$ | $\begin{gathered} 18.2^{* *} \\ (6.8) \end{gathered}$ |
| Language background |  | $\begin{aligned} & -24.9 \\ & (16.5) \end{aligned}$ | $\begin{gathered} -5.6 \\ (17.0) \end{gathered}$ | $\begin{gathered} -8.2 \\ (16.0) \\ \hline \end{gathered}$ | $\begin{aligned} & -23.8 \\ & (16.6) \\ & \hline \end{aligned}$ | $\begin{aligned} & -22.2 \\ & (16.4) \end{aligned}$ | $\begin{aligned} & -23.8 \\ & (15.9) \end{aligned}$ | $\begin{aligned} & -21.1 \\ & (16.3) \end{aligned}$ | $\begin{gathered} -6.2 \\ (14.5) \end{gathered}$ |
| Receptive vocabulary |  |  | $\begin{gathered} 2.7^{* *} \\ (0.9) \\ \hline \end{gathered}$ |  |  |  |  |  |  |
| Grammatical knowledge |  |  |  | $\begin{aligned} & 5.9^{* * *} \\ & (1.2) \end{aligned}$ |  |  |  |  |  |
| Orthographic knowledge |  |  |  |  | $\begin{gathered} 0.7 \\ (1.1) \end{gathered}$ |  |  |  |  |
| Metacognitive knowledge |  |  |  |  |  | $\begin{gathered} 1.4 \\ (1.3) \end{gathered}$ |  |  |  |
| Word recognition (ms) |  |  |  |  |  |  | $\begin{aligned} & -0.07 \\ & (0.05) \end{aligned}$ |  |  |
| Lexical retrieval (ms) |  |  |  |  |  |  |  | $\begin{aligned} & -0.03 \\ & (0.03) \\ & \hline \end{aligned}$ |  |
| Sentence verification (ms) |  |  |  |  |  |  |  |  | $\begin{aligned} & -0.03^{* * *} \\ & (0.01) \\ & \hline \end{aligned}$ |
| Fit (-2*loglikelihood) | 1714.9 | 1712.8 | 1705.0 | 1693.4 | 1712.3 | 1711.7 | 1710.7 | 1711.8 | 1704.0 |
| difference |  | 2.1 | $7.8 *$ | 19.4*** | 0.5 | 0.9 | 2.1 | 1.0 | $8.8{ }^{* *}$ |
| difference $d f$ |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Notes. Model 0 is Model 1 from Appendix D. Models 2a to 2 g are compared to model 1. $\quad *=p<.05 ; \quad * *=p<.01 ; \quad * * *=p<.001$.

Table 4.2
Multilevel analyses with writing proficiency (repeatedly measured) as dependent variable. Predictors are time of measurement (coded as 0, 1 and 2), language background (coded as 0 and 1), and the interaction variables created by time of measurement and background.

| 51 students, 10 classes | 0 | 1 | 2 |
| :---: | :---: | :---: | :---: |
| Variance | 1036.4 | 987.1 | 987.1 |
|  | (775.8) | (742.9) | (742.9) |
|  | 2013.1 | 2386.6 | 2437.8 |
|  | (727.7) | (723.4) | (722.2) |
|  | 3685.6 | 2539.3 | 2385.7 |
|  | (516.1) | (355.6) | (334.1) |
|  | 6735.2 | 5913.0 | 5810.6 |
| Distribution of variance | 15.4\% | 16.7\% | 17.0\% |
|  | 29.9\% | 40.4\% | 42.0\% |
|  | 54.7\% | 42.9\% | 41.1\% |
| Explained variance |  | 4.8\% |  |
|  |  | - | - |
|  |  | 31.1\% | 6.0\% |
|  |  | 12.2\% | 1.7\% |
| Intercept | 289.3 (12.9) | 246.8 (16.4) | 260.5 (17.3) |
| Main effects | 0 | 1 | 2 |
| Language background | -25.1 (16.5) | -24.9 (16.5) | -51.8* (19.9) |
| Time of measurement (1) |  | $43.8^{* * *}$ (10.0) | 27.5 (13.8) |
| Time of measurement (2) |  | $66.6^{* * *}(10.0)$ | 41.7** (13.8) |
| Time of measurement (1) * background |  |  | 31.8 (19.3) |
| Time of measurement (2) * |  |  | 48.8* (19.3) |
| Fit (-2*loglikelihood) | 1749.3 | 1711.3 | 1704.9 |
| difference |  | 38.0 *** | $6.4 *$ |
| difference $d f$ |  | 2 | 2 |
| compared to model |  | 0 | 1 |

Notes. $\quad *=p<.05 ; \quad{ }^{* *}=p<.01 ; \quad{ }^{* * *}=p<.001$.

In order to answer the second research question, namely whether there is improvement in writing proficiency in low-achieving adolescents, an additional regression analyses was conducted which is presented in Table 4.2.

In Model 0, only background is included. In Model 1, it is shown that inclusion of two grade variables (which indicate whether the second and third measurement differ significantly from the first) make a significant contribution to the model (difference $-2 * \log$ likelihood $=38.0, d f=2, p<.001$ ). Therefore, we can conclude that low-achieving students' writing proficiency improves between Grade 7 and 9 ( $Z=$ $6.66, p<.001) .{ }^{25}$ The growth trajectories for the native-Dutch adolescents and the language-minority students are displayed in Figure 4.1. We further investigated whether the growth trajectories differed between the native-Dutch and the language-minority students. Inclusion of the interaction variables (Table 4.2, Model 2) significantly improves model fit (difference -2 * $\log$ likelihood $=6.4, d f=2, p<.05$ ), which indicates that the developmental patterns differ between both groups. Improvement in writing proficiency is more substantial in the language-minority students (coded as 1 ) than in the native-Dutch students (coded as 0 ).

Of the three variables that have significant explanatory power for writing proficiency (the total of variance on the class, student and occasion level), i.e.,


Figure 4.1. Writing proficiency mean scores for native-Dutch students and students from languageminority backgrounds in Grade 7 to 9.

[^17]receptive vocabulary, grammatical knowledge, and speed of sentence verification, only grammatical knowledge explains writing proficiency development, i.e., variance at the occasion level (research question 3), see Table 4.1, Model 2b. Of the variance in writing proficiency development $4.9 \%$ is explained by including grammatical knowledge in the model. Additional regression analyses on the difference scores (both for grammatical knowledge and for writing proficiency between Grades 7 and 9) indicate that gains in grammatical knowledge are significantly related to gains in writing proficiency.

In the fourth research question we investigated whether there is a difference between native-Dutch students and language-minority students in the predictive power of the components. Interaction effects between background and each of the repeatedly measured components were included (one by one) as predictors in the regression equation. However, these analyses showed no significant interactions, indicating that there were no significant differences between the two groups in our sample with respect to the predictive power of components of writing proficiency.

### 4.4 Discussion

In this study, we aimed to explore to what extent low-achieving adolescents' writing proficiency is determined by linguistic knowledge, metacognitive knowledge and fluency variables. The study adopted a longitudinal design, allowing us to examine both students' level and development of writing proficiency as well as analyze the associations of these variables with the level and development of linguistic knowledge, metacognitive knowledge, and fluency. In addition, we examined differences in developmental patterns and relationships among skills within students from native-Dutch and language-minority backgrounds.

Results showed that vocabulary and grammar knowledge had significant contributions to the explanation of low-achieving adolescents' level of writing proficiency. The roles of vocabulary and grammar knowledge are in line with theoretical accounts of the writing process by, for example, Hayes (1996), attributing a prominent role to linguistic resources: a large vocabulary and a rich repertoire of sentence frames enable writers to retrieve clear representations for the contents of their texts (Beers \& Nagy, 2009; Nagy \& Scott, 2000). This adds to text quality and writing proficiency. The results also corroborate outcomes of previous research by Schoonen et al. (2003) involving a heterogeneous sample of adolescent students, showing that vocabulary and grammar knowledge are important components of their writing proficiency. The results of our current study demonstrate that even within the narrower population of low-achieving adolescents, vocabulary and
grammar knowledge explain individual differences in students' level of writing proficiency.

Additionally, we found a significant relation between the low-achieving adolescents' level of writing proficiency and sentence-verification speed. This finding suggests that for these students fluent comprehension of sentences is an important component of their writing quality. This is consistent with the claim made by Flower and Hayes (1981) in their influential model of the writing process that reading comprehension is an important aspect. Writing involves frequent rereading, both for evaluating text written so far (Flower \& Hayes, 1981) and for reinstating information on the basis of which new text is generated (Torrance \& Galbraith, 2006). Consequently, as the ability to (re)read becomes more fluent, the writing process can be monitored more efficiently. In addition, it is possible that more fluent reading helps students switching more efficiently between the writing prompts and their own writing. It is known from the literature that if information is processed more efficiently, more working memory capacity remains available for storage during these switches (McCutchen, 2000; Torrance \& Galbraith, 2006). Therefore, writers who are more efficient in processing and storage of what has been read, may dedicate more attention to text quality. The association between sentenceverification speed and writing proficiency, found in this study, suggests that, within the group of adolescent low achievers, fluency of reading is an important component of their level of writing proficiency.

Knowledge of orthography is an important aspect of writing (Berninger \& Swanson, 1994; Chenoweth \& Hayes, 2001; McCutchen, 2012). Nevertheless, it was not found to play a significant role in explaining low-achieving adolescents' level of writing. The lack of explanatory power of orthographic knowledge in our study contrasts with the outcomes of Abbott et al. (2010) and Schoonen et al. (2003) who used more heterogeneous samples. Possibly, low-achieving adolescents use a more restricted vocabulary to avoid spelling problems while writing, whereas in more heterogeneous samples the better spellers are also the ones that use a more varied vocabulary, contributing to text quality. If that is the case, the absence of a relation between spelling and level of writing proficiency for low-achieving adolescents can be attributed to the quite low lexical variety that is used by these students.

In contrast with results presented by Schoonen et al. (2003), in our study metacognitive knowledge was not found to be a significant predictor of level of writing proficiency. The lack of significant explanatory power of metacognitive knowledge for our low-achieving adolescents might well be accounted for by their limited metacognitive knowledge in comparison to their academically more advanced peers. This limited knowledge prevents poor writers effectively making use
of text characteristics and writing strategies in their process of text production (Alamargot \& Fayol, 2009; Berninger \& Swanson, 1994).

Our analyses did not show a significant relation between word-recognition speed and writing. Although reading of what has been written is an important aspect in writing, it is not restricted to the reading of isolated words, which is captured in the word-recognition speed task. It may be, though, that the fluent reading of larger units (as exemplified in our sentence-verification speed task) is of more relevance for good writing. In addition, word-recognition speed is shown to be less explanatory for text comprehension with increasing age (Francis, Fletcher, Catts, \& Tomblin, 2005; Perfetti, 1999) and does not correlate (or only weakly) with reading comprehension of lowachieving students in the age range 13-16 (Van Steensel et al., 2014; Chapters 2 and 3). Therefore, it is to be expected that it becomes less explanatory for individual differences between these students' writing quality as well.

We did not find a significant relation between low achievers' lexical retrieval speed and writing proficiency either. From the literature it appears that in general writing quality is related to the use of rich and varied vocabulary (Crossley et al., 2011; Engber, 1995). It is therefore plausible that differences in writing quality of our low-achieving students are also related to differences in lexical richness. This may explain why our measure of lexical retrieval speed consisting solely of easy (highly frequent) words for our students does not capture relevant aspects for explaining differences in their writing quality.

The next issue concerns development in writing proficiency of low-achieving adolescents. Using a repeated-measures multilevel model we established that the low-achieving students significantly improved their writing proficiency between seventh and ninth grade. Growth in writing proficiency in this period is important for meeting academic literacy requirements for this academically vulnerable population. Our finding suggests that in the course of these three grades low-achieving adolescents' writing proficiency benefits from education and/or experience.

Analyses directed at our second research question revealed that performance of both native-Dutch students and language-minority students improved significantly, but that for the latter the increase was significantly larger than for the former. This catching up is consistent with the absence of an overall effect of language background on writing proficiency; only in Grade 7 we found a significant difference between writing proficiency of both subgroups in our sample (see Appendix F). However, the language-minority students had significantly lower knowledge of vocabulary and grammar in all three grades than their native-Dutch peers (see Appendix F). We will return to this issue below.

Our third research question concerned the relative contributions of knowledge and fluency on writing development. In relation to this question, we
found a significant effect of grammar knowledge. In addition to its explanatory power on level of writing proficiency, grammar knowledge significantly contributed to development in writing proficiency, a small effect of $4.9 \%$ explained variance on the occasion level. We performed an additional regression analysis revealing that differences in writing development were positively related to differences in development in grammatical knowledge. The positive effect of growth in grammatical knowledge on development of writing suggests that low-achieving students' growth in grammar knowledge is conditional or causally linked to (a part of) their growth in writing proficiency. The nature of this relationship between grammar and writing development however, is still an open issue. On one hand, increased (morpho-)syntactic knowledge may enable a student to use more varied sentences in writing, resulting in texts that express ideas more clearly or adequately (Beers \& Nagy, 2009; Myhill, 2008; Scott, 2004). Another possibility is that increased grammatical knowledge facilitates students' formulation of sentences in writing, thereby freeing cognitive resources for conceptual processes, such as rhetorical aspects of writing (Deane et al., 2008; McCutchen, 1996; Torrance \& Galbraith, 2006). On the other hand, however, it might well be that development in grammar knowledge is rather a consequence of writing experience. Experience in writing provides students with occasions for reflection on formulation processes and constraints, and might therefore lead to more awareness of grammatical structure. So, although it is not clear whether growth in grammar precedes growth in writing proficiency or the other way around, our result does suggest that for low-achieving students one is (partly) conditional on the other in the time frame in question (between Grades 7-9).

The explanation of development in writing proficiency was quite limited. This might have been due to the relatively low reliability coefficients for writing proficiency in our studies. Therefore, a substantial part of the variance in writing proficiency and writing development that we established was not related to individual differences in writing proficiency. This means that variance in writing development may have been captured in a too limited fashion, to be explained in a reliable manner.

The fourth question that was addressed in this study concerned the comparison of contributions of knowledge and fluency to writing (level and development) between low-achieving students with language-minority backgrounds and their native-Dutch peers. Although significant differences were present between both groups with respect to the levels of grammar knowledge and receptive vocabulary (both of which significantly contributed to students' level of writing proficiency), and with respect to the progress students displayed in writing proficiency, no significant interactions were detected between students' background
and any of the components. This suggests that the components of writing may be of equal importance in writing proficiency and writing development of both subgroups of low-achieving adolescents.

The faster growth in writing we found for the language-minority subgroup would normally be accounted for by the so-called threshold hypothesis in much of the second language literature (for example Alderson, 1984; Bernhardt, 2000; Hulstijn, 2015, Ch. 8). The notion of a threshold implies that a critical amount of L2 knowledge is needed for reading or writing texts in a second language. In our case, low vocabulary and grammar knowledge would have hampered language-minority students' achievements in Grade 7, but passing the threshold would have allowed them to catch up with their native-Dutch peers in Grades 8 and 9. In other words, the languageminority students would have profited more from their expanded linguistic resources than the native-Dutch students. However, our finding that there are no significant interactions of vocabulary and grammar knowledge explaining both groups' different slopes for writing development is inconsistent with this explanation. If a threshold of linguistic knowledge would exist in our case, then significant interactions would have been found. Therefore, other explanations have to be developed for the difference in growth between our language-minority and native subpopulations. Maybe the language-minority students profit more from writing education in these years than their peers, or maybe they have profited from more writing experience out of school.

Suggestions for future research. Knowledge of grammar and vocabulary were found to be associated with low-achieving adolescents' level of writing proficiency. Investigating these students' written texts may shed more light on changes in lexical or morphosyntactic characteristics in their writing. This may lead to a better understanding of the roles that vocabulary and grammar play in low-achieving students' writing proficiency level and development. With respect to orthographic knowledge, it is of interest to investigate whether low-achieving students avoid spelling problems by using restricted vocabulary and grammatical structures. This can be done, for example, by examining differences in word use and spelling between low achievers and more proficient writers of the same age.

In order to unravel the nature of the relationship between low-achieving adolescents' gains in grammar knowledge on one hand and their writing development on the other, we recommend a more detailed investigation of the directionality of the relationship. This can be done, for example, by experimentally manipulating morphosyntactic knowledge or by interventions directed at systematic exercises in sentence building embedded in the teaching of writing. The effects should be compared with effects of writing instruction without a grammatical training component. Insights into the effects of both conditions on students' writing proficiency as well as on students'
grammatical knowledge might provide us with a deeper understanding of the directionality of the relation between growth in grammatical knowledge and writing proficiency. In previous studies among heterogeneous samples, teaching adolescents to construct a complex sentence out of some basic sentences (sentence combining), had positive effects on these students' writing performance (Graham \& Perin, 2007). In addition, Fearn and Farnan (2007), Hoogeveen and Van Gelderen (in press), and Myhill, Jones, Lines, and Watson (2012) found positive effects of functional grammar teaching, i.e., grammar teaching related to semantic functions in specific types of texts (genres). This contextualized teaching of grammar does not focus on formal grammatical rules. Rather, the functioning of word groups or grammatical structures in texts is crucial, and students are guided in using these structures appropriately in their own writings. In the study by Myhill et al. (2012) the benefits of this type of grammar teaching were stronger for the more proficient writers in the sample. Therefore, more research within the population of low-achieving adolescents is needed on the issue of whether these students' writing proficiency is positively affected by sentence combining or functional grammar instruction.

Third, assessing low-achieving adolescents' metacognitive knowledge may have suffered from these students' limited explicit knowledge of strategies for reading and writing. In future research, a test in which metacognitive knowledge is assessed in a more concrete context (e.g., consisting of statements explicitly focusing on concrete tasks, such as 'writing a recipe' or 'writing a letter to a friend'), might be a better way of assessing their knowledge and exploring individual differences.

In this study, we did not find a significant relation between metacognitive knowledge and writing. It is important to keep in mind that metacognitive knowledge is distinct from the metacognitive skills that students use in reading and writing (cf. Veenman, Van Hout-Wolters, \& Afflerbach, 2006). De Milliano, Van Gelderen, \& Sleegers (2012), who conducted a think-aloud study with low-achieving adolescents, showed that students who applied more varied self-regulating strategies in writing, produced texts of higher quality (in that specific task) than their peers who used less varied self-regulatory activities. Thus, differences between low-achieving adolescents' writing quality appear to be related to differences in the application of metacognitive skills in a specific writing task. It would be interesting to investigate how low-achieving students' metacognitive knowledge relates to their metacognitive skills applied in different writing contexts, and analyze both knowledge and skill in relation to students' writing proficiency. For example, associations between students' knowledge of text structures (e.g., knowledge about functions of headings, or the understanding that only one central idea should be put into a paragraph), and their use of text structuring (e.g., use of appropriate paragraphing) in a specific writing task could be investigated. In addition, relations of the assessed metacognitive knowledge and use with global text
quality in the same writing task could be established, as well as relations with global quality of other texts (of the same genre).

Finally, we recommend research into the differential growth patterns in writing proficiency between native-Dutch and language-minority students. We could not explain the differential growth by different roles of vocabulary or grammar knowledge or fluency, neither by differences in metacognitive knowledge. Possibly, there are other differences between both subgroups that could account for the more substantial growth of the language-minority students, for example, differences with respect to their motivation, self-regulation, out-of-school experiences with writing, or the way both groups profit from education.

Implications for education. Although inter-individual differences in level of writing proficiency could be explained by vocabulary knowledge, we did not find effects of vocabulary on students' growth in writing proficiency. It could be that individual gains in vocabulary knowledge do not (yet) predict individual differences in writing development because low-achieving students still lack the abilities to appropriately apply these gains in vocabulary knowledge in the complex process of composing a text (cf. Graham, Harris, \& Mason, 2005). As a consequence, many low-achieving students would potentially benefit from educational attention focusing on the actual use of their (enriched) vocabulary during writing, for example, by raising students' awareness of the importance of rich vocabulary in texts, and encouraging them to make full use of their lexical knowledge in the process of writing.

Apart from knowledge of vocabulary and grammar, sentence-verification speed accounted for a substantial part of level of writing proficiency. Frequent reading helps students to become more fluent readers and, additionally, has a positive effect on their linguistic knowledge (Cunningham \& Stanovich, 1991; Swanborn \& De Glopper, 1999). These are important components in the process of writing, and, as the findings of this study suggests, they also explain differences in the writing proficiency of low-achieving adolescents. In addition, experience with reading might lead these students to more awareness of characteristics of good texts. Therefore, presumably, frequent reading of different genres may be a good way for improving low-achieving students' writing proficiency. Since many low-achieving adolescents do not read frequently (Van Kruistum, 2013), we recommend to motivate them to read more often and provide them with ample opportunities for access to texts concerning topics that are enjoyable or relevant for them.

Although students' writing proficiency presumably would benefit substantially from practice in writing, in general, text writing is not prioritized in Dutch primary education (Dutch Education Inspectorate, 2012; Kuhlemeier, Van Til, Feenstra, \& Hemker, 2013) and apparently many students do not dispose of elaborate experience
in writing texts when they enter Grade 7. Especially for low-achieving students, this limited writing experience might have serious consequences for their writing development during adolescence. Writing practice could raise students' awareness of text types, text writing strategies, text structures, and the appropriate use of linguistic features in texts, which is important in writing. Furthermore, frequent writing might lead to more efficient transcription processes in writing, enabling adolescents to devote more working-memory capacity to rhetorical aspects of their texts. Therefore, we would recommend providing low-achieving adolescents with ample opportunities to write texts, preferably combined with strategic and linguistic support. A teacher could, for example, introduce a writing task by focusing on the role of the reading audience or the function of temporal markers in a text. Students could be provided with (peer) feedback on their first drafts specifically directed to issues that were presented in the introduction of the writing task. Presumably, by practicing writing, in combination with this kind of support, students become more aware of specific characteristics of good texts. In addition, it is likely that they make more use of these characteristics in other texts as well, leading to texts of better quality. Finally, positive experiences with writing texts might provide students with more confidence and motivation, which is of great value in learning to write and in approaching new (writing) tasks.

Limitations. A limitation of the current study concerns the small sample size. The magnitude of our sample $(\mathrm{N}=51)$ was constrained by the need for multiple and quite elaborate data collection procedures in a longitudinal design stretched over three grades of secondary education. What was gained in richness and longevity of our data, was lost in terms of statistical power. Therefore, in order to validate (or expand) our findings, a replication using larger samples of low-achieving adolescents is needed. Nevertheless, the current study has offered some valuable insights into writing proficiency and development of low achievers. First, it has shown that for this group of adolescents improvement in writing proficiency from Grade 7 to 9 is feasible, and, despite their initial falling behind, language-minority students can achieve the same level of writing as their native peers. Second, we have found that vocabulary and grammar knowledge, and speed of sentence verification, play substantial roles in the explanation of level of writing proficiency while the contributions of spelling, metacognitive knowledge and word-level fluency were negligible for this group of adolescents. Finally, regarding development in writing proficiency, grammatical knowledge accounted for a small part of the variation between students. These are important stepping stones in further establishing the types of educational interventions that are beneficial for low-achieving adolescents' development in writing proficiency.

## Chapter 5

## Discussion

### 5.1 Introduction

In this dissertation we examined development of reading comprehension and writing proficiency in a sample of low-achieving adolescents in the Netherlands. Especially for low-achieving adolescents there is much to gain in improving literacy skills, and these students may be in need of educational interventions that are designed to improve their reading and writing. Insights in low-achieving students' literacy development and the relative importance of related variables might help teachers and policy makers incorporating essential elements in their educational practices in order to enhance students' reading and writing skills and, indirectly, their societal perspectives as well. Although research focusing on low-achieving adolescents could yield outcomes relevant for these purposes, the focus on lowachieving students is rather scarce in scientific literature on reading and writing (Braze, Tabor, Shankweiler, \& Mencl, 2007; Juzwik et al., 2006; Klassen, 2002). While other studies did indeed compare high- and low-achieving students, the current study set out to investigate differences existing within the group of low achievers. We were particularly interested in associations between reading comprehension and writing proficiency on one hand, and students' linguistic and metacognitive knowledge, and fluency on the other. One of the unique features of this study was that it had a longitudinal design. This enabled us to shed light on several developmental issues concerning reading and writing, and their constituting components.

In this final chapter, the three studies that were presented in the previous chapters will be discussed and related to each other and to other relevant literature. On one hand, we investigated relative contributions of knowledge and fluency on the prediction of low-achieving students' level of reading comprehension and writing proficiency. On the other hand, we investigated these students' development in reading and writing between Grade 7 and 9, and investigated to what extent individual differences in developmental patterns were associated with differences in students' (development in) linguistic knowledge, fluency, and metacognitive knowledge. Paragraph 5.2 deals with level of reading comprehension and writing proficiency in relation to linguistic knowledge, fluency, and metacognitive knowledge. Particularly, contrasts and similarities between Chapter 2 (predicting reading comprehension in Grade 7) and Chapter 3 (predicting level of reading comprehension covering the period between Grades 7 and 9) will be discussed.

Paragraph 5.3 is concerned with development in low-achieving adolescents' reading comprehension and writing proficiency, and with components significantly contributing to this development. Subsequently, some differential findings between native-Dutch and language-minority students will be further discussed in paragraph 5.4. Finally, we will go deeper into strengths and limitations of this study, and consider suggestions for future research and educational implications.

### 5.2 Level of reading comprehension and writing proficiency: Roles of linguistic knowledge, fluency, and metacognitive knowledge

Linguistic knowledge. Both reading comprehension and writing proficiency are complex processes that draw on several linguistic resources stored in long-term memory. A skilled reader applies knowledge of linguistic forms to build an appropriate mental representation of a text (Anderson \& Freebody, 1979; Gough \& Tunmer, 1986; Kintsch, 1998; Perfetti, Landi, \& Oakhill, 2005), whereas a skilled writer uses linguistic knowledge to formulate adequately, that is, to convey information or ideas precisely and concisely (Beers \& Nagy, 2009; Chenoweth \& Hayes, 2001; Crossley, Weston, McLain, Sullivan, \& McNamara, 2011; Hayes, 1996; Nagy \& Scott, 2000; Torrance \& Galbraith, 2006). Individual differences in reading comprehension and in writing proficiency in heterogeneous samples of adolescents are found to be associated with differences in knowledge of vocabulary and grammar (e.g., Schoonen et al., 2003; Van Gelderen et al., 2004), that is, in general, those adolescents who are better readers and writers possess more vocabulary and grammar knowledge than their peers who are relatively poor in reading and writing. The studies presented in the preceding chapters established that this association also holds within the narrower population of low-achieving adolescents in Grade 7 to 9 . Knowledge of vocabulary and grammar is substantially related to low-achieving students' levels of reading comprehension (Chapter 3; amounts of explained variance between students: $39.6 \%$ and $31.5 \%$ by vocabulary and grammar knowledge respectively) and writing proficiency (Chapter 4; amounts of explained variance between students: $26.9 \%$ and $37.1 \%^{26}$ by vocabulary and grammar knowledge respectively). These findings indicate that also for low-achieving adolescents knowledge of vocabulary and grammar plays an important part in reading comprehension and writing proficiency.

[^18]Orthographic knowledge might help readers to quickly and accurately identify whole words (Adams, 1990; Ehri, 2005; Moats, 2005/2006; Treiman, 1993), which facilitates reading comprehension. Nevertheless, orthographic knowledge is more directly of interest in writing, rather than in reading. We did not include orthographic knowledge in the analyses of the contributions of several components to reading comprehension. ${ }^{27}$ We did include it however in the analyses for writing. Orthographic knowledge plays a role in writing qualitatively good texts in several ways. First, words that are misspelled can make texts less easy to read, and, as a consequence, readers might devalue the quality of the ideas that are expressed in the text (Graham, Harris, \& Hebert, 2011; Marshall \& Powers, 1969). Second, difficulty in spelling words can interfere with other processes during writing. For example, consciously thinking about the spelling of a word takes time and burdens writers' cognitive processing load. Because of this heavier processing load, ideas that have not been written down yet might decay or even be forgotten by the writer during the writing process (Berninger, 1999; Graham, Harris, \& Fink-Chorzempa, 2002). In heterogeneous samples of adolescents, knowledge of orthography has been found to contribute to students' writing proficiency (Abbott, Berninger, \& Fayol, 2010; Limpo \& Alves, 2013; Schoonen et al., 2003). Nevertheless, no significant associations between orthographic knowledge and writing proficiency were found in our sample of low-achieving adolescents. Berman, Nayditz, and Ravid (2011) showed that adolescents (13-14 years-olds) from high-SES backgrounds produced more diverse lexicon and syntax in their writing than their low-SES peers. The contrast between SES-groups might also indicate a contrast between high- and low-achieving adolescents. Therefore, it is plausible that low achievers make use of a more restricted lexicon and syntax than high-achieving students. If that is the case, the fact that we found no relation between orthographic knowledge and level of writing proficiency, might be attributed to a relatively low lexical and syntactic variety used by low-achieving students: Writing with restricted vocabulary and syntax presumably poses fewer demands on orthographic knowledge.

Fluency. In addition to linguistic knowledge, aspects of fluency, such as speed of word decoding, sentence verification, or lexical retrieval, play an important part in the reading and writing process. For example, if decoding is too slow, key information that has been read might have decayed by the time subsequent information is decoded by the reader (Kirby \& Savage, 2008). Therefore, it has been

[^19]suggested that decoding needs to be automated before a reader can fully pay attention to text-level characteristics (LaBerge \& Samuels, 1974; Perfetti, 1999) and devote enough working memory resources to building a mental representation of a text (Kintsch 1988, 1998). With respect to writing a text, fluent reading enables a writer to more easily reread (and evaluate) what has been written so far, and to move back and forth between the written text and a writing prompt (Flower \& Hayes, 1981). In addition, fluent access to linguistic resources lowers the cognitive processing load during writing, thereby facilitating access to knowledge that can be applied to coordinate the writing process, for example, by reviewing the text (Deane et al., 2008; McCutchen, 1996; Torrance \& Galbraith, 2006).

As students gain experience in reading and writing, and decoding and encoding processes run more smoothly, the contribution of word-level fluency in reading comprehension and writing proficiency diminishes, while the predictive power of processes directed at the text level increases (Berninger, 1999; Limpo \& Alves, 2013; Perfetti et al., 2005, Scardamalia \& Bereiter, 1986). With respect to reading comprehension, empirical studies suggest that by the end of primary school the role of word decoding speed is small (Ouellette \& Beers, 2010; Tilstra, McMaster, Van den Broek, Kendeou, \& Rapp, 2009; Verhoeven \& Van Leeuwe, 2008) and that in secondary grades word decoding speed does no longer explain individual differences in reading comprehension in heterogeneous samples of adolescents (Van Gelderen et al., 2004). Apparently, by then, students have automatized their word decoding speed to such an extent that it no longer constrains comprehension. In contrast with what is found in heterogeneous samples of adolescents, in the population of low-achieving adolescents, significant relationships between wordlevel fluency and reading comprehension or writing proficiency might still be present because word-level fluency may not be fully automatized yet and therefore still pose demands on students' cognitive processing loads.

With respect to low-achieving adolescents' reading comprehension we found that fluency (i.e., word-recognition speed and efficiency, and sentence-verification speed) was associated with seventh grade reading comprehension in a subsample of the low-achieving adolescents, namely the native-Dutch students (Chapter 2). This finding seems to suggest that for low-achieving native-Dutch students fluency is not automatized yet in Grade 7 and still poses real challenges to their reading comprehension. Although levels of fluency in the language-minority students did not significantly differ from those of the native-Dutch students, we did not find a significant association between language-minority students' fluency and reading comprehension. An explanation might be that for these students fluency did not play a part in explaining individual differences in reading comprehension because limited linguistic knowledge formed a bigger obstacle. For these language-minority
students, contributions of linguistic knowledge to reading comprehension were significantly larger than for the native-Dutch students. Furthermore, levels of knowledge and vocabulary were significantly lower. It may be assumed that wordlevel fluency does not help in comprehension if access to meaning is seriously hampered by limited knowledge of vocabulary and grammar (cf. Buly \& Valencia, 2002; Crosson \& Lesaux, 2010; Geva \& Farnia, 2012).

In the period covering the investigation, Grade 7 to 9 , we found a small, though not uniquely contributing, significant effect of word-recognition speed on reading comprehension level. However, we did not find any effect of other fluency variables on reading comprehension in low-achieving adolescents, neither did we establish that word-recognition speed particularly predicted reading comprehension in the native-Dutch subgroup. ${ }^{28}$ The explanation for this discrepancy in predictive power of fluency between Grade 7 (Chapter 2) and the period covering Grade 7 to 9 (Chapter 3) in native-Dutch students' reading comprehension might be that because of increased automatization of single word-recognition and sentence-verification speed between Grade 7 and Grade 9 (see Appendix G), students were not hindered in their reading comprehension anymore by slow decoding. These findings corroborate the findings from Van Steensel, Oostdam, Van Gelderen, \& Van Schooten (2014), who cross-sectionally investigated the relative contribution of word-level fluency on adolescents' reading comprehension in a sample of (predominantly native-Dutch) low-achieving students. They found that in Grade 7 students' reading comprehension was significantly related to word decoding, whereas in Grade 9 it was not. Although a cross-sectional design does not capture longitudinal relationships, these findings seem to indicate that low-achieving students' word-level fluency ceases to constrain their reading comprehension in the course of grades 7 to 9.

Regarding writing proficiency, the word-level fluency components (wordrecognition speed and lexical retrieval speed) were not found to be predictive for individual differences between low-achieving adolescents' writing proficiency level, in the period covering grades 7 to 9 . Speed of sentence verification however, was found to be a significant contributor (Chapter 4; explaining $46.1 \%$ of the studentlevel variance in writing). This outcome can be interpreted in terms of students' processing load that might be lowered by fluent sentence reading. According to models of the writing process, reading facilitates the monitoring process in writing

[^20](Flower \& Hayes, 1981, Torrance \& Galbraith, 2006) and writers who are more efficient readers might therefore devote more attention to rhetorical aspects of texts because of the lower cognitive processing load reading poses for them (McCutchen, 2000; Torrance \& Galbraith, 2006).

Metacognitive knowledge. Metacognitive knowledge, that is, knowledge of text characteristics and effective reading and writing strategies, is another important component in theories on reading and writing (Berninger \& Swanson, 1994; Perfetti, et al., 2005). It is assumed that, although students' metacognitive knowledge is not the same as their application of this knowledge in the reading and writing process (cf. Veenman, Van Hout-Wolters, \& Afflerbach, 2006), readers and writers apply their knowledge of text characteristics and strategies to some extent in dealing with a text. Several studies in heterogeneous samples of adolescents showed an association between students' metacognitive knowledge and their levels of reading comprehension (Baker \& Brown, 1984; Biancarosa \& Snow, 2006; Van Gelderen et al., 2003; Welie, Schoonen, \& Kuiken, submitted) and writing proficiency (Berninger \& Swanson, 1994; Schoonen et al., 2003). In the current sample of low-achieving students, students appeared to have quite limited metacognitive knowledge about reading and writing (Chapters 2-4). In addition, in the same sample of students, repertoires of self-regulatory activities during reading and writing, appeared to be quite limited (De Milliano et al., 2012, 2014). Nevertheless, metacognitive knowledge was found to be related to low-achieving students' reading comprehension (Chapter 3; amounts of explained variance between students: $15.2 \%)$, suggesting that within the relatively narrow population of low-achieving adolescents metacognitive knowledge has a role in explaining individual differences in reading comprehension. This finding is in line with outcomes of Van Steensel et al. (2014), who also found a substantial relationship between metacognitive knowledge and level of reading comprehension in a larger sample of low-achieving adolescents ( $\mathrm{N}=328$ ). For students' writing proficiency, however, we did not find a significant contribution of metacognitive knowledge. This might be due to the relatively low reliabilities of both the metacognitive knowledge test (ranging from . 50 to .60 ), and writing proficiency (ranging from .51 to .67 ). Another explanation is that students' limited metacognitive knowledge prevented them making use of text characteristics and writing strategies in the process of text production (Alamargot \& Fayol, 2009; Berninger \& Swanson, 1994). It might be that the discrepancy between knowledge, as assessed in the metacognitive knowledge test, and the actual application of this knowledge, is larger in writing proficiency than in reading comprehension, for example, because of the greater demand writing poses on a student's cognitive processing load. However, this needs to be investigated more thoroughly.

Several studies showed that whereas the contribution of word-level fluency diminishes over the years (e.g., Adams, 1990, Hoover \& Gough, 1990; Perfetti et al., 2005), metacognitive knowledge and skills become more predictive of reading comprehension as students get older (Kolić-Vehovec, Bajšanski, \& Rončević Zubković, 2010; Paris \& Jacobs, 1984; Schoonen, Hulstijn, \& Bossers, 1998). According to Pintrich and Zusho (2002), acquiring metacognitive knowledge is only a first step in acquiring successful use of strategies in the reading process. It needs considerable amount of practice and experience before such knowledge is implemented. A stronger relation between metacognitive knowledge and reading in older students might indicate that older students become more capable of using strategies they know, possibly because they are better able to evaluate their performance (Baker, 2005). In our study, we investigated whether an increase in the contribution of metacognitive knowledge to low-achieving adolescents' reading comprehension was present between Grade 7 and 9 . However, such increase was not found. Furthermore, Van Steensel et al. (2014) found no significant interactions between grade and metacognitive knowledge, indicating that the relative contribution of metacognitive knowledge on reading comprehension is not significantly different between Grade 7 and 9 in low-achieving adolescents. Possibly, we could not establish larger explanatory power of metacognitive knowledge in Grade 9 than in Grade 7, because students' metacognitive knowledge was still relatively limited, and the individual differences in the narrow population of lowachieving adolescents are small. Alternatively, although closer investigation of agerelated associations between metacognition and reading comprehension in lowachieving adolescents is needed, it can be speculated that low-achieving adolescents do not optimally benefit from their increased metacognitive knowledge between Grade 7 and 9 (see Appendix G). Possibly, they do not sufficiently realize that the strategies they know are beneficial in comprehending the text they are faced with, or they lack the cognitive resources or motivation to exert the effort required by successful strategy use (Baker, 2005).

Sentence span and nonverbal cognitive ability. As pointed out in Chapter 2, reading comprehension draws also on more general skills, such as working memory capacity (Baddeley, 2003; Daneman \& Carpenter, 1980; Siegel \& Ryan, 1988) and nonverbal cognitive ability (McGrew, 1993). Therefore, we took into account possible contributions of working memory (as assessed by a sentence span task in Grade 7) and nonverbal cognitive ability (as assessed by Raven's Standard Progressive Matrices at the beginning of Grade 8) in the analysis in Chapter 2. Although there were significant correlations between sentence span and nonverbal cognitive ability on one hand, and reading comprehension on the other, these variables did not
contribute to the prediction of students' reading comprehension in Grade 7 beyond the contributions of knowledge and fluency. We performed additional analyses in order to establish whether sentence span and nonverbal cognitive ability significantly contributed to reading comprehension beyond the significantly contributing variables in the period covering Grade 7 to 9 . Sentence span did not significantly contribute to reading comprehension, as was the case in Grade 7 only. However, nonverbal cognitive ability did contribute significantly to the prediction of reading comprehension beyond the other predictors. This finding indicates that differences in nonverbal cognitive ability explain differences in low-achieving students' reading comprehension. According to McGrew (1993) it is possible that students who have relatively advanced nonverbal cognitive abilities are better at constructing a coherent model of a text, and relating new information to existing knowledge.

### 5.3 Reading and writing development from Grade 7 to 9

In previous research, reading comprehension and writing proficiency as well as their constituting components were found to develop among heterogeneous samples of adolescents, as was to be expected in the context of school education (e.g., Beitchman et al., 2008; Catts, Bridges, Little, \& Tomblin., 2008; Farnia \& Geva, 2011; Farr, Hughes, Robbins, \& Greene, 1990; Gentry, 1982; Smith, 2011). We did not have clear expectations concerning the existence of substantial growth rates in reading comprehension, writing proficiency, and their components in a low-achieving population. On one hand, low-achieving seventh-grade adolescents have developed poor literacy habits, because of a prolonged period of failure in their educational history (e.g., Juel, 1988; Stanovich, 1986). This could lead to limited development or even stagnation. On the other hand, substantial progress could be expected because the low achievers start at a low level and there is simply much to gain in their literacy achievement.

Studies investigating students' reading growth patterns show mixed results on the issue of whether low achievers differ in their growth patterns from their highachieving peers. Some studies seem to confirm a so-called Matthew effect, that is, a pattern of the poor getting poorer and the rich getting richer, in reading (Bast \& Reitsma, 1998; McNamara, Scissons, \& Gutknecht, 2011; Morgan et al., 2008; Niemi et al., 2011). Outcomes of other studies seemed to be more in line with a compensatory growth trajectory (as suggested by Leppänen, Niemi, Aunola, \& Nurmi, 2004), indicating that the gap between high- and low-achieving students narrows over time (Aarnoutse \& Van Leeuwe, 2000; Huang, Moon, \& Boren, 2014; Leppänen et al., 2004; Shaywitz, et al., 1995). This increased growth rate of low
achievers could be a consequence of schools' focus on low-achieving students in order to raise the achievements of the lowest achieving students, and, as a consequence, the overall performance of a school's students (Farkas \& Duffett, 2008).

In the current study, it was observed that students' reading comprehension and writing proficiency developed considerably in the course of three years of prevocational education (Chapters 3 and 4). Both effect sizes, $\eta^{2}{ }_{p}=.44$ and $\eta^{2}{ }_{p}=.32$ respectively, are considered as large (Cohen, 1988). Students also displayed gains in linguistic knowledge, metacognitive knowledge, and fluency (see Appendix G); the effect sizes ranged from middle-large (grammatical knowledge, orthographic knowledge, and metacognitive knowledge) to large (receptive vocabulary and each of the fluency variables). These results clearly show that gains in reading comprehension, writing proficiency, and their constituting components are feasible, also in low-achieving adolescents. These gains suggest that the low-achieving adolescents benefited from literacy experience and/or schooling between Grade 7 and Grade 9.

Analyses showed that individual differences in low-achieving students' reading and writing development could be explained to some extent by development in linguistic knowledge. First, gains in reading comprehension were found to be associated with gains in vocabulary knowledge in a subsample of the low-achieving adolescents, namely the language-minority students. For the nativeDutch students however, individual differences in development in reading comprehension could not be accounted for by any of the components. Second, gains in writing proficiency were, to a small extent, associated with gains in grammatical knowledge. Associations between levels of linguistic knowledge and reading and writing are in line with theoretical accounts (such as Chenoweth \& Hayes, 2001; Hayes, 1996; Kintsch, 1998; Gough \& Tunmer, 1986; Perfetti et al., 2005; Torrance \& Galbraith, 2006), and are well established in the reading and writing literature. The results of the current study established that in addition to the association between levels of linguistic knowledge and level of reading comprehension and writing proficiency, there are associations between development in vocabulary and grammar knowledge and development in respectively reading and writing in lowachieving adolescents. These are relevant findings for education, because they indicate that improvement in reading comprehension and writing proficiency of lowachieving adolescents could possibly be supported by interventions involving improvement of knowledge of vocabulary and grammar (see Section 5.6).

The established associations, that is, the association between gains in vocabulary knowledge and gains in reading comprehension in the language-minority students, and the association between gains in grammatical knowledge and gains in
writing proficiency in the whole sample, are presumably bidirectional. On one hand, gains in vocabulary and grammar knowledge might affect gains in reading comprehension and writing proficiency. In an intervention study, gains in knowledge of vocabulary were found to positively affect reading comprehension (e.g., Edmonds, et al., 2009), suggesting a causal effect of gains in vocabulary on gains in reading comprehension. This could easily be interpreted in the light of the role that vocabulary knowledge plays in the comprehension process in constructing mental representations of texts (Anderson \& Freebody, 1979; Kintsch, 1998). Likewise, knowledge of grammar is an important aspect in formulating during the writing process. Increased grammatical knowledge (not to be confused with traditional grammar directed at labeling words or parts of speech) may enable students to express their ideas more clearly or adequately (Beers \& Nagy, 2009; Myhill, 2008; Scott, 2004). Furthermore, lexical and grammatical knowledge facilitates students' understanding and formulation processes and results in more attentional resources being available for conceptual processes in reading and writing (Deane et al., 2008; McCutchen, 1996; Mezynski, 1983; Torrance \& Galbraith, 2006). On the other hand, gains in linguistic knowledge might be influenced by reading and writing experience. Gains in vocabulary knowledge, for example, are found to be a result of frequent reading (Nagy, Herman, \& Anderson, 1985; Nagy, Anderson, \& Herman, 1987; Swanborn \& De Glopper, 1999) and, in the same line of reasoning, it might well be that development in grammar knowledge is a consequence of frequent writing, possibly because experience in writing might lead to more awareness of grammatical structures. In addition to these bidirectional associations between linguistic knowledge and reading and writing, it might be that there is one underlying variable (verbal aptitude), underlying and affecting both (Anderson \& Freebody, 1979). However, although the exact nature of causal relationships between linguistic knowledge and reading and writing could not be established in our analyses, findings seem to indicate that in the reading and writing development of low-achieving adolescents, growth in vocabulary and grammar knowledge plays a small but significant role in Grade 7 to 9 , more specifically, vocabulary knowledge for the language-minority students' reading development and grammatical knowledge for writing development of the whole group.

### 5.4 Differential findings between native-Dutch and language-minority students

A number of differences between low-achieving native-Dutch students and students from language-minority backgrounds were found in the current study (Chapters 24). In this section, we will discuss these findings. First, there were differences in
performance levels of reading, writing, and (linguistic) knowledge and fluency between both subgroups. Second, we found differential effects of levels of knowledge and fluency on levels of reading and writing between the two groups. The third discrepancy concerns the development in reading comprehension and writing proficiency: Language-minority students displayed more growth in both reading and writing than the native-Dutch students. Finally, we will go deeper in the established association between gains in vocabulary and gains in reading comprehension, which was present in the language-minority students, but not in the native-Dutch subgroup.

Differences in levels of reading, writing, and their components. In other studies, language-minority students have been found to perform on average below their native peers in several language domains. They had lower average levels of reading comprehension (Kieffer, 2008; National Center for Education Statistics, 2009) and writing proficiency (Geva \& Genesee, 2006) than their native peers. In addition, they had on average less knowledge of vocabulary and grammar (Aarts \& Verhoeven, 1999; Biemiller, 1999; Farnia \& Geva, 2011; Garcia, 1991; Jean \& Geva, 2009; Lesaux \& Kieffer, 2010; Lesaux, Lipka, \& Siegel, 2006; Verhoeven, 1990). However, on other measures, such as word- and text-level fluency, they were not found to perform below their native peers (Crosson \& Lesaux, 2010; Geva \& Farnia, 2012). In the studies presented in this dissertation, we established that within the sample of lowachieving adolescents, the native-Dutch students outperformed the languageminority students with respect to reading comprehension and writing proficiency in seventh grade. In eight and ninth grade the two groups performed at equal levels. On receptive vocabulary, grammatical knowledge, lexical retrieval speed and sentence-verification speed, the native-Dutch students on average outperformed the language-minority students in each of the three consecutive years. Both subgroups performed at an equal level on word-recognition speed and efficiency. These findings show that the difference in linguistic knowledge between languageminority students and native students, as found in other studies, is also reflected within our sample of low-achieving adolescents. Regarding fluency, the pattern is somewhat different. Similar to what has been found in more heterogeneous samples with respect to word-reading fluency (speed and efficiency of word recognition), both subgroups were found to perform at equal levels. However, on other fluency measures, that is, lexical retrieval speed and sentence-verification speed, the native students on average outperformed the language-minority students.

Differential roles of knowledge and fluency between native-Dutch and languageminority students' reading comprehension and writing proficiency. On the basis of findings that language-minority students lag behind their native peers on reading
comprehension and linguistic knowledge, but not on (word-level) fluency, it has been suggested in literature that reading comprehension difficulties of students from language-minority backgrounds are caused by disadvantages in linguistic knowledge. In several studies, the association between linguistic knowledge and reading comprehension is found to be stronger for language-minority students than for their native peers (Babayigit, 2014; Droop \& Verhoeven, 2003; Geva \& Farnia, 2012; Gottardo \& Muller, 2009). However, studies among low-achieving students show mixed results. As part of the SALSA-project (see Chapter 1), Van Steensel et al. (2014) found a stronger association between vocabulary knowledge and reading comprehension for low-achieving adolescents (Grade 7-9) from language-minority backgrounds ( $n=91$ ) than for their native peers ( $n=237$ ). On the other hand, in a study conducted in Germany, Marx et al. (2015) did not find significant differences between native and language-minority students in the relationship between reading comprehension and linguistic knowledge in a sample of low-achieving adolescents ( $\mathrm{N}=479$; Grade 9 ), when controlling for students' socio-economic backgrounds.

In the study presented in Chapter 2, the subgroups of low-achieving adolescents differed with respect to the strength of associations found between reading comprehension on one hand and composite variables of knowledge and fluency on the other. With respect to the role of the composite variable for fluency in reading comprehension we found a positive effect in Grade 7 for the native-Dutch students, suggesting that for some of these students fluency was not sufficient (see Section 5.2). This effect was not present in the language-minority students. In contrast, the language-minority students' reading comprehension was strongly predicted by the knowledge composite variable in Grade 7, whereas it was not for the native-Dutch students' reading comprehension. In our subsequent analysis, covering the grades 7-9 (Chapter 3), we did not use composite variables, but more specific indicators of linguistic and metacognitive knowledge and fluency, such as grammar, vocabulary, word-recognition efficiency and speed, and sentenceverification speed. In this analysis, the differences in predictive power between native and language-minority students were not found. In contrast, it seemed that for both groups the contribution of grammar, vocabulary and metacognitive knowledge was quite strong, while the contributions of word level fluency and sentence-verification speed was very small to non-significant. The difference between the results in Grade 7 versus the longitudinal results can be explained by the fact that there were several methodological contrasts between the two analyses. First, we used composite variables for knowledge and fluency in Grade 7, while we used more specific variables in the longitudinal analysis, adding more detail. Second, the longitudinal analysis makes use of repeated measures for each grade, while the analysis in Grade 7 is only directed at one moment in time. Thus, even while there
may exist a difference between predictive power for both groups in Grade 7, this difference may disappear in the longitudinal analysis. Third, the analysis in Grade 7 was not based on exactly the same sample as the longitudinal analysis, due to attrition (10 of the 60 students dropped out after Grade 7).

We also investigated differential associations between writing proficiency and its components between both subgroups, but no significant interaction effects were found. In both groups, knowledge of vocabulary, grammar, and speed of sentence verification appeared to contribute to writing proficiency. Possibly, the components are equally contributing to writing proficiency in language-minority and native-Dutch low-achieving adolescents. Another possibility is that we could not detect small differences because of the limited power of our analysis.

Catching up in reading comprehension and writing proficiency. Mixed findings have been reported with respect to the growth patterns of reading comprehension in native students and language-minority students. Francis, Shaywitz, Stuebing, Shaywitz, \& Fletcher (1996), for example, reported that the growth pattern of language-minority students' reading comprehension (from Grade 1 to 9) was rather similar to the natives' reading-comprehension pattern. However, Kieffer (2008) found that growth rate in language-minority students (from kindergarten to Grade 5) slowed down more than that of their native peers, suggesting that the gap between these populations increases. Whether differences in growth between the two subgroups of our population of low-achieving adolescents, that is, native-Dutch and language-minority students, would be present, is a question that was addressed in our study. We found that the language-minority students displayed larger growth between Grade 7 and 9 than the native-Dutch students, both in reading comprehension and writing proficiency, such that the initial gaps in reading comprehension and writing proficiency between language-minority students and native-Dutch students disappeared (see Figures 5.1 and 5.2).


Figure 5.1. Reading comprehension mean scores for native-Dutch and language-minority background students from Grade 7 to 9 (Max. $=65$ ).


Figure 5.2. Writing proficiency mean scores for nativeDutch and language-minority background students from Grade 7 to 9 (Highest obtained score was 423.5).

The difference in growth between both groups might have been related to lower linguistic knowledge of the language-minority students, posing a kind of a threshold for them (cf. Alderson, 1984; Bernhardt, 2000; Hulstijn, 2015, chapter 8) in Grade 7. The notion of a threshold implies that a critical amount of L2 knowledge is needed for reading or writing in a second language. In our case, low vocabulary and grammar knowledge could have hampered language-minority students' achievements in Grade 7, but passing the threshold would have allowed them to
catch up with their native-Dutch peers in Grades 8 and 9. A larger contribution of vocabulary to reading comprehension (development) that was found in languageminority students in comparison with their native-Dutch peers (Chapter 2; Chapter 3, Van Steensel et al., 2014) is in line with such an explanation. However, with respect to low-achieving students' writing proficiency, our analyses seemed not to confirm a threshold effect, since we did not find a larger contribution of vocabulary or grammar to writing proficiency for language-minority students than for native-Dutch students. Therefore, it is likely that other factors played a role in the languageminority students' larger growth in reading and writing, for example, students' (culturally influenced) attitudes towards school success, motivational factors with respect to reading or writing texts, or the way students profit from education and experience.

The role of vocabulary in language-minority students' gains in reading comprehension. The growth that language-minority students displayed in reading comprehension between Grade 7 and 9 was found to be associated with their gains in vocabulary knowledge (Chapter 3). We did not find such an effect in the nativeDutch low-achieving adolescents. Although we did not establish the causality of the association between gains in vocabulary and gains in reading comprehension, the relationship is presumably a reciprocal one, as has been argued in Section 5.3. Gains in vocabulary probably affect gains in reading comprehension, and gains in reading comprehension might affect gains in vocabulary in the low-achieving adolescents from language-minority backgrounds. The contrast between the language-minority students and the native-Dutch students may indicate that language-minority students profit more from gains in vocabulary in their reading comprehension than the native students. They might make better strategic use of their increased vocabulary for text comprehension, for example because they are more metalinguistically aware of the value of words because of their experience in learning more than one language (see e.g. Bruno, 2001; Corder, 1979; Thomas, 1988).

### 5.5 Suggestions for future research

Replication. A limitation of the current study, concerns the small sample size. However, our study used a precisely defined and focused sample, in which we controlled for quite a lot of variables. For that reason we selected a small group of students from within classrooms, instead of selecting all students in those classrooms. This procedure has the advantage that the characteristics of students in our sample (for example the languages spoken at home) are much more sharply defined than usual in larger samples. Furthermore, testing of all predictors occurred
in individual or small group sessions throughout the whole study securing that students understood their tasks well and carried them out according to the instructions. In addition, the use of repeated measures analyses (Chapters 3 and 4) provided us much more statistical power using 150 instead of 50 data points for each variable. Therefore, although in order to validate our findings, a replication using larger samples of low-achieving adolescents is needed, we believe the current study has offered some valuable insights into reading and writing of low-achieving adolescents.

Word-level, sentence-level and text-level fluency in reading comprehension. In the explanation of individual differences in reading comprehension within the group of adolescent low achievers (Chapters 2 and 3) we took into account the relative contributions of word-level and sentence-level fluency on reading comprehension. It appeared that for the native-Dutch students the relative contribution of fluency diminished between Grade 7 and Grade 9, presumably because word-level fluency had become sufficiently automated (see Section 5.2). In this study we did not include a measure of fluency above the sentence level, such as text-level fluency (i.e., a measure of accuracy and speed of reading a (short) text), although it would have been a valuable addition in reading comprehension research among adolescents. The recognition of words or sentences that are part of larger text units involves the use of other words in context (Stanovich, 1980), which is a closer approximation of what happens in the process of text comprehension. In fact, text reading fluency has been reported as an important predictor for students' reading comprehension in higher elementary grades (Geva \& Farnia, 2012; Marx et al., 2015; Wiley \& Deno, 2005), in contrast with word-reading fluency (Jenkins, Fuchs, Van den Broek, Espin, \& Deno, 2003; Share, 2008). Moreover, results of an intervention study by Wagner \& Espin (2015) showed that improvement in word-level fluency in fifth- and sixthgrade struggling readers was not associated with gains in students' reading comprehension, whereas improvement in text-level fluency was found to have a positive effect on reading comprehension. It might well be that when contributions of word-level fluency on reading comprehension diminish, contributions of text-level fluency, which is not much automated yet, remain stable, or even increase, at the same time. Therefore, further longitudinal research into seventh- to ninth-grade low-achieving adolescents' reading comprehension is recommended in which textlevel fluency is also taken into account. It would be interesting to investigate associations between reading comprehension and fluency at text-, sentence-, and word-level longitudinally, in order to further unravel the contributions of several levels of fluency to the explanation of individual differences in both native and
language-minority adolescent low achievers' reading comprehension at different points in time.

Metacognitive knowledge. We did not find a significant relation between metacognitive knowledge and students' writing proficiency. De Milliano et al. (2012, 2013) showed that, among the same students as the ones examined in the current study, students who applied more varied self-regulating strategies in reading and writing, attained better reading comprehension and produced texts of higher quality (in that specific task) than their peers who used less varied self-regulatory activities. Thus, in contrast with metacognitive knowledge, use of self-regulatory strategies was found to contribute to low-achieving adolescents' writing proficiency. It would be interesting to investigate how metacognitive knowledge relates to students' selfregulatory skills applied in different writing contexts, and analyze both knowledge and skill in relation to students' writing proficiency. For example, associations between students' knowledge of text structures (e.g., knowledge about functions of (sub)titles, or the understanding that only one central idea should be put into a paragraph), and their use of text structuring (e.g., use of appropriate paragraphing) in a specific writing task could be investigated. Furthermore, relations of the assessed metacognitive knowledge and use with global text quality could be established.

In our study, we assessed students' metacognitive knowledge using a test that was based on the instrument by Schoonen et al. (2003), Schoonen, Van Gelderen, Stoel, Hulstijn and De Glopper (2011), Van Gelderen et al. (2004), and Van Gelderen, Schoonen, Stoel, De Glopper and Hulstijn (2007). The students in our sample performed rather poorly on this test, suggesting that their knowledge about text structures and reading and writing strategies was quite limited. However, other factors could have played a role in their poor performance on the metacognitive knowledge test as well. We tested students' metacognitive knowledge in a rather general sense, that is, the students were orally instructed that they had to keep in mind that the statements were about reading and writing texts from newspapers or schoolbooks, which might have been not specific enough. A test in which more concrete reading or writing events would have been presented in the statements, could be more suitable for low-achieving adolescents. For example, statements explicitly focusing on concrete tasks, such as 'reading a recipe' or 'writing a letter to a friend'.

Interconnections between reading and writing. Reading and writing are interconnected skills. Both depend on common cognitive abilities, for example, conceptual, visual or phonological abilities (Berninger \& Swanson, 1994; Just \& Daneman, 1992; McCutchen, 2000; Shanahan, 2006). Correlations between reading
comprehension and writing proficiency are established both in children and in adults (Berninger, Abbott, Abbott, Graham, \& Richards, 2002). As shown in the studies presented in this dissertation, the component skills of reading comprehension and writing proficiency overlap: we found that in the population of low-achieving adolescents both reading and writing are associated with linguistic and metacognitive knowledge and, to some extent, fluency. Furthermore, reading comprehension and writing proficiency might also influence each other (Shanahan, 1992; Tierny \& Shanahan, 1996). Writers, for example, often read and reread what they are writing. We found that fluent sentence reading is associated to proficiency in writing (Chapter 4). In addition, writing can help a reader in gaining insights in text characteristics or intentions of a writer, and these insights might be transferred to text reading. On the other hand, reading a text might, for example, raise a writer's audience awareness leading a writer to take this into account in his own writing. Preliminary analyses of our data indicate that low-achieving adolescents' level of reading comprehension and level of writing proficiency are significantly associated, beyond the contributions of the componential skills (see Appendix H). ${ }^{29}$ However, whether reading comprehension and writing proficiency are causally linked in the low-achieving population is still unclear and needs to be further investigated. Furthermore, it would be interesting to examine whether the interrelationship between reading and writing could effectively be used in reading and/or writing instruction for low-achieving adolescents. There are mixed results of studies investigating the effects of writing instruction on students' reading comprehension or the other way around (Shanahan, 2006; Stahl, Pagnucco, \& Suttles, 1996; Tierny \& Shanahan, 1996). However, there are several educational approaches in which reading and writing instructions are combined, and results of these approaches seem promising. Beneficial effects are reported for students' reading comprehension as well as for their content learning from text (Snow, Burns, \& Griffin, 1998), but also for their writing proficiency (e.g., Mason, Hickey Snyder, Sukhram, \& Kedem, 2006; Mason, Davison, Hammer, Miller, \& Glutting, 2013). We recommend research focusing on the question of whether these positive effects can also be attained in the population of low-achieving adolescents.

Individual differences in development. Students differed in their levels of reading comprehension and writing proficiency, and they differed in their gains in reading comprehension and writing proficiency. However, for reading comprehension and writing proficiency, the variance explaining development was smaller than the

[^21]variance explaining individual differences at each moment in time. In other words, the students differed more with respect to level of reading comprehension and writing proficiency than with respect to growth in reading comprehension and writing proficiency. As a consequence, there was less variance to explain in students' growth than in students' level by the components that we included in our studies. The results of our analyses also show that only a small proportion of the developmental differences could be explained by the knowledge and fluency components. Growth in reading could be explained to some extent (16.2\%) by growth in vocabulary (only for the language-minority students), and writing proficiency growth could for a small part (4.9\%) be explained by growth in grammatical knowledge. The remainder of the developmental variance in reading comprehension and writing proficiency was left unexplained.

Especially for writing proficiency the explanation of development was quite limited. Given the relatively low reliability coefficients for writing proficiency in our studies, a substantial part of the variance in writing proficiency and writing development that we established, was not related to individual differences in writing proficiency. This means that variance in writing development may have been captured in a fashion too limited to be explained in a reliable manner. We assessed writing proficiency by three writing tasks in different genres: a narrative task, an argumentative task and an instructive task. Research has shown that in general, there is much task variance in writing assessment (Huang, 2009; Schoonen, 2005). In order to attain higher generalizability in the assessment of writing proficiency, it has been recommended to include more tasks (Bouwer, Béguin, Sanders \& Van den Bergh, 2015). Therefore, to gain more insight in developmental differences in writing proficiency among low-achieving adolescents, longitudinal research, in which more writing tasks are included, is recommended.

Causality. Students' development in reading comprehension and writing proficiency was found to be related to students' gains in knowledge of vocabulary and grammar to some extent. In order to unravel the directionality of the relationship between students' gains in vocabulary and development in reading comprehension in the language-minority students, and the relationship between gains in grammar knowledge and writing development, we recommend a more detailed investigation of these associations in both native and language-minority students. This can be done, for example, by experimentally manipulating students' knowledge of vocabulary and grammar in reading and writing instruction respectively. The effects should be compared with effects of reading and/or writing instruction with no specific emphasis on enhancing students' linguistic knowledge. This might provide us with a deeper understanding of the directionality of the relation between growth
in vocabulary and grammar knowledge and growth in reading and writing proficiency respectively. Since development in reading comprehension was associated with gains in vocabulary knowledge only in the subsample of language-minority students, we further recommend intervention studies taking into account possible differential effects of vocabulary gains on reading comprehension development between the two subgroups of low-achieving adolescents. It could be the case that, if one assumes that the relation between vocabulary and reading comprehension is (partly) causal, as suggested by findings of Edmonds et al. (2009), language-minority students will profit more from gains in vocabulary than the native students do for their reading comprehension (see Section 5.4). This assumption however, seems to be contrasted by findings by Carlo et al. (2004), who found a positive effect of a vocabulary intervention among fifth graders' reading comprehension in a half-year time interval. The effects were as large for language-minority students as for native students. Thus, no differential effect of the vocabulary intervention was found in that study. Whether differential effects of vocabulary interventions between languageminority and native students would arise among seventh- to ninth-grade low achievers, is still an open issue that could be addressed in future research among low-achieving students.

### 5.6 Implications for educational practice

The study presented in this dissertation has shown that for the group of adolescent, scholastically low-achievers considerable improvement in reading comprehension, writing proficiency and its constituting components is feasible from Grade 7 to 9. Furthermore, it demonstrates that the language-minority students - although starting at lower levels of reading comprehension and writing proficiency - appear to catch up in the two following years. Teachers therefore, might expect substantial gains from low-achieving adolescents in their reading comprehension and writing proficiency. Expressing high expectations in their interactions with low-achieving students might positively influence these students' achievement (cf. the Pygmalion effect, introduced by Rosenthal \& Jacobson, 1968). In addition, expressing these realistic expectations might have a positive effect on students' experiences with reading and writing, and, as a consequence, provide adolescents with more confidence and motivation.

Since word-level fluency did hardly explain individual differences in reading comprehension and writing proficiency in our sample of students in Grade 7 to 9 , educational attention towards improving word-level fluency for this group of students should not be prioritized. More beneficial effects can be expected from educational interventions emphasizing vocabulary and grammar knowledge given
that these components showed substantial associations with reading comprehension and writing proficiency of the low-achieving students. Since presumably associations between vocabulary and grammar on one hand and reading comprehension and writing proficiency on the other are not unidirectional but reciprocal, interventions directed at improving vocabulary and grammar knowledge in direct connection with reading and writing activities seem most promising.

It appeared from this study that low-achieving students' metacognitive knowledge is quite limited. The students in our study had trouble indicating strategies for successfully reading or writing texts. Furthermore, the repertoire of self-regulatory activities (such as questioning or summarizing in reading, and evaluating or revising in writing) of these same students appeared to be rather limited as well (De Milliano et al., 2012, 2014). Students with limited metacognitive knowledge and self-regulatory skills might have severe trouble at school in meeting requirements, such as learning from textbooks. Therefore, attention should be paid to improving these low-achieving students' knowledge and use of strategies in the context of reading and writing. Reciprocal teaching (Palincsar \& Brown, 1984) is an instruction method of which positive effects on reading comprehension are confirmed by several studies (Rosenshine \& Meister, 1994). Reciprocal teaching consists of the teaching of concrete reading comprehension strategies, such as predicting and summarizing, which can be applied by students to new texts. The instruction and practice are interactive: students and teachers interact with each other. Reciprocal teaching was originally designed for small groups of students, guided by an expert tutor (originally a researcher or research assistant), and positive effects were found for these contexts. Reciprocal teaching on reading comprehension in natural class settings however, yielded mixed results (Okkinga, Van Steensel, Van Gelderen, Van Schooten, \& Sleegers, in prep.; Rosenshine \& Meister, 1994). In order to enhance low-achieving students' reading comprehension, reciprocal teaching may however be a good instrument in situations where smallgroup tutoring is feasible because it leaves ample room for interaction between teacher and students and for discussion of useful applications of reading strategies.

Frequent reading helps students to become more fluent readers and, additionally, has a positive effect on their linguistic knowledge (Cunningham \& Stanovich, 1991; Swanborn \& De Glopper, 1999), and presumably also on students' writing (Chapter 4). In addition, experience with reading might lead students to more awareness of characteristics of good texts. In a similar vein, frequent writing practice might help students to become better writers. Therefore, frequent reading and writing in different genres may be a good way for improving low-achieving students' reading comprehension and writing proficiency. Many low-achieving adolescents do not read frequently. Moreover, students' out-of-school reading is very
infrequently directed towards the 'traditional' epistemic reading goals favored in school (Van Kruistum, 2013). Furthermore, since writing is not prioritized in Dutch primary education (Dutch Education Inspectorate, 2012; Kuhlemeier, Van Til, Feenstra, \& Hemker, 2013), adolescents do not have much experience in writing texts. Therefore, we recommend that teachers motivate these students to read and write more often and provide them with ample opportunities to read and write epistemic texts concerning topics that are enjoyable and/or relevant for them.

### 5.7 Concluding remarks

This research has unearthed valuable insights into the level and development of lowachieving adolescents' reading comprehension and writing proficiency, and in factors associated with them. These insights can be applied in various ways to enhance the efforts of teachers who attempt to advance low-achieving students' literacy achievements, in order to make these students more successful at school and in future careers. At the same time, there remains a challenge for researchers to continue gathering more insights in low-achieving students' reading and writing development, and closing the gap between theory and practice by inspiring teachers to effectively apply acquired knowledge and insights in educational practice. Still much needs to be learned about causal mechanisms explaining the associations established in this study, as well as about successful interventions that positively affect low-achieving students' reading comprehension and writing proficiency. It may well be that reading and writing remain challenging activities for low-achieving adolescents. Nevertheless, improvement has shown to be possible, and as long as students' potentials are not fully employed, there is work to be done for students themselves, for their teachers, and for researchers. Undoubtedly, these lowachieving adolescents are worth our efforts.

## 6 References

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## 7 Appendices

Appendix A
Correlations between reading comprehension ability and component skill tests for all students ( $N=60$ ) in Grade 7 (Chapter 2).

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1. Reading comprehension | - | . 23 | -. 12 | .67** | .58** | -.28* | .37* | .34* | .40* |
| 2. Word-recognition efficiency |  | - | -.32* | . 20 | . 18 | -.50** | . 25 | -. 15 | -. 04 |
| 3. Word recognition (ms) |  |  | - | -. 18 | -. 08 | .64** | . 03 | . 04 | -. 11 |
| 4. Grammatical knowledge |  |  |  | - | .66** | -.32* | .50** | . 23 | .33** |
| 5. Receptive vocabulary |  |  |  |  | - | -. 16 | .57** | . 19 | .39** |
| 6. Sentence verification (ms) |  |  |  |  |  | - | -. 05 | . 15 | . 10 |
| 7. Metacognitive knowledge |  |  |  |  |  |  | - | . 01 | . 20 |
| 8. Nonverbal cognitive ability |  |  |  |  |  |  |  | - | . 20 |
| 9. Sentence span |  |  |  |  |  |  |  |  | - |

Notes. Due to drop-out, nonverbal cognitive ability scores of four of the students are missing, so correlations are based on the

Appendix B

|  | Grade 7 |  |  |  | Grade 8 |  |  |  | Grade 9 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Native-Dutch |  | Languageminority |  | Native-Dutch |  | Languageminority |  | Native-Dutch |  | Languageminority |  |
| Reading comprehension | 43.3 | (5.7) | 38.1 | (8.0) | 44.7 | (7.1) | 42.0 | (8.9) | 47.8 | (6.4) | 46.5 | (8.8) |
| Receptive vocabulary | 54.3 | (7.0) | 46.0 | (7.6) | 56.7 | (6.6) | 48.0 | (9.4) | 60.3 | (3.1) | 50.9 | (8.5) |
| Grammatical knowledge | 36.5 | (3.8) | 31.2 | (5.6) | 36.5 | (4.3) | 31.8 | (7.2) | 37.8 | (4.2) | 34.4 | (4.6) |
| Metacognitive knowledge | 29.2 | (3.9) | 26.3 | (3.9) | 30.0 | (4.8) | 27.2 | (4.3) | 30.9 | (3.6) | 29.2 | (4.9) |
| Word-recognition efficiency | 83.5 | (12.4) | 78.7 | (16.9) | 93.4 | (11.4) | 88.6 | (18.5) | 97.4 | (11.3) | 92.6 | (17.4) |
| Word recognition (ms) | 834.0 | (129.6) | 842.8 | (114.8) | 819.7 | (112.2) | 826.3 | (97.2) | 745.2 | (147.3) | 753.7 | (143.3) |
| Sentence verification (ms) | 4089.9 | (654.7) | 4587.8 | (706.8) | 3565.1 | (659.4) | 4103.3 | (593.7) | 3128.1 | (617.5) | 3774.8 | (628.2) |

Appendix C
Correlations between writing tasks in Grade 7, 8 and 9. $N=51$ (Chapter 4).

|  | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ |
| :--- | :--- | :--- | :--- |
| Grade 7 correlations |  |  |  |
| 1. Instructive | 1 |  |  |
| 2. Argumentative | $.36^{* *}$ | 1 |  |
| 3. Narrative | $.39^{* *}$ | $.38^{* *}$ | 1 |
| Grade 8 correlations |  |  |  |
| 1. Instructive | 1 |  |  |
| 2. Argumentative | $.56^{* *}$ | 1 | 1 |
| 3. Narrative | .27 | $.41^{* *}$ |  |
| Grade 9 correlations |  |  |  |
| 1. Instructive | 1 |  | 1 |
| 2. Argumentative | .23 | $.41^{* *}$ | .17 |
| 3. Narrative |  |  |  |

Notes. ${ }^{*}=$ significant at $.05 .^{* *}=$ significant at .01 .
Appendix D

Appendix E
Means and standard deviations for native-Dutch $(n=25)$ and language-minority $(n=26)$ students in grades 7, 8 and 9 (Chapter 4).

|  | Grade 7 |  |  |  | Grade 8 |  |  |  | Grade 9 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Native-Dutch |  | Language minority |  | Native-Dutch |  | Language minority |  | Native-Dutch |  | Language minority |  |
| Writing proficiency | 266.2 | (75.4) | 203.8 | (93.9) | 293.7 | (76.1) | 263.2 | (97.1) | 307.9 | (41.1) | 294.4 | (65.2) |
| Receptive vocabulary ( $\mathrm{Max}=73$ ) | 54.3 | (6.9) | 46.0 | (7.6) | 56.9 | (6.6) | 48.0 | (9.4) | 60.5 | (3.3) | 50.9 | (8.5) |
| Grammatical knowledge ( $\mathrm{Max}=50$ ) | 36.3 | (3.8) | 31.2 | (5.6) | 36.6 | (4.3) | 31.8 | (7.2) | 38.0 | (4.3) | 34.4 | (4.6) |
| Orthographic knowledge ( $\mathrm{Max}=68$ ) | 49.9 | (4.6) | 45.4 | (6.0) | 50.4 | (5.8) | 49.3 | (6.9) | 51.6 | (5.1) | 48.5 | (6.4) |
| Metacognitive knowledge ( $\mathrm{Max}=45$ ) | 29.2 | (3.9) | 26.3 | (3.9) | 30.0 | (4.7) | 27.2 | (4.3) | 31.0 | (3.5) | 29.2 | (4.9) |
| Word recognition (ms) | 825.9 | (133.1) | 842.8 | (114.8) | 809.5 | (121.0) | 826.3 | (97.2) | 738.4 | (148.2) | 753.7 | (143.3) |
| Lexical retrieval (ms) | -120.2 | (269.2) | 126.0 | (329.7) | -63.1 | (196.1) | 59.9 | (186.9) | -45.9 | (152.6) | 44.2 | (143.3) |
| Sentence verification (ms) | 4063.9 | (653.9) | 4587.8 | (706.8) | 3516.3 | (690.0) | 4103.2 | (593.7) | 3097.5 | (623.5) | 3774.8 | (628.2) |

## Appendix F

Significant effects of background (native-Dutch versus language-minority) on students' $(N=51)$ performance on writing proficiency and the seven independent variables (Chapter 4).

|  | Grade 7 | Grade 8 | Grade 9 |
| :--- | :---: | :---: | :---: |
| Writing proficiency | $* a$ | n.s. | n.s. |
| Receptive vocabulary | $* * *$ | $* * *$ | $* * *$ |
| Grammatical knowledge | $* * * a$ | $* * a$ | $* * a$ |
| Orthographic knowledge | $* *$ | n.s. | n.s. a |
| Metacognitive knowledge | $* *$ | $*$ | n.s. |
| Word recognition (ms) | n.s. | n.s. | n.s. |
| Lexical retrieval (ms) | $* *$ | $*$ | $*$ |
| Sentence verification (ms) | $* *$ | $* *$ | $* * *$ |

Notes. ${ }^{*}=p<.05 ;^{* *}=p<.01 ;^{* * *}=p<.001 ;$ n.s. $=$ not significant; $\mathrm{a}=$ with class level included.

## Appendix G

Results of repeated-measures ANOVAs performed on the component variables ( $N=50$, Chapter 5).

| Component | $\mathbf{F}$ | Significance | Effect size |
| :--- | :--- | :---: | :--- |
| Receptive vocabulary | $F_{(2,98)}=21.4$ | $p<.001$ | $\eta^{2}{ }_{p}=.31$ |
| Grammatical knowledge | $F_{(2,98)}=8.2$ | $p<.01$ | $\eta^{2}{ }_{p}=.14$ |
| Orthographic knowledge | $F_{(2,98)}=7.2$ | $p<.01$ | $\eta^{2}{ }_{p}=.13$ |
| Metacognitive knowledge | $F_{(2,98)}=6.1$ | $p<.01$ | $\eta^{2}{ }_{p}=.11$ |
| Word-recognition efficiency | $F_{(2,98)}=99.1$ | $p<.001$ | $\eta^{2}{ }_{p}=.67$ |
| Speed of written word recognition | $F_{(2,98)}=13.6$ | $p<.001$ | $\eta^{2}{ }_{p}=.22$ |
| Speed of lexical retrieval | $F_{(2,98)}=69.5$ | $p<.001$ | $\eta^{2}{ }_{p}=.59$ |
| Speed of sentence verification | $F_{(2,98)}=74.7$ | $p<.001$ | $\eta^{2}{ }_{p}=.61$ |

## Appendix H

Multilevel analyses with writing proficiency (repeatedly measured) as dependent variable. Predictors are time of measurement (coded as 0,1 and 2), and background (coded as 0 and 1, for native-Dutch and language-minority students respectively), repeated measurements of receptive vocabulary, grammatical knowledge, speed of sentence verification, and reading comprehension (Chapter 5).

| 51 students, 10 classes, <br> 3 times of measurement |  | 1 | 2 | 3 |
| :---: | :---: | :---: | :---: | :---: |
| Variance | class | 987.1 (742.9) | 129.3 (266.1) | $0.0 \quad$ (0.0) |
|  | student | 2374.5 (723.7) | 1366.0 (498.2) | 991.2 (377.8) |
|  | occasion | 2575.7 (360.7) | 2527.7 (354.6) | 2494.1 (350.0) |
|  | total | 5937.3 | 4023.0 | 3485.3 |
| Distribution of variance | class | 17.2\% | 3.2\% | 0\% |
|  | student | 41.4\% | 34.0\% | 28.4\% |
|  | occasion | 41.4\% | 62.8\% | 71.6\% |
| Explained variance | class |  | 86.9\% | 100\% |
|  | student |  | 42.5\% | 27.4\% |
|  | occasion |  | 1.9\% | 1.3\% |
|  | total |  | 32.2\% | 13.4\% |
| Intercept |  | 250.3 (16.2) | 106.3 (68.7) | 34.6 (65.8) |
| Main effects |  | 1 | 2 | 3 |
| Time of measurement |  | 33.3 *** (5.0) | 12.7 (6.6) | 8.3 (6.4) |
| Language background |  | -24.9 (16.5) | 14.9 (15.7) | 6.6 (14.5) |
| Receptive vocabulary |  |  | 1.6 (0.9) | 0.4 (0.9) |
| Grammatical knowledge |  |  | 4.5*** (1.2) | $3.5^{* *}$ (1.2) |
| Sentence verification (ms) |  |  | $-0.024^{* *}(0.009)$ | -0.018* (0.009) |
| Reading comprehension |  |  |  | $3.5{ }^{* * *}(0.9)$ |
| Fit (-2*loglikelihood) |  | 1712.8 | 1684.7 | 1670.9 |
| difference |  |  | $28.1{ }^{* * *}$ | $13.8{ }^{* * *}$ |
| difference $d f$ |  |  | 3 | 1 |
| compared to model |  |  | 1 | 2 |

## 8 Summary in English

## Reading and writing development of low-achieving adolescents The roles of linguistic knowledge, fluency and metacognitive knowledge

Many adolescent students have to cope with insufficient reading and writing skills. They are for example unable to comprehend information from schoolbooks, or to write text that is understandable to those it is addressed to. This results in disappointing educational achievement and reduced motivation. Eventually it may even lead to dropping out, which of course is undesirable for both the student and for society.

Especially low-achieving adolescents who are relatively poor in reading and writing would benefit from successful interventions. Although research focusing on low-achieving adolescents could yield outcomes beneficial to teaching reading and writing to this population, little research has been directed at the question of how individual differences in reading comprehension and writing proficiency within this group can be explained. This is the background which led to the research project SALSA (an acronym for Study into Adolescent Literacy of Students At-Risk), funded by the Dutch Organization for Scientific Research (NWO). Within this project the reading and writing development of poor readers and writers in Grades 7-9 has been investigated. This dissertation is part of the SALSA-project and is specifically directed at the role of various types of knowledge and skills, that are important to the (development of) reading comprehension and writing proficiency of low-achieving adolescents.

A substantial part of the students visiting lower vocational tracks of education in the large western cities of The Netherlands (the target population of the SALSAproject) is made up of students from immigrant backgrounds. Many of them have been raised with another language than - or next to - Dutch. Since various studies have indicated that children from immigrant families generally score less well in regard reading comprehension and writing proficiency, our study distinguished between two groups of students, namely: 'native' students, for whom Dutch is the only language spoken at home, versus 'language-minority' students with whom another home language is spoken next to Dutch.

We know that for reading comprehension and writing proficiency, the availability of knowledge is an important condition. Not just linguistic knowledge, such as vocabulary, spelling, and grammar (command of forming words and sentences), but also knowledge about the composition of texts and about efficient strategies that can be applied in reading and writing of texts (metacognitive knowledge) is important. Apart from knowledge, fluency (or speed) with which
words and sentences can be processed is important in reading comprehension and writing proficiency. In general, someone who performs basic reading and writing processes effortless, retains more working memory capacity for dealing with other aspects of the text, as compared to someone who is less fluent. The resultant capacity can be applied to, for example, linking sentences and paragraphs, which aids the understanding of a text, or helps to improve the clarity of a text one writes oneself.

Several studies have shown that reading comprehension and writing proficiency of the general population of adolescents is strongly associated with linguistic knowledge. Students who have more linguistic knowledge are generally more able to understand the content of a text, and are able to write better texts. At the same time it is true that less knowledge of a language often corresponds with weaker reading and writing skills. Fluency seems to be less predictive. Whether, and to what extent, these same associations exist within the more homogeneous group of low-achieving adolescents, has to our knowledge not been investigated until now. Such information is extremely relevant for reading and writing education directed at (language-minority) low-achieving adolescents. Although knowledge of such relations between linguistic and metacognitive components on one hand and reading comprehension and writing proficiency on the other does not directly lead to successful educational interventions, it is certainly informative for educational experiments directed at improving low-achieving adolescents' reading comprehension and writing proficiency.

Sixty students initially participated in the research presented in this dissertation. Their skills in reading comprehension, in writing proficiency, and in various components of reading and writing (linguistic knowledge, metacognitive knowledge, and fluency) was tested in each of the first three grades of the two lowest tracks of vocational education. To measure the reading and writing skills we used a test that was developed in the SALSA-project (Van Steensel, Van Gelderen \& Oostdam, 2013). The knowledge the students possessed was tested through a number of written tests, covering receptive vocabulary as well as grammatical knowledge, orthographic knowledge, and metacognitive knowledge. The level of fluency was established with a test for word decoding (known as the Three Minutes Test), as well as with a number of computerized tests measuring speed and accuracy with which students could read words and sentences, and speed of lexical retrieval. In the statistical analyses, we investigated associations between knowledge and fluency on one hand and students' level and development of reading comprehension and writing proficiency on the other.

The empirical part of this dissertation consists of three studies. In the first (Chapter 2) we addressed the question to what extent the differences in level of
reading comprehension, were associated with differences in knowledge (a composite variable consisting of vocabulary knowledge, grammar knowledge, and metacognitive knowledge), and fluency (a composite variable consisting of speed and efficiency of word recognition, and speed of sentence verification). This analysis considered our students in seventh grade only. It turned out that associations differed between the native- and the language-minority students. For the first group of students, differences in fluency correlated significantly with differences in reading comprehension, while this contribution was negligible for language-minority students. For the language-minority students, however, it turned out to be much more predictive what level of knowledge they possessed. An explanation is that language-minority students, who scored significantly lower on both linguistic knowledge and reading comprehension, could not utilize the advantage of more efficient word recognition, because their faltering knowledge denied them access to word meaning.

The two other studies (Chapters 3 and 4), were directed at the development of reading comprehension and writing proficiency of native and language-minority low-achieving adolescents in the course of Grade 7 to 9 . We first investigated to what extent knowledge and fluency are correlated to the level of reading comprehension and writing proficiency. Knowledge of vocabulary and grammar was substantially related to students' levels of reading comprehension and writing proficiency. That is, in general, those adolescents who were better readers and writers possessed more vocabulary and grammar knowledge than their peers who were relatively poor in reading and writing. This finding is in line with what we know from research on students across the whole ability range. In addition, metacognitive knowledge played an important role in reading comprehension. Students possessing more knowledge of text building and of reading and writing strategies, were also better in understanding texts. In addition, contrary to what was found in seventh grade (Chapter 2), fluency was not predictive for native students' reading comprehension. Possibly the progress in fluency these students experienced resulted in more effortless processing, such that limited fluency was no longer an obstacle in text comprehension.

In respect of writing proficiency, it turned out that, next to vocabulary and grammar, sentence verification speed showed a substantial correlation with the quality of written texts. Reviewing and rewriting of text constitutes an important part of the writing process. The ease of sentence reading may be related to the ease of reading and reviewing one's own text. For low-achieving adolescents this may result in higher quality texts.

In Chapters 3 and 4 we also analyzed the development of reading comprehension, writing proficiency and the linguistic and metacognitive
components from Grade 7 to 9 . Contrary to what is sometimes asserted, namely that the reading and writing development of low-achieving adolescents stagnates, we found clear evidence of progress. Our analyses show that students progressed substantially, both with regard to reading comprehension and writing proficiency as with regard to knowledge and fluency. We further found that the progress in reading comprehension and writing proficiency of the native and language-minority students in our study, differed. The language-minority students initially scored significantly lower than the native- students, but in the course of Grade 7 to 9 they showed more progress. This progress was so strong, that at the end of Grade 9 there were no significant differences in reading comprehension and writing proficiency between the two groups. What did remain though, were significant differences between the language-minority and native- students with respect to vocabulary and grammatical knowledge (an advantage of the native students).

The final series of findings from Chapters 3 and 4 concerns the association between gains in reading comprehension and writing proficiency on one hand and gains in knowledge and fluency on the other. There were individual differences with respect to the extent to which students progressed. Part of these differences in development in reading comprehension can be statistically explained by an increase in vocabulary knowledge. This was the case only for the language-minority students. Gains in grammatical knowledge can be related to development in writing proficiency. We are aware that a causal relationship cannot be established with the analyses that were performed. Nevertheless, it is plausible that part of the association can be construed as causal, meaning that vocabulary is a requirement for text understanding, and grammatical knowledge is a requirement for writing proficiency. It is also possible that progress in reading comprehension and writing proficiency advances knowledge of vocabulary and grammar. Previous research has demonstrated that new words can be learned through reading. In the same line of reasoning, by increasing their writing experience students could become more aware of the role and the correct use of grammatical structures. Further research is required to determine the causality of the correlation obtained, within the population of low-achieving adolescents.

Our research was conducted with a relatively small sample, as only sixty students participated in Grade 7. Because of this, it could be that we have missed (small) effects that would have shown up in a larger sample. Despite this limitation we can however draw some lines to educational practice. More knowledge of vocabulary and grammar go together with better reading comprehension and writing proficiency. These components therefore play an important role in the reading and writing process of low-achieving adolescents. Full attention could be given to this in the reading and writing education of these young people. In addition,
metacognitive knowledge of these students was quite limited. Increasing that kind of knowledge may help students to become better readers and writers. Of course, it remains important to not only focus on the linguistic and metacognitive components of reading and writing but also offer students enough opportunity and encouragement to read and write texts.

Finally we want to emphasize that, in view of the progress in reading comprehension and writing proficiency that was obtained in this study, there is no reason for pessimism as to what low-achieving adolescents are capable of. On the contrary! The young people who took part in our research progressed significantly. Students can derive much value from high yet realistic expectations that a teacher has of their achievements. These expectations should certainly be stated while teaching low-achieving adolescents.

## 9 Samenvatting in het Nederlands

## Ontwikkeling in lees- en schrijfvaardigheid van zwak presterende leerlingen in het vmbo De rol van linguïstische kennis, vloeiendheid en metacognitieve kennis

Veel middelbare scholieren hebben te kampen met onvoldoende lees- en schrijfvaardigheid. Zo zijn ze bijvoorbeeld onvoldoende in staat om informatie uit schoolboeken goed tot zich te nemen of om hun eigen teksten begrijpelijk te schrijven voor degene aan wie de tekst is gericht. Dit resulteert in tegenvallende schoolprestaties en verminderde motivatie. Uiteindelijk kan het zelfs leiden tot schooluitval, wat uiteraard uiterst ongewenst is voor de leerling zelf, maar ook voor de maatschappij.

Hoewel juist jongeren die relatief zwak zijn in lezen en schrijven, gebaat zouden zijn met succesvolle interventies, is er nog weinig onderzoek verricht naar hoe individuele verschillen in begrijpend lezen en schrijfvaardigheid binnen deze groep kunnen worden verklaard. Naar aanleiding van deze problematiek is in 2007 een door de Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) gefinancierd onderzoeksproject opgezet, dat in de wandelgangen het SALSA-project werd genoemd, wat staat voor Studie naar Achtergronden van Lees- en Schrijfontwikkeling bij Adolescenten. Binnen dit project is vanuit verschillende invalshoeken de ontwikkeling van lees- en schrijfvaardigheid onderzocht van relatief zwakke lezers en schrijvers in het voortgezet onderwijs: vmbo-leerlingen uit de basisen kaderberoepsgerichte leerweg. Dit proefschrift maakt onderdeel uit van het SALSA-project en richt zich specifiek op de rol van diverse typen (taal)kennis en vaardigheden die van belang zijn voor (de ontwikkeling van) lees- en schrijfvaardigheid van leerlingen in het vmbo.

Een groot deel van de vmbo-leerlingen op scholen in de Randstad, waar het in dit proefschrift beschreven onderzoek plaatsvond, bestaat uit leerlingen met een migrantenachtergrond. Veel van hen zijn opgevoed met een andere taal dan of naast het Nederlands. Uit verschillende peilingen en onderzoeken is gebleken dat kinderen uit migrantengezinnen over het algemeen minder goed scoren wat betreft taalkennis en lees- en schrijfvaardigheid. Daarom hebben we in ons onderzoek twee groepen leerlingen onderscheiden: van huis uit eentalige leerlingen (de 'eentalige' leerlingen) en leerlingen met een andere thuistaal (de 'meertalige' leerlingen).

We weten dat voor het begrijpend lezen en begrijpelijk schrijven kennis van de taal vereist is. Niet alleen woordenschat en spelling, maar ook kennis van grammatica (beheersing van woord- en zinsvorming). Daarnaast is metacognitieve kennis van belang, d.w.z. kennis over de opbouw van teksten en efficiënte
strategieën die kunnen worden ingezet bij het lezen en schrijven van een tekst. Naast kennis is ook vloeiendheid, of de snelheid waarmee woorden of zinnen kunnen worden verwerkt, van belang bij het lezen en schrijven van een tekst. In het algemeen geldt dat iemand die vlotter is met deze basisprocessen in lezen en schrijven meer werkgeheugencapaciteit beschikbaar houdt voor andere aspecten van de tekst dan iemand die hier minder vloeiend in is. De hierdoor beschikbare capaciteit kan aangewend worden voor bijvoorbeeld het leggen van verbanden tussen zinnen en alinea's, wat het begrip van een gelezen tekst en de begrijpelijkheid van een geschreven tekst ten goede komt.

In verschillende studies is aangetoond dat tekstbegrip en schrijfvaardigheid van jongeren sterk samenhangt met kennis van de taal. Leerlingen die over meer taalkennis beschikken, zijn over het algemeen dus ook beter in staat om de inhoud van een tekst te begrijpen en om kwalitatief goede teksten te schrijven. Eveneens geldt dat minder taalkennis vaak samengaat met een zwakkere lees- en schrijfvaardigheid. De rol van vloeiendheid blijkt minder groot te zijn. Of en in welke mate deze zelfde verbanden aanwezig zijn binnen de homogenere groep van jongeren die relatief zwak zijn in lezen en schrijven (zoals de vmbo-leerlingen uit ons onderzoek), is voor zover wij weten nog niet eerder onderzocht. Deze informatie is bijzonder nuttig met het oog op onderzoek naar succesvolle onderwijsinterventies die erop zijn gericht om de lees- en schrijfvaardigheid van deze leerlingen te bevorderen.

Ongeveer zestig leerlingen verleenden hun medewerking aan het in dit proefschrift beschreven onderzoek. Hun vaardigheid in lezen en schrijven, en in de verschillende componenten (kennis van de taal, metacognitieve kennis en vloeiendheid) is getoetst in de eerste drie leerjaren van het vmbo. Voor het meten van de lees- en schrijfvaardigheid is gebruik gemaakt van een toets die binnen het SALSA-project is ontwikkeld (Van Steensel, Oostdam \& Van Gelderen, 2013). De kennis waarover de leerlingen beschikten is getoetst met een aantal schriftelijke tests, waarin receptieve woordenschat, grammaticale kennis, orthografische kennis en metacognitieve kennis aan bod kwamen. Vloeiendheid is in kaart gebracht met een gangbare test voor technisch lezen (de Drie-Minuten-Toets) en een aantal computertests (waarin de snelheid en accuratesse is gemeten waarmee leerlingen woorden en zinnen konden lezen en de beschikking hadden over hun woordkennis). In de analyses hebben we de scores van de leerlingen voor deze componenten in verband gebracht met hun scores voor de lees- en schrijftoets.

Dit proefschrift bestaat uit drie deelstudies. In één van de deelstudies (Hoofdstuk 2) hebben we ons gericht op de vraag in hoeverre de niveauverschillen in tekstbegrip die we in het eerste leerjaar tussen leerlingen aantroffen, samenhang vertoonden met verschillen in kennis (een composietvariabele bestaande uit
woordenschat, grammatica en metacognitieve kennis) en vloeiendheid (een composietvariabele bestaande uit snelheid en efficiëntie van woordherkenning, en snelheid van zinsverificatie). Uit onze verkenning van de data bleek dat de gevonden verbanden verschilden tussen leerlingen die van huis uit alleen Nederlands spraken en leerlingen die opgegroeid waren met een andere thuistaal. Voor de eerste groep leerlingen bleken verschillen in vloeiendheid significant samen te hangen met verschillen in tekstbegrip, terwijl deze bijdrage voor de leerlingen met een andere taalachtergrond te verwaarlozen was. Voor deze leerlingen bleek het van veel groter belang te zijn over hoeveel kennis ze beschikten. Het verband tussen kennis en tekstbegrip was zelfs groter dan voor de van huis uit eentalige leerlingen. Eén verklaring zou kunnen zijn dat de meertalige leerlingen, die zowel qua taalkennis als qua tekstbegrip significant lager scoorden, het voordeel van vlotter lezen niet konden benutten, omdat gebrekkige (woord)kennis hen de toegang tot belangrijke betekeniselementen uit een tekst ontzegde.

De twee andere deelstudies (Hoofdstuk 3 en 4) waren gericht op de ontwikkeling van de lees- en schrijfvaardigheid van een- en meertalige leerlingen in de loop van de eerste drie leerjaren van het vmbo. Allereerst hebben we gekeken in hoeverre de kennis- en vloeiendheidsmaten in verband konden worden gebracht met het niveau van tekstbegrip en schrijfvaardigheid in de periode van het eerste leerjaar tot en met het derde leerjaar. We vonden dat kennis van grammatica en woordenschat een sterke samenhang vertoonde met zowel de lees- als schrijfvaardigheid van vmbo-leerlingen. Een leerling met relatief veel lexicale en grammaticale kennis, scoort ook relatief hoog op lees- en schrijfvaardigheid. Mogelijk helpt kennis van de taal een vmbo-leerling bij het goed begrijpen en adequaat formuleren van teksten. Wat betreft de leesvaardigheid speelde bovendien metacognitieve kennis een belangrijke rol. Leerlingen die over meer kennis van tekstopbouw en strategieën beschikten, waren beter in het begrijpen van teksten. Overigens speelde de vloeiendheid, in tegenstelling tot wat we in het eerste leerjaar vonden, ook voor de eentalige leerlingen geen substantiële rol. Mogelijk heeft de vooruitgang in vloeiendheid die de leerlingen doormaakten ertoe geleid dat processen geautomatiseerder verlopen, waardoor beperkte vloeiendheid geen belemmering meer vormde in het tekstbegrip. Wat betreft de schrijfvaardigheid bleek zinsverificatiesnelheid, naast kennis van woordenschat en grammatica, een substantieel verband te vertonen met de kwaliteit van de geschreven teksten. In het schrijfproces vormt het teruglezen en herzien van geschreven tekst een belangrijk onderdeel. Door het gemak waarmee tekst kan worden gelezen, kan het controleren ook efficiënter verlopen. Dit hangt weer samen met hogere tekstkwaliteit, kennelijk ook voor schrijvers uit het vmbo.

In hoofdstuk 3 en 4 hebben we ook de ontwikkeling van lees- en schrijfvaardigheid en de componenten tussen het eerste jaar en het derde jaar van het vmbo in kaart gebracht. In tegenstelling tot wat wel wordt beweerd, namelijk dat het niveau van vmbo-leerlingen blijft steken, vonden wij duidelijke aanwijzingen voor groei. Onze analyses laten zien dat leerlingen zowel op lees- en schrijfvaardigheid als op elk van de kennis- en vloeiendheidsmaten aanzienlijk vooruitgingen. We hebben aanvullend gekeken of de groei in lees- en schrijfvaardigheid van de eentalige en meertalige groepen binnen onze steekproef van elkaar verschilden. Dat blijkt inderdaad het geval, voor zowel lees- als schrijfvaardigheid. De meertalige leerlingen scoorden aanvankelijk een flink stuk lager dan de eentalige leerlingen, maar in de loop van de drie schooljaren vertoonden ze een snellere vooruitgang. Die ontwikkeling was zelfs zo sterk dat er aan het eind van het derde leerjaar geen significante verschillen meer waren tussen beide groepen in lees- en schrijfvaardigheid. Wel bleven er significante verschillen bestaan tussen deze twee groepen voor wat betreft woordenschat en grammaticakennis.

De laatste reeks aan bevindingen uit Hoofdstuk 3 en 4 heeft te maken met de groei in lees- en schrijfvaardigheid. Leerlingen verschilden onderling in de mate waarin ze vooruitgingen. Een deel van deze verschillen in ontwikkeling in tekstbegrip kon worden verklaard vanuit een toename in woordenschat. Dit was overigens alleen bij de meertalige leerlingen het geval. Een toename in grammaticale kennis kon worden gerelateerd aan ontwikkeling in schrijfvaardigheid. Wij zijn ons ervan bewust dat met behulp van de uitgevoerde analyses een oorzakelijk verband niet is aan te tonen. Desondanks is het aannemelijk dat een deel van het verband wel causaal te duiden is, dus dat kennis van woordenschat een voorwaarde is voor tekstbegrip, en grammaticale kennis voor schrijfvaardigheid. Het is ook mogelijk dat groei in lees- en schrijfvaardigheid juist groei in woordenschat en grammatica bevordert. Eerder onderzoek heeft bijvoorbeeld aangetoond dat door te lezen nieuwe woorden kunnen worden geleerd. Daarnaast zou een jongere door veel te schrijven zich meer bewust kunnen worden van de rol van het juiste gebruik van grammaticale structuren. Verder onderzoek is nodig om de causaliteit van de gevonden verbanden binnen de vmbo-populatie te onderzoeken.

Ons onderzoek is uitgevoerd onder een relatief kleine steekproef (zo'n zestig leerlingen verleenden hun medewerking). Hierdoor kan het zijn dat we (kleine) effecten hebben gemist, die in een grotere steekproef wel aan het licht zouden zijn gekomen. Ondanks deze beperking kunnen we toch enkele lijnen trekken naar de onderwijspraktijk. In de eerste jaren van het vmbo gaat met name rijkere kennis van woordenschat en grammatica samen met beter tekstbegrip en betere schrijfproducten. Deze componenten spelen dus een belangrijke rol in het lees- en
schrijfproces van vmbo-leerlingen en hier zou volop aandacht aan kunnen worden besteed in het lees- en schrijfonderwijs aan deze jongeren. Daarnaast bleek dat de metacognitieve kennis van de leerlingen vrij beperkt was. We weten dat kennis over teksten, en het gebruik van strategieën van belang zijn in het lees- en schrijfproces. Het vergroten van dergelijke kennis zou leerlingen mogelijk kunnen helpen in het beter lezen en schrijven. Onverlet blijft dat het belangrijk is om niet alleen op de deelcomponenten van lezen en schrijven aandacht te vestigen, maar leerlingen ook genoeg gelegenheid te bieden om ervaring op te doen met het zelf lezen en schrijven van teksten.

Tot slot willen we benadrukken dat er gezien de gevonden groei in lees- en schrijfvaardigheid geen reden is tot pessimisme over wat een vmbo-leerling in zijn of haar mars heeft, integendeel! De jongeren die deelnamen aan ons onderzoek zijn behoorlijk vooruitgegaan. Een leerling kan veel waarde ontlenen aan hoge, mits realistische, verwachtingen die een leerkracht van zijn of haar prestaties heeft. Deze verwachtingen mogen ook zeker worden uitgesproken in het onderwijs aan vmboleerlingen.

## 10 Dankwoord

Wat was ik blij toen ik destijds hoorde dat ik deze promotieplek zou krijgen. De ideale baan, zo was mijn overtuiging. Naast de vele momenten waarin ik er ontzettend van genoot, zijn er ook momenten geweest dat ik het promoveren verfoeide. Momenten achter de computer zonder inspiratie: ronduit saai. Momenten tijdens de dataverzameling waarop het alles behalve saai was. Zouden de leerlingen er wel zijn? En zouden ze nog wel aan ons onderzoek mee willen blijven doen? Het gebruik van de oude, degelijke NELSON-laptops heeft mij soms ook angsten doen uitstaan. Gelukkig hielden ze vol, zelfs na die winterse val op dat beijzelde Amsterdamse stoepje.

Er zijn veel mensen die een rol hebben gespeeld in de totstandkoming van dit boek. Allereerst wil ik mijn begeleiders Jan Hulstijn en Amos van Gelderen bedanken. Jullie kennis, ideeën en vertrouwen in mij inspireerden me om vol te houden. Jullie remden me soms af als ik eens de details of irrelevante dingen (die toch echt wel interessant waren) met teveel enthousiasme te lijf ging. Met jullie geduld en vertrouwen hebben jullie me enorm gesteund. Vooral in de afrondende fase is dit van grote betekenis voor me geweest. Jan, als een rasechte 'Doktorvater' ontfermde je je over me, vanaf het begin. Je stelde me aan interessante mensen voor, wees me op kansen en academische valkuilen, schonk heerlijk vaak de thee bij, en vroeg me of ik alsjeblieft voorzichtig wilde doen met de straat oversteken: 'Amsterdam is een drukke stad en al die trams en taxi's.' Amos, altijd geïnteresseerd in hoe het met me ging, bereid om mijn stukken scherper te helpen formuleren, ook - of juist - als ik niet bijster scherp was. Je kennis, creativiteit en kritische blik hebben een enorme verrijking aangebracht in dit proefschrift. Erik van Schooten heeft ook een belangrijke rol vervuld in de aansturing van dit onderzoek. Erik, je hebt veel betekend in de uitvoering en interpretatie van de verschillende analyses die in dit proefschrift zijn opgenomen. Je was hierbij buitengewoon behulpzaam, en je was altijd beschikbaar als ik weer eens een beroep op je deed. Dank voor al je hulp en de tijd die je voor ons onderzoek hebt vrijgemaakt!

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Belangstelling voor mijn onderzoek en kritische vragen heb ik van veel mensen mogen ontvangen, in kleiner verband natuurlijk vanuit het SALSA-clubje. Binnen het ACLC waren er de NAP-dagen en presentaties op juniorenoverleggen waar ik nuttige feedback heb gekregen. Ook de CASLA-bijeenkomsten waren een bron van inspiratie, net als de MMM-meetings met Marjolein Cremer en Margarita Steinel. In de bredere, Nederlandstalige context heb ik veel gehad aan de conferenties en studiedagen van Anéla, de OnderwijsResearchDagen en de vmbo-studiedag van Stichting Lezen. I would like to express my gratitude to people I met and spoke with in international contexts. Those who were part of the international partner projects in Toronto and Geneva, and people whom I met at international conferences.

Naast mijn interesse voor lezen en schrijven had ik ook andere interesses. Genoten heb ik van muziek, dans, hardlopen in het bos, Spaanse lessen, maar vooral het samenzijn met mensen om wie ik geef: vrienden en familie. Tijdens een van onze bijeenkomsten met Jan en Amos over de analyses uit het derde hoofdstuk concludeerde Jan. 'Dus wie kennis vermeerdert, vermeerdert begrip'. Mijn gedachten dwaalden automatisch af naar het 'wie kennis vermeerdert, vermeerdert smart' uit Prediker. 'Is begrip dan hetzelfde als smart?' Het begrip en meeleven dat ik heb ontvangen van de mensen die ik in mijn hart heb gesloten, heb ik in ieder geval als zegen en zeker niet als smart ervaren. Wat fijn dat zij iets minder hard over me oordeelden dan ik over mezelf deed, als ik weer eens tijd besteed had aan dagdromen, of aan zinloze analyses, of aan een stuk tekst dat ik toch weer schrapte. Lieve Jos, jij in het bijzonder dank je wel. Voor al je hulp, aanmoedigingen en enorme liefde!

Er is veel om dankbaar voor te zijn. Ik hoop met mijn onderzoek, hoe bescheiden dan ook, een bijdrage te hebben geleverd aan de kennis over lezen en schrijven in het vmbo, en mede daardoor ook een schakeltje te mogen zijn in de levens van die jongeren van wie niet altijd ten volle wordt ingezien dat ze ontzettend waardevolle mensen zijn met allerlei talenten. Ik ben ervan overtuigd dat ze de liefde en zorg die in hun ontwikkeling wordt gestoken meer dan waard zijn.


[^0]:    ${ }^{2}$ This chapter was previously published as:
    Trapman, M., Van Gelderen, A., Van Steensel, R., Van Schooten, E., \& Hulstijn, J. (2014). Linguistic knowledge, fluency and meta-cognitive knowledge as components of reading comprehension in adolescent low achievers: differences between monolinguals and bilinguals. Journal of Research in Reading 37(S1), 1-21.
    The first author was the principle investigator of this study. The other authors acted as either advisors (Van Schooten and Van Steensel) or supervisors (Hulstijn and Van Gelderen).

[^1]:    ${ }^{3}$ We accepted two exceptions to this rule. Two native-Dutch students have one parent who was born outside the Netherlands. We decided to include these students after verifying (again) that Dutch was the only language spoken at home for these students.
    ${ }^{4}$ Of the 30 language-minority students, 24 students reported in an interview that they learned to read in their home language from the age of 7 or older. $t$-tests showed no significant differences between the students who could or could not read in their home language in Dutch reading comprehension, and all the other measured variables in this study, with one exception: word-recognition speed $\left(t_{(28)}=-2.25 p=0.03\right)$. Language minority students that could not read in their home language were faster in Dutch word recognition.

[^2]:    ${ }^{5}$ In the Netherlands, most of the language-minority secondary-school students are from the second-generation Turkish and Moroccan immigrants. In general, their families have low socioeconomic status, low level of education and low levels of professional training (CBS, 2012; Tesser \& ledema, 2001). At home, the language spoken by their parents is often the ethnic group language, although Dutch may be used beside this other home language. Outside the domestic environment, for example, at school, Dutch is the language that is primarily used (Extra \& Verhoeven, 1993).

[^3]:    ${ }^{6}$ Based on complete cases.

[^4]:    ${ }^{7}$ Based on complete cases.

[^5]:    ${ }^{8}$ School and class level practically coincide in this study, since 10 classes come from nine different schools.
    ${ }^{9}$ Although researchers agree that a larger sample will increase the statistical power of an analysis, there are some differences in what is considered as an appropriate sample size for regression analysis. Harris (1985) suggests to have an absolute minimum of 10 subjects per variable.

[^6]:    ${ }^{10}$ The sample size was sufficient for doing a PCA (Kaiser-Meyer-Olkin measure of sampling adequacy $(\mathrm{KMO})>.5)$. For the analysis, $\mathrm{KMO}=.66$ and the KMO -values for the individual predictors (anti-image correlation matrix) range from . 58 to .70. Furthermore, correlations between predictors were large enough to conduct a PCA (Bartlett's test of sphericity $\chi^{2}(15)=$ 115.33, $p<.001$ ). In Table 2.3 the factor loadings after rotation (Direct Oblimin) are presented.

[^7]:    ${ }^{11}$ We checked whether these results can be attributed to a differential reliability of the measurements for the native-Dutch and language-minority students. Therefore, we corrected the correlations between reading comprehension, knowledge and fluency in the two subgroups for attenuation. It appeared that these corrected correlations still differed significantly between the two groups. For the native-Dutch students, the corrected correlation between reading comprehension and knowledge is .44 ( $p<.05$ ), for the language-minority students it is $89(p<.001)$ This difference is significant (Fisher $Z=3.5, p<.001$ ). For the nativeDutch students, the corrected correlation between reading comprehension and fluency is -. 70 ( $p<.001$ ), for the language-minority students it is -.13 (not significant). This difference is also significant (Fisher $Z=2.7, p<.01$ ).

[^8]:    12 This chapter has been submitted as:
    Trapman, M., Van Gelderen, A., Van Schooten, E., \& Hulstijn, J. Reading comprehension level and development in native and language-minority adolescent low achievers: Roles of linguistic and metacognitive knowledge and fluency.
    The first author was the principle investigator of this study. The other authors acted as either methodological advisor (Van Schooten) or supervisors (Hulstijn and Van Gelderen).

[^9]:    ${ }^{13}$ We accepted two exceptions to this rule. Two native students have one parent who was born outside the Netherlands. We decided to include these students after verifying that Dutch is the only language spoken at home for these students.

[^10]:    ${ }^{14}$ In the Netherlands, most of the language minority secondary-school students are from the second generation Turkish and Moroccan immigrants. In general, their families have low socioeconomic status, low level of education and low levels of professional training (Tesser \& ledema, 2001). At home, the language spoken by their parents is often the ethnic group language, although Dutch may be used beside this home language. Outside the domestic environment, for example, at school, Dutch is the language that is primarily used.
    ${ }^{15}$ Thirteen students dropped out of the study for different reasons (chronical illness, change of school and the burden of the requirements of research participation). $t$-tests showed no significant difference between the students dropping out and the remaining students in our sample on any of the measured variables.

[^11]:    ${ }^{16}$ Repeated-measures ANOVAs on each of the components of reading comprehension show that all students improve on these components, although there are no significant differences in growth between the native-Dutch and the language minority students.

[^12]:    ${ }^{17}$ This chapter has been submitted as:
    Trapman, M., Van Gelderen, A., Van Schooten, E., \& Hulstijn, J. Writing proficiency level and writing development of low-achieving adolescents: Roles of linguistic knowledge, fluency and metacognitive knowledge.
    The first author was the principle investigator of this study. The other authors acted as either methodological advisor (Van Schooten) or supervisors (Hulstijn and Van Gelderen).

[^13]:    ${ }^{18}$ We accepted two exceptions to this rule. Two native-Dutch students have one parent born outside the Netherlands. We decided to include these students after verifying that Dutch is the only language spoken at home for these students.

[^14]:    ${ }^{19}$ In the Netherlands, most of the secondary-school students from immigrant backgrounds are from the second generation Turkish and Moroccan immigrants. In general, their families have low socioeconomic status, low level of education and low levels of professional training (CBS, 2012; Tesser \& ledema, 2001). At home, the language spoken by their parents is often the ethnic group language, although Dutch may be used beside this home language. Outside the domestic environment, for example, at school, Dutch is the language that is primarily used.
    ${ }^{20}$ Twelve students dropped out of the study for different reasons (chronical illness, change of school and the burden of the requirements of research participation). $t$-tests showed no significant difference between the students dropping out and the remaining students in our sample on any of the measured variables.

[^15]:    ${ }^{21}$ Cronbach's alpha coefficient for the typing speed test were . 96 (Grade 7), . 94 (Grade 8) and . 95 (Grade 9).

[^16]:    ${ }^{22}$ During the three years of the longitudinal study students spread into diverse classes. In the analysis we chose to use the categories based on in which class they were in the first year of the study.
    ${ }^{23}$ Coded as 0 (Grade 7), 1 (Grade 8), and 2 (Grade 9).
    ${ }^{24}$ Coded as 0 (native-Dutch students) and 1 (language-minority students).

[^17]:    ${ }^{25}$ Improvement is also present between Grade 7 and $8(Z=4.38, p<.001)$ as indicated in the Time of measurement (2) row in Table 4.2. An additional analysis indicates that there is growth between Grade 8 and Grade $9(Z=1.99, p<.05)$ as well.

[^18]:    ${ }^{26}$ These numbers represent the variance at class and student level together in order to make them more easily comparable to the variance that is explained in the reading comprehension variance. (In the analyses of writing proficiency a class level was included, whereas in the reading analyses this was not necessary.)

[^19]:    ${ }^{27}$ We ran an additional multi-level regression analysis (conform the repeated measures analyses performed in Chapter 3), and found that a model including orthographic knowledge did not significantly improve model fit over a model including only time of measurement and language background as predictors ( $\Delta \mathrm{I} G \mathrm{LS}=2.9$ ).

[^20]:    ${ }^{28}$ We checked for interaction effects of fluency variables and students' background on reading comprehension but no significant interactions were found (Chapter 3), indicating that the relative contribution of fluency on reading comprehension is not significantly different between the native-Dutch students and the language-minority students in the period covering Grade 7-9.

[^21]:    29 Adding reading comprehension in a model predicting writing proficiency leads to a significantly better model fit ( $\Delta \mathrm{I} G \mathrm{LS}=13.8, d f=1$ ) than a model only including significant component variables of writing.

