A componential approach to eighth graders' expository text comprehension

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Author contributions

Chapter 1

Welie, C., Schoonen R. & Kuiken, F.

Welie wrote this chapter. Schoonen and Kuiken acted as supervisors and commented on earlier versions of this chapter.

Chapter 2

This chapter is a slightly adapted version of:

Welie, C., Schoonen, R., Kuiken, F. & Van den Bergh, H. (in press). Expository text comprehension in secondary school: for which readers does knowledge of connectives contribute the most? *Journal of Research in Reading*. DOI: 10.1111/1467-9817.12090

Welie was the principal investigator for this article. He posed the research questions this article aimed to answer. In order to answer these questions, he recruited participants from three secondary schools to participate in the study. Welie also applied for approval from the Ethics Committee of the ACLC to carry out this study. In collaboration with coordinators from the participating schools, Welie set up a scheme to submit eighth graders from thirteen classes to seven tests and two questionnaires, one pertaining to reading motivation and one background questionnaire. Of these seven tests, five tests and the background questionnaire were used for the analyses in this article. Welie designed the knowledge of connectives test and the background questionnaire for this study specifically and he slightly adapted the tests that were used in previous studies. Together with test assistants Milana Baslerová and Merel Burghouwt, Welie administered the tests and entered the test scores in the statistics application SPSS. Welie performed the statistical analyses to answer the research questions from this study and wrote the article that described the results. Schoonen and Kuiken acted as supervisors and gave feedback on the instruments and earlier versions of the article. Based on the valuable comments from his supervisors, Welie rewrote and revised the paper until it was

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ready for submission. Welie submitted the article to the *Journal of Research in Reading* and received comments about two statistics issues from the editor of the journal, concerning controlling for curvilinear effects and the treatment of missing data, respectively. Welie asked for statistics advice from Van den Berg on how to deal with these two statistics issues. Based on Van den Bergh's advice, Welie performed additional statistical analyses, rewrote the paper and resubmitted it to the *Journal of Research in Reading*.

Chapter 3

This chapter is a slightly adapted version of:

Welie, C., Schoonen, R., & Kuiken, F. (under review). The relationship between higher order fluency and expository text comprehension in secondary school.

The procedure followed writing this article and the responsibilities of the authors are identical to the procedure and task descriptions of the authors for chapter 2: Welie was the principal investigator, while Schoonen and Kuiken acted as supervisors. Welie posed the research questions, recruited participants from three schools, asked for approval from the Ethics Committee to carry out the study, administered the tests, analyzed the data and described the results in the article. For this article specifically, Welie designed a text reading fluency test. Other tests used for the analyses in this article were used in previous studies and slightly adapted by Welie. Schoonen and Kuiken acted as supervisors and provided feedback on the instruments and earlier versions of this article. Welie used the feedback from his supervisors to rewrite the article until it was suitable for submission.

Chapter 4

This chapter is a slightly adapted version of:

Welie, C., Schoonen, R., & Kuiken, F. (under review). The role text structure inference skill plays for eighth graders' expository text comprehension.

The procedure followed writing this article and the responsibilities of the authors are identical to the procedure and task descriptions of the authors for chapter 2: Welie was the principal investigator, while Schoonen and Kuiken acted as supervisors. Welie posed the research questions, recruited participants from three schools, asked for approval from the Ethics Committee to carry out the study, administered the tests, analyzed the data and described the results in the article. For this chapter specifically, Welie designed a test to measure text structure inference skill. Welie also adapted the tests in this article that were used previously in other studies. Schoonen and Kuiken acted as supervisors and commented on the instruments and earlier versions of the article. Based on the valuable comments from his supervisors, Welie revised the article until it was suitable for submission.

Chapter 5

This chapter is a slightly adapted version of:

Welie, C., Schoonen, R. & Kuiken, F. (submitted). Eighth graders' expository text comprehension: do motivational aspects add to cognitive skills?

The procedure that was followed writing this article and the responsibilities of the authors are almost identical to the procedure and task descriptions of the authors for chapter 2: Welie was the principal investigator, while Schoonen and Kuiken acted as supervisors. Welie posed the research questions, recruited participants from three schools, asked for approval from the Ethics Committee to carry out the study, administered the tests, analyzed the data and described the results in the article. For this article specifically, Welie translated items from Guthrie et al.'s *Motivations for Reading Information Books School Questionnaire* (MRIB-S: Guthrie et al., 2009). Welie also added two motivational subscales to this questionnaire. Other tests used for this article were used in previous studies and were slightly adapted by Welie. Schoonen and Kuiken acted as supervisors and provided comments on the instruments and earlier versions of the article. Schoonen performed the confirmatory factor analyses reported in this paper to investigate whether motivational subscales

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had to be regarded as separate constructs. Based on the useful comments from his supervisors, Welie revised the article until it was suitable for submission.

Chapter 6

Welie, C., Schoonen R. & Kuiken, F.

Welie wrote this chapter. Schoonen and Kuiken acted as supervisors and commented on earlier versions of this chapter.

Chapter 1 General introduction

1.1 Background

In secondary school text comprehension is an indispensable skill: it is a prerequisite for students to learn from their history, geography or biology school book texts. Yet a large proportion of students fails to achieve the desired level of text understanding (Hacquebord, Linthorst, Stellingwerf, & de Zeeuw, 2004; Inspectie van het onderwijs, 2008; Kamil, 2003; Lemke et al., 2004; OECD, 2003; 2007; Perie, Grigg, & Donahue, 2005). For example, in the Netherlands 20 to 30 percent of seventh graders have been estimated to be unable to understand their school book texts (Hacquebord et al., 2004), and about 25 percent of the eighth graders in the United States seem to have insufficient text comprehension skills to understand their school books (National Centre for Education Statistics, 2003). Moreover, inadequate text comprehension skills may not only hamper secondary school students in learning from their school book texts - and subsequently frustrate their school success - but text comprehension is also an essential skill in adult life. That is, secondary school students will eventually need to participate as citizens and workers in society. A full participation in modern society is not possible without adequate text comprehension skills. As a citizen, one needs to understand letters from municipalities, insurance companies, tax authorities and so forth. And as a worker, even for blue-collar professions, reading comprehension skills become increasingly important as written (digital) communication is becoming more and more standard.

Inadequate text comprehension skills have been shown to be an issue particularly for readers with a language minority background who do not speak the majority language at home. In several countries these readers have been shown to perform worse on reading comprehension tests in the majority language than their monolingual peers (for a review in North-American context, see August & Shanahan, 2006; for the Netherlands, see, for example Aarts & Verhoeven, 1999; Trapman, van Gelderen, van Steensel, van Schooten, & Hulstijn, 2014; Van

Gelderen et al., 2003). The most important reason for this difference is assumed to be language minority students' lower linguistic knowledge levels in the majority language (e.g., Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis, Lindsey, & Bailey, 2004; Páez, Tabors, & López, 2007; Swanson, Sáez, & Gerber, 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000). In addition to language background, socio-economic status (SES) - often confounded with language background - has been linked to reading and language proficiency too: students from families with a low SES are more at risk of lower reading and language proficiency than their peers who grow up in families with an average or a high SES (OECD, 2006).

In Amsterdam-West, where most secondary schools have a large population of students with a language minority background and a low SES, a consortium of fourteen secondary schools initiated a project entitled OTAW ("Opbrengst Taalonderwijs Amsterdam-West", which translates into 'Results of Language Education Amsterdam-West'). The first aim of this project was to investigate students' level and development of expository text comprehension and vocabulary knowledge in the first three years of secondary education (grades seven to nine, age range twelve to sixteen). A second aim of this project was to investigate relationships between students' language proficiency and language education characteristics. The OTAW project served as the stepping stone for the dissertation at hand. In the next section of this introduction (section 1.2), we will summarize the outcomes of the OTAW project, which have been described more extensively in three research reports (Kuiken, 2012; Welie, 2013a; 2013b). In section 1.3, we will zoom in on the notion of text comprehension; we will describe the hierarchical nature of text comprehension and the reading processes involved at each level of the hierarchy. Next, in section 1.4, we will summarize what is known from earlier research on the components that bring about text comprehension at various textual levels. Lastly, in section 1.5, we will describe how components identified as key to text comprehension in earlier research form the foundation for the present dissertation, which investigates components associated with individual differences in eighth graders' expository text comprehension. In this section we will also

formulate our research questions, and we will discuss how each chapter of this dissertation will provide an answer to parts of these questions.

1.2 Summary of the results of the OTAW project

1.2.1 Language proficiency in Amsterdam-West

Of the fourteen schools in Amsterdam-West that participated in the OTAW project, twelve schools tested their students' expository text comprehension and vocabulary knowledge levels. Three cohorts, each compromising approximately 1500 students, were tested at these twelve schools. Students from these twelve schools received education at different educational levels, ranging from prevocational (lowest level) to pre-university education (the highest level). The first cohort started secondary school (grade seven) in school year 2010-2011 and was tested on their expository text comprehension skills at the start and end of grade seven and at the end of grades eight and nine. Vocabulary knowledge was tested at the same time intervals, except for ninth grade, since there was no vocabulary test for this grade available in the test suite used by these schools. The second cohort started secondary school in school year 2012-2013 and was tested in grades seven and eight, whereas the third cohort of students, which started secondary school in school year 2013-2014, was tested only in grade seven.

Students were administered vocabulary knowledge and expository text comprehension tests from the Dutch test suite *Diataal* (Hacquebord, Stellingwerf, Linthorst, & Andringa, 2005). Expository text comprehension was tested using texts that were representative of school book texts. For each test administration from seventh to ninth grade, *Diataal* has set guidelines for students' expository text comprehension and vocabulary knowledge levels. For expository text comprehension, this norm is linked to the reference levels for reading described in the Framework for Language and Mathematics, as developed under the authority of the Ministery of Education, Culture and Science in the Netherlands (Referentiekader Taal en Rekenen, Commissie Meijerink, 2009). As secondary school education in the Netherlands is divided into various educational tracks, the Framework for

Language and Mathematics describes the language proficiency level that should be attained at the end of secondary school for each track. At the end of primary school, when starting secondary school, all students should have attained level 1F. The 1F level entails that a student is able to read and comprehend simple expository texts about everyday topics and topics close to the student's social world. Level 2F should be attained at the end of the lower tracks in prevocational education (in Dutch: vmbo-b or vmbo-k). At the 2F level students should not only be able to read and comprehend expository texts about everyday topics and topics close to their social worlds, but also about topics that are more distant from their own social worlds. Level 3F should be attained at the higher tracks in prevocational education or general secondary education (in Dutch: *vmbo-gl*, *vmbo-tl* and *havo*). At this level students are able to read and comprehend fairly complex expository texts about a wide variety of topics. Level 4F is required at the end of pre-university education (in Dutch: vwo). Students who have attained level 4F are able to deal with complex expository texts about a wide variety of topics.1 Appendix I provides more information about the Dutch educational tracks.

1.2.1.1 Expository text comprehension

Results from the OTAW project indicated that students from the lower tracks in prevocational education (*vmbo-b/vmbo-k*) did not meet the standards for expository text comprehension from grades seven to nine. At the end of grade nine, expository text comprehension levels for these students were only slightly above the standard for the initial level at seventh grade (the 1F-level). These results are worrying, as students from the lower prevocational tracks have to attain level 2F by the end of grade ten. Students from the highest tracks in prevocational education (*vmbo-t*) also scored below standard for grades seven to nine: at the end of ninth grade, these students' expository text comprehension levels were slightly above the standard set for the end of seventh grade. Again, this is worrisome, as students from the higher

¹ For a more elaborated description of the F-levels in terms of test characteristics and tasks see the Framework for Language and Mathematics which is available via the following link: http://www.taalenrekenen.nl/downloads/referentiekader-taal-en-rekenenreferentieniveaus.pdf/

levels of prevocational education are expected to reach level 3F by the end of secondary education.

The picture was somewhat rosier for students from general secondary education (*havo*). In grade seven and eight these students met the standard for expository text comprehension. However, expository text comprehension levels unfortunately did not improve in grade nine; at the end of grade nine, students' expository text comprehension levels were similar to those at the end of grade eight, and below the standard. The general picture for students in the general secondary education track was that growth in expository text comprehension was strongest in grade seven, smaller in grade eight and non-existent in grade nine. A similar trend was visible for pre-university students. Figure 1.1 shows the standard set and the mean expository text comprehension score for each educational level from grades seven to nine for cohort 1, i.e. students who started secondary school in 2010 (note that results were comparable across cohorts).

Another way of evaluating students' expository text comprehension development is through a comparison with their peers. To this end, students were categorized in percentile bands that represented how students performed relative to their peers (in the Netherlands) who received instruction at the same educational track. Most of the twelve participating secondary schools appeared to have a high proportion of students that were among the 25% weakest readers in their educational track. For some schools half or more than half of the students belonged to the 25% weakest readers (see Welie, 2013a for details). These results underscore that expository text comprehension is a problem for many secondary school students who participated in the OTAW project.

For students from cohort 1, it was also investigated how language background and SES were related to expository text comprehension outcomes. It was found that monolingual Dutch students outperformed bilingual (language minority) Dutch students on expository text comprehension from grades seven to nine. This is in line with previous studies that have found differences in reading comprehension levels between these two groups in favor of the monolinguals (for a review in North-American context see August & Shanahan, 2006; for the

Netherlands see for example Aarts & Verhoeven, 1999; Trapman et al., 2014; Van Gelderen et al., 2003). Mean socio-economic status of the students, as measured by mean educational level of parents/caretakers using the SOI-index², appeared to be low: the mean of the parents/caretakers' highest completed educational level was equal to having completed the first years of secondary education or having attended a short course after primary education, such as a language course (no prevocational courses). Socio-economic status correlated positively, but only weakly (correlations below .30), with students' expository text comprehension outcomes in grades seven to nine.

1.2.1.2 Vocabulary knowledge

Results for vocabulary knowledge in the OTAW project were more or less equal across cohorts. Figure 1.2 shows the results of vocabulary knowledge for cohort 1. For students from the lowest prevocational track (vmbo-b/vmbo-k) there is a remarkable discrepancy between vocabulary knowledge and expository text comprehension performances: whereas there is almost no improvement in expository text comprehension for students from this track (see Figure 1.1), vocabulary knowledge levels of these students increase according to the prescribed standard. On the other hand, for students from the other tracks, performance for vocabulary knowledge is generally in accordance with that for expository text comprehension. That is, students from the highest prevocational track (*vmbo-t*) perform below standard for vocabulary knowledge in grades seven and eight, parallel to their expository text comprehension results. Similar outcomes are achieved by students from the higher general secondary education track (havo) as for both vocabulary knowledge and expository text comprehension the standard in grade seven and eight is met. Also, for students from the pre-university track (vwo), expository text comprehension and vocabulary knowledge develop in parallel in grade eight: in this grade both vocabulary knowledge and expository text com-

² The SOI-index (StandaardOnderwijsIndeling; "Standard for classifying educational level") classifies one's highest completed educational level on a scale from one to seven; level one signifies the lowest educational level and level seven the highest possible educational level. The SOI is retrieved from: http://www.cbs.nl/nl-

NL/menu/methoden/classificaties/overzicht/soi/2006/default.htm



General introduction 7

Mean expository text comprehension level



Figure 1.2 Mean vocabulary knowledge level of the students from cohort 1 for the various educational levels in grades seven and eight, as well as the norms for vocabulary knowledge for these levels.

8 Individual differences in reading comprehension

prehension score were just below the standard. At the end of grade seven, however, results for reading comprehension and vocabulary knowledge differs for preuniversity students: whereas for expository text comprehension the standard was met, this was not the case for vocabulary knowledge.

Lastly, students from the higher general secondary education track (*havo*) and the pre-university track (*vwo*) show a remarkable difference in growth curves for vocabulary knowledge compared to those for expository text comprehension: for students from both tracks expository text growth diminishes in grade eight, while this is not the case for vocabulary knowledge growth.

In a similar vein as for expository text comprehension, students were compared with their peers in the same educational track for the development of vocabulary knowledge. The results were similar to those for expository text comprehension: for eleven out of twelve secondary schools in the OTAW project (see Welie, 2013a for details), more than 25% of the students (ranging from 26.3% to 83.3%) belonged to the 25% lowest scoring students for vocabulary knowledge in grades seven to nine. This outcome underscores that most students attending the secondary schools that participated in the OTAW project have less vocabulary knowledge than their peers in the Netherlands from the same educational level. This leads to particular educational challenges for their teachers.

Finally, language background and SES were related to vocabulary knowledge levels as well. Monolingual students (cohort 1) outperformed their bilingual peers with a language minority background in grades seven and eight in vocabulary knowledge. Correlations between SES and vocabulary knowledge were again positive and weak.

1.2.2 Results of language education in Amsterdam-West

The goal of the OTAW project was not merely to describe language proficiency levels, but also to link students' language proficiency levels to particular characteristics of language education, and in particular, to identify 'best practices' that can improve students' vocabulary knowledge and expository text comprehension levels. In order to get a better understanding of this issue, the

following information about language education was collected from each secondary school participating in the OTAW project through questionnaires and interviews: teaching method used for Dutch language arts, time spent per week on Dutch language arts, instruction methods in language arts classes, remedial activities for language and reading problems, and courses teachers attended that were directed at improving their skills in teaching language and reading development.

1.2.2.1 Dutch language arts classes

Schools used one of the following three teaching methods for Dutch language arts instruction: *Op Nieuw Niveau*, *Taaldomein* or *Talent*. It could not be established whether one of these three methods resulted in better expository text comprehension outcomes than the other methods. Also, time spent on Dutch language arts did not appear to be a significant predictor of expository text comprehension outcomes: despite large differences between schools in time spent per week on language arts, ranging from 180 to 300 minutes, schools attained comparable expository text comprehension levels across educational tracks. A possible explanation of why the amount of time spent on language arts classes was not a predictor for expository text comprehension outcomes could be the quality of language arts classes. Although we did not *compare* schools that participated in the OTAW project on the instructional quality of language arts classes in various schools. To that end, an online questionnaire about instruction in the language art classes was filled out by 55 Dutch language arts teachers.

Results obtained with through this questionnaire revealed that there was room for improvement in terms of embedding writing and reading education in meaningful tasks (see Welie, 2014 for a more detailed description). According to advocates of a 'contextualized' approach (e.g., Guthrie et al., 2004; Hajer, Meestringa, & Tordoir, 2009; Pressley, 2006), a key characteristic of effective language teaching is that technical aspects of language should be embedded in meaningful tasks: for example, a focus on spelling when writing a letter of application. Results from the questionnaire, however, revealed that technical aspects

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of writing, such as grammar and spelling were mainly instructed in a decontextualized, isolated fashion. Neither was the instruction of reading comprehension strategies embedded in a meaningful context, for example by practicing reading strategies using history, biology or geography texts that students had to learn for an exam. Language art teachers did not use school book texts from other subjects to practice reading comprehension strategies, although using texts from other subjects could underscore the relevance of reading strategies for students. In line with results from our questionnaire, De Milliano (2013) also found, based on class observations, that instruction in language arts classes at the lower prevocational tracks mainly involved isolated spelling and grammar instruction and that texts of other school subjects were seldom used for the instruction of reading comprehension strategies.

Another remarkable outcome from the questionnaire was that individual and class reading were the most commonly used didactical approaches. Only a quarter of the language art teachers indicated they use twin or group reading in their classes. This seems a missed opportunity, as interactive reading methods have been demonstrated to improve students' reading comprehension and motivation in secondary school; two examples of such methods are CSR (Collaborative Strategic Reading: Vaughn & Klingner, 1999; Vaughn, Klingner, & Bryant, 2001) and PALS (Peer-Assisted Learning Strategies: Fuchs, Fuchs, & Kazdan, 1999; Mastropieri et al., 2001). Moreover, the few teachers that used twin or group reading did not seem to follow certain crucial best practices for successful collaborative reading instruction. For example, twin or group formation was not based on reading comprehension levels, even though it has been suggested that poor readers could learn from peers with better comprehension skills. Nor was twin or group reading characterized by a shared responsibility, which has been put forward as an important criterion for collaborative reading (see for example Palinscar & Herrenkohl, 2002). Shared responsibility can be created, for example, by means of role assignment: each student performs a particular role that contributes to finalizing the overall reading task; one student serves as chair, for example, while another student summarizes text information. Twin or group reading mainly involved discussing

comprehension questions after text reading. Practicing other language skills in relation to the reading task, for example writing, was rarely done, although it has been suggested that an integrative approach in which other language skills, such as writing, are practiced in parallel to reading improves the efficacy of reading instruction (e.g., Guthrie et al., 2004; Hajer et al., 2009; Pressley, 2006). Moreover, it appeared that twin or group reading seldom involved the practice of reading comprehension strategies, whereas shared cognition and the practice of reading strategies while reading out loud is one of the essential characteristics that approaches to collaborative reading share. Sharing cognition creates the possibility for students to learn from each other about ways to tackle comprehension problems during reading.

There was also room for improvement in terms of class reading instruction. Two thirds of the language arts teachers indicated that they did not model the use of reading comprehension strategies in front of the class by reading out loud and sharing cognition, although this type of exemplary behavior has been argued to be necessary for students in order to become successful in performing reading strategies on their own (e.g., Davey, 1983; Duffy, Roehler, & Herrmann, 1988; Paris, Wasik, & Turner, 1991). Furthermore, answers from the questionnaire indicated that many of the language arts teachers did not instruct reading strategies at all stages in the reading process (before, during and after reading), as well as explaining to students how, when and why reading strategies are applied. It also turned out that class reading was mainly teacher centered and that students could be more involved in meaning construction during class reading (see for example Reciprocal Teaching (RT): Palinscar & Brown, 1984; 1989); think, for instance, of, letting students explain difficult words from a text to each other, instead of relying on teacher explanation. Another example is letting students ask each other questions about the text, instead of the teacher raising questions.

Outcomes from the questionnaire also indicated that tailored reading comprehension education, whether based on a variety of exercises, texts or instructional activities, is not the standard. Even in a stratified school system as in the Netherlands, it is important to match reading comprehension level with text difficulty, exercises and instructional needs, due to differences in reading comprehension within classes.

The questionnaire also revealed that the use of various text types in reading comprehension education is not common. Language arts teachers indicate that they mainly use texts from the Dutch language art methods or texts from newspapers (also adapted to students' reading comprehension level) for instructional purposes. As mentioned before, language art teachers seldom used texts from other school books, for example from biology or history books, for reading instruction. It is, however, important that students practice their reading comprehension skills with a broad variety of texts and that students get acquainted with the specific characteristics of each type of text. This is especially relevant because knowledge about text structure is associated with reading comprehension skill (Meyer, Brandt, & Bluth, 1980; Meyer & Ray, 2011).

In addition, the questionnaire revealed that students are not able to choose the texts they want to read, even though offering a choice to students appears to increase reading motivation and comprehension (Guthrie et al., 2004; Guthrie, Wigfield, & You, 2012). Text choice may easily be integrated in the class room; for example, a couple of texts about the same topic from which students may select the text they want to read. Providing text choice for the practice of reading comprehension strategies may also increase motivation for the application of reading strategies; students will probably put more effort in applying reading comprehension strategies when reading a biology text of which the content will be examined the day after.

1.2.2.2 Remedial activities and courses for teachers

Schools of the OTAW project initiated a wide variety of remedial activities, participated in various projects to promote reading and teachers of these schools took several language related courses. Unfortunately, it was not possible to draw conclusions about the effect of separate remedial activities, as schools differed on many activities other than these remedial activities. Effects of remedial activities could therefore not be studied in isolation, as would be the case in experimental

settings where groups are compared on the basis of a single intervention, while other educational characteristics are kept (roughly) equal.

Nevertheless, two findings revealed that any kind of reading remediation seems better than no remedial activities at all. First, one school that initiated remedial activities in grade seven in one school year, but not in another year, showed a reduced percentage of poor readers in various educational tracks at the end of grade seven in the year when the school offered remedial activities. Second, another school that did not offer remedial activities at the highest prevocational and general secondary educational tracks in grade seven was the only school that did not show a decline in the percentage of poor readers for these tracks.

Furthermore, remedial activities that take into account the specific needs of readers (i.e. tailored instruction) seemed most effective in dealing with reading problems. Readers with average or poor reading skills (compared to peers on a national level) were classified by their reading comprehension scores in one of three reader types. Those classified as problem readers were characterized by problems at all textual levels (sentence, paragraph and text level). The bottom-up readers were the ones with no problems at the word and sentence level of understanding but with a restricted global text understanding (i.e. paragraph and text level), whereas the compensating readers showed appropriate global understanding but nevertheless had comprehension problems at the word and sentence level. Schools that offered instruction focused at the specific needs of these reader types using the method Diaplus showed a consistent decline in the percentage of poor readers at all educational levels. Other remedial activities that did not take reader type into account were less consistent in their results across educational levels. The success of Diaplus might depend on the use of expository texts as instruction material, as the reading comprehension test consisted of the same type of texts.

Another interesting finding is related to the selection of readers for remediation. One school not only offered remedial activities to poor readers, but also to students with average reading skills in grade seven. At this school, a large proportion of students with average reading skills at the start of grade seven developed towards being good readers (in comparison to peers from the same educational level) at the end of grade seven, whereas at schools that did not offer remedial activities to average skilled readers, most of these readers had to be considered weak readers at the end of grade seven, when compared to peers from the same educational level. This outcome stresses the relevance of selecting readers with average reading comprehension skills for remediation purposes: if these readers are not selected for remedial activities in grade seven, they fall behind and become weak readers.

Also worth mentioning is that the school that attained the best reading comprehension results took a total of six remedial measures to increase students' language development, whereas other schools took only some of these measures. Although it was not possible to pinpoint which of these six measures were key to improving students' reading proficiency, it could well be that the strength lies in the combination of these measures. These measures were: i) selecting both readers with average reading comprehension skills and weak readers for remedial activities (as mentioned in the previous paragraph); ii) offering tailored instruction to the readers selected for remediation (see earlier this section); iii) providing an extra class of one hour a week for students (i.e., in addition to the language arts classes) aimed at improving students' ability to deal with difficult texts and at increasing their vocabulary knowledge; iv) instructing students to use a note book to write down difficult words during science and social class studies; v) increasing parent involvement in improving students' language proficiency: parents/caretakers signed a contract in which they promised to ensure that their child reads 30 minutes a day at home; vi) offering teachers a course that addressed the importance of academic word knowledge and the way in which teachers could provide language support in their classes.

1.3 Text comprehension at various levels

In the previous section describing the results of the OTAW project, we did not zoom in on the notion of text comprehension. In this section, we will describe what it

actually means to comprehend a text by describing the various levels of text comprehension and the reading processes involved at each level.

Text comprehension involves the construction of a mental representation of a text (Kintsch & Rawson, 2005; Kintsch, 1998; Perfetti, 1999; Perfetti, Landi, & Oakhill, 2005; Zwaan & Radvansky, 1998). Executing reading processes at the word, sentence and text level results in the construction of such a mental representation. At the word level, words have to be decoded and the lexical semantic information encoded in these words has to be retrieved from the mental lexicon. At the sentence level, integrative processes are executed that result in an understanding of the way constituents in a sentence relate to each other. At the text level, integrative processes occur as well: the mental model is constantly updated by adding information from sentences to the already constructed model. In order to update the mental model the relationship between sentences has to be inferred. Furthermore, reading processes at the text level take place that are concerned with inferring the structure or topic of larger text parts (text sections, paragraphs, etc.) and their interrelationships. Word and sentence level comprehension has been referred to as local text comprehension or microstructure formation, whereas above sentence level comprehension is usually referred to as global text comprehension or macrostructure formation (see e.g., Kintsch & Rawson, 2005).

Because a text is never fully explicit, local and global text understanding requires a reader to make inferences (Kintsch & Rawson, 2005; Kintsch, 1998; Perfetti, 1999; Perfetti et al., 2005; Zwaan & Radvansky, 1998), i.e. to fill the gaps in a text at the local and global level. For example, when reading the two sentences "Peter parked the truck. He locked the door" a bridging inference is required for local understanding: the reader has to infer that *the door* is the *door of the truck*. Gaps may also need to be filled at the global level; for instance, in a text where the topic of a text is not mentioned explicitly and left for the reader to infer.

Based on the notion that text comprehension involves more than what is explicitly mentioned in a text, Kintsch (1998) distinguished between a textbase and a situation model representation of a text. A textbase representation equals the meaning of the text without adding anything to the text not mentioned explicitly. A situation model, on the other hand, is a representation of the situation a text describes and is the result of an integration of text-derived and knowledge-derived information. In Figure 1.3, in the center part of the figure, the hierarchical nature of text comprehension is depicted as described above.

1.4 Individual differences in text comprehension

The goal of text reading is to build a coherent situation model of a text. This goal is not accomplished equally well across readers, because they differ in the successful execution of the word, sentence and text level processes underlying text comprehension. In turn, these varying degrees of success, have been related to differences between readers in the cognitions that bring about successful execution of reading processes. Some of these cognitions are more clearly related to comprehension at a specific text level, whereas others are involved in comprehension at various text levels.

Decoding skill, for example, is a skill identified as key at the word level (e.g., Kintsch, 1998; Perfetti, 1999); the process of decoding is necessary to convert the letters of words into a meaningful unit. Not surprisingly, vocabulary knowledge is also essential at the word level; without knowledge of a word, successful word decoding will not be very helpful for word identification, because no lexical semantic information from the word can be retrieved from the mental lexicon (studies stressing the importance of vocabulary knowledge for reading comprehension are for example: Beck, Perfetti, & McKeown, 1982; Carlisle, 2007; McKeown, Beck, Omanson, & Perfetti, 1983; Nagy, 2007; Stahl & Fairbanks, 1986; Van Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn, 2007). Syntactic knowledge, or grammar knowledge, has been argued to relate to differences in processing success at the sentence level (Oakhill, Cain, & Bryant, 2003; Stothard & Hulme, 1992). An individual's working memory capacity has also been proposed as a cause for differences in sentence comprehension success: a low working memory capacity may serve as a processing bottleneck (e.g., Daneman & Carpenter, 1980; Seigneuric, Ehrlich, Oakhill, & Yuill, 2000). The idea of the bottleneck is that under





described by Kintsch (1998).

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high processing demands readers with lower working memory capacity are less successful in holding and integrating sentence information in working memory, with poorer sentence comprehension as a result. Because of working memory's function of holding and integrating information, differences in working memory capacity are also likely to play a role at text level comprehension (cf., Daneman & Carpenter, 1980). Inference skill, as already mentioned in the previous section, plays a role both at the local and global level of text understanding, namely to fill in the information left implicit in the text. Proficiency in inference skill has been argued to depend on differences in adequate textbase construction, reader goals, working memory capacity and general knowledge (Perfetti et al., 2005; Yuill & Oakhill, 1991). It is important to note that inferences can be classified in many types - automatic, controlled, text-based, knowledge-based, etc. (see for example, Kintsch, 1993) - and that it may depend on the type of inference which cognitions are required for successful execution.

The skills mentioned in the previous paragraph suffice to explain individual differences in text comprehension according to the simple view of reading (Gough, Hoover, & Peterson, 1996; Gough & Tunmer, 1986; Hoover & Gough, 1990). In this simple view, reading comprehension is described as the product of two components: decoding skill and listening comprehension. The listening comprehension component is similar to the reading comprehension component in the sense that it is a complex skill dependent on the cognitions mentioned in the previous paragraph: vocabulary knowledge, syntactic knowledge, working memory capacity and inference skill.

The simple view of reading, however, does not take into account a crucial distinction between listening and reading. When reading, as opposed to listening, the text remains available, which leaves more room for the application of reading strategies, such as strategic behavior to compensate for reading problems (cf., Kirby & Savage, 2008). Readers may, for example, strategically infer the meaning of an unknown word by using context or they may reread text parts if they notice their concentration was lost reading a particular text part. Given the importance of strategic behavior for skilled reading, it has been argued that reading strategies

should be added to the simple view of reading (Kirby & Savage, 2008). In accordance with this view, knowledge about reading strategies (metacognitive knowledge) has been identified as an important contributor to text comprehension in addition to linguistic knowledge (e.g., Cromley & Azevedo, 2007; Schoonen, Hulstijn, & Bossers, 1998; Trapman et al., 2014; Van Gelderen et al., 2007). Knowledge about reading strategies is associated with the application of reading strategies intended to improve comprehension at the word, sentence and text level. At the word level, for example, knowledge about reading strategies may be applied to infer the meaning of unknown words. At the text level, knowledge about reading strategies and text structure may lead a reader to direct his attention to headings or titles to infer the global structure of a text.

Apart from metacognitive knowledge and reading strategies, another proposed addition to the simple view of reading is fluency in lower-order processing, i.e. word and sentence level processing. Under the assumption that working memory capacity is limited for all readers, several researchers have argued that fluency in lower-order processes is also essential, in addition to the successful execution (accuracy) of these processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). These researchers argue that fluency in lower-order processes is a prerequisite in order to have working memory capacity free for the successful execution of higher order comprehension processes. According to this view, word reading fluency and sentence reading fluency are essential components in text comprehension as well. In other words, while knowledge is important, fluent access to this knowledge is considered crucial too.

Figure 1.3 shows the abovementioned cognitions and how they relate to text comprehension at various levels. The center of the figure illustrates how the various levels of text comprehension are embedded, while the left and right sides of the figure depict the cognitions that contribute to comprehension at various text levels (arrows indicate influence). Note that Figure 1.3 depicts a simplified model, offering a general overview of the components that contribute to text comprehension for the purpose of the present dissertation. As such, our model does not aim to
provide a detailed description of how the components contribute to each other. For the same reason, we have not indicated in our model in which way the cognitions interact in their contribution to text comprehension. Furthermore, in the context of the present dissertation, we did not depict further subcomponents associated with the abovementioned cognitions. For example, Figure 1.3 does not take into account that decoding skill in itself depends on other cognitions, such as orthographic knowledge and phonological awareness (see for example Perfetti, 1999).

1.5 Individual differences in eighth graders' expository text comprehension

The previous section indicates that there is more to text comprehension than vocabulary knowledge. This appears to be the case for expository text comprehension as well, as findings from the OTAW project have shown that vocabulary knowledge and expository text comprehension do not develop in parallel (see section 1.2). Two examples of this lack of parallel growth were i) the difference between adequate growth in vocabulary knowledge and lack of substantial growth in expository text comprehension in grade eight and nine in the higher tracks, while vocabulary knowledge showed a more linear growth.

The idea that vocabulary knowledge is not sufficient to account for the differences in expository text comprehension raises the question of which other individual differences between readers are related to expository text comprehension in secondary school. With the results from earlier research as described in the previous section as a starting point, we set the goal of investigating which individual differences matter for eighth graders' expository text comprehension. We consider it important to focus on expository texts in the broader context of secondary school readers struggling with expository text comprehension (e.g., Hacquebord et al., 2004; Kamil, 2003; Lemke et al., 2004; OECD, 2003; 2007; Perie et al., 2005), and in the more specific context of our population in Amsterdam-West, where many

students, especially those with a language minority background, are facing difficulties with understanding expository texts.

In order to better understand the individual differences that are essential to expository text comprehension skill, we will measure eighth graders' expository text comprehension and several components that are potential sources for individual differences in expository text comprehension. Four components are central to this dissertation, namely knowledge of connectives, text reading fluency, text structure inference skill and reading motivation. Sentence reading fluency, general vocabulary knowledge and metacognitive knowledge serve as control variables to obtain a better understanding of the specific importance of these four components. Figure 1.4 shows the predictors of expository text comprehension included in this study.

This dissertation aims to answer two questions concerning the four components central to this dissertation. The first one is whether these four components account for unique variance in expository text comprehension, when controlling for the variance accounted for by the control variables. The second question is whether the predictive value of these four components depends on readers' cognitive resources and language backgrounds. These two research questions will be examined for each of the four components in a separate chapter of this dissertation: knowledge of connectives in chapter 2, text reading fluency in chapter 3, text structure inference skill in chapter 4 and reading motivation in chapter 5. In chapter 6, the results of the preceding chapters will be discussed.

Our study builds on previous research on individual differences in text comprehension, in the sense that it examines four components that have been understood less well in the context of expository text comprehension, while taking into account three control variables that have been shown to relate to text comprehension in secondary school readers (e.g., Trapman et al., 2014; Van Gelderen et al., 2003). We are well aware of the fact that these control variables do not do justice to the full set of components identified by previous research (see previous section) as being important for text comprehension, but for practical reasons we have to choose an appropriate subset of the cognitions identified in earlier studies. In the remainder of this chapter we will first explain our choice of

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control variables. Then, we will discuss for each of the four key components how they are considered to play a role in text comprehension and why there is reason to believe that they have unique predictive value for expository text comprehension (research question 1). Figure 1.4 shows how each component potentially contributes to various levels of text comprehension. Lastly, we will discuss why the predictive value of these key components might vary depending on readers' cognitions and language backgrounds (research question 2).

1.5.1 Rationale for choice of control variables

The choice of our control variables is based on the cognitions identified as important to text comprehension in previous research (see section 1.4). We choose control variables on the basis of three perspectives: fluency, vocabulary knowledge and metacognitive knowledge. We consider it important to control for reading fluency, in accordance with the view that fluency of lower-order processing is important for higher-order comprehension processes. For expository texts, characterized as dense and difficult, we assume that fluency of lower order-processes is particularly essential, as expository texts may require relatively more effortful and strategic processing (as opposed to narrative text comprehension, for example). From a developmental point of view, we think a measure of reading fluency at the sentence level is more appropriate than one at the word level, as it has been shown that the relationship between word recognition skills and text comprehension is strong for novice readers but decreases with age (e.g., Adams, 1990; Francis, Fletcher, Catts, & Tomblin, 2005; Hoover & Gough, 1990; Van Gelderen et al., 2007). Moreover, studies with seventh and eighth graders have shown that word recognition was not a significant predictor of text comprehension, whereas sentence reading fluency was (Trapman et al., 2014; Van Gelderen et al., 2007).

We consider general vocabulary knowledge the best choice for a variable that controls for knowledge, taking into consideration general knowledge and syntactic (grammar) knowledge as well, as these have also have been argued to be important to text comprehension (see section 1.4). We consider general vocabulary knowledge a better choice than grammar knowledge on theoretical grounds: the

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importance of vocabulary knowledge for text comprehension is widely acknowledged (Kintsch, 1998; e.g., Perfetti et al., 2005), whereas the importance of grammar knowledge is more controversial (Perfetti et al., 2005). Moreover, from a statistical point of view, the exclusion of grammar knowledge as a predictor does not seem to be an issue either since grammar knowledge did not have unique predictive value for eighth graders' text comprehension accounting for vocabulary knowledge and metacognitive knowledge (Van Gelderen et al., 2004).³ Additionally, we can account for general knowledge in the selection of expository texts for our reading comprehension test, without negative consequences for a valid measurement of eighth graders' expository text comprehension. This makes vocabulary knowledge a better choice of predictor for expository text comprehension than general knowledge (or more specific topic knowledge) would be. By including expository texts about several topics in our reading comprehension test, as well as texts that are supposed to present unknown information to eighth graders, we will try to level out the influence of general knowledge. On the other hand, leveling out vocabulary knowledge as a factor in our reading comprehension test, for example by selecting expository texts with high frequent (easy) words, would lead to an invalid measurement of eighth graders' expository text comprehension.

We also consider metacognitive knowledge pivotal to expository text comprehension. The application of reading strategies may be especially important for expository texts considered dense and difficult by secondary school readers (Guthrie, Wigfield, & Klauda, 2012; Wigfield, Cambria, & Ho, 2012), and metacognitive knowledge serves as a necessary condition for the execution of strategic reading behavior, though insufficient by itself. In the present study, in accordance with other studies on individual differences in text comprehension in the Netherlands with readers comparable in age and grade level (Trapman et al., 2014; Van Gelderen et al., 2007), we define metacognitive knowledge more broadly than knowledge of reading strategies and include knowledge about writing strategies and

³ Note that, in a population of seventh graders, a lack of unique predictive value for text comprehension was established for working memory as well, on top of vocabulary knowledge and metacognitive knowledge (Trapman et al., 2014).

knowledge about text structure as part of our definition of metacognitive knowledge. Defining metacognitive knowledge in this broader sense makes it possible to compare our results to previous studies in the Netherlands. Another reason for defining metacognitive knowledge in a broader sense is that it enables us to use a test for metacognitive knowledge that has been shown to be reliable in previous studies in the Netherlands (Trapman et al., 2014; Van Gelderen et al., 2007).

1.5.2 Knowledge of connectives

In chapter 2 of this dissertation, we will examine whether knowledge of connectives has unique predictive value for expository text comprehension, taking into consideration the control variables mentioned in the previous section. Connectives are words that help to build the text base of expository texts by signaling coherence at the local and global text level. That is, connectives may signal relationships within or between sentences or may indicate the overall structure of expository texts. For instance, 'because' may express a causal relationship between two sentence parts, 'moreover' an additive relationship between two sentences, and 'therefore' may signal a problem-solution overall structure of an expository text.

Our motivation to examine the unique predictive value of knowledge of connectives is that, for secondary school readers, it has remained unclear how the contributions of general vocabulary knowledge and knowledge of connectives to expository text comprehension are related. Although we know from previous studies that connectives are important words in expository texts, as readers often need these words in order to establish the intended relationship between text parts (c.f., Degand, Lefèvre, & Bestgen, 1999; Degand & Sanders, 2002; Singer & O'Connell, 2003; Van Silfhout, Evers-Vermeul, Mak, & Sanders, 2014), it is unclear to what extent knowledge of connectives is a unique factor separate from general vocabulary knowledge, in an individual differences approach to expository text comprehension. In Chapter 2 of this dissertation, we will provide an answer to this question.

1.5.3 Text reading fluency

In chapter 3, we will scrutinize text reading fluency. We depart from the assumed necessity of fluent word and sentence level processes for the execution of above sentence level processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001) and hypothesize that the fluency of above sentence level processes may also determine whether other reading processes are executed successfully. Strategic reading processes concerned with textbase or situation model construction can be hampered when higher order processing is slow and effortful. Especially for expository texts, which are challenging in terms of attention, effort, reasoning, and strategic processing, speed in the execution of above sentence level processes (i.e. above lower-order fluency) could be an additional requirement for all higher order processes to be executed successfully. In chapter 3, we will discuss two unique above sentence level reading processes and we will examine to what extent the fluency of these processes is associated uniquely with eighth graders' expository text comprehension, controlling for sentence reading fluency, general vocabulary knowledge and metacognitive knowledge.

1.5.4 Text structure inference skill

Chapter 4 deals with text structure inference skill, which is defined as a reader's ability to infer the overall structure of a text. This overall structure can be signaled explicitly in the text by signaling words or phrases or may not be mentioned explicitly, left for the reader to infer. If text structure is signaled explicitly, text structure inference skill contributes to a macrostructure construction of the textbase, while, when the structure of a text is left implicit the inference of text structure enables a macrostructure construction of the situation model (see section 1.3 for the distinction between textbase and situation model).

Expository texts are often structured in one of the five following patterns: problem-solution, causation, description, comparison and collection/sequence (Meyer, 1985). We expect that readers who are able to infer these patterns (or top-

level structures) in expository texts, will be facilitated to store text information hierarchically. That is, once readers infer a certain top-level structure, this structure may be used as a scheme to make a distinction between more and less important text information and to store text information accordingly. Due to these processes, text structure inference skill is expected to be strongly related to text understanding.

The association between text structure inference skill and text comprehension is established by the seminal work of Meyer, Brandt and Bluth (1980). However, to date it has not been clarified whether text structure inference skill has unique predictive value for expository text comprehension, controlling for the other cognitions identified in earlier research. In chapter 4, this issue will be addressed by investigating whether text structure inference skill has unique predictive value for expository text comprehension while taking into account sentence reading fluency, general vocabulary knowledge and metacognitive knowledge.

1.5.5 Reading motivation

Chapter 5 addresses reading motivation. The relationship between reading motivation and expository text comprehension we assume to be of a different nature than that of the other three components central to the preceding chapters of this dissertation (i.e. knowledge of connectives, text reading fluency and text structure inference skill). In contrast to these three components, we theorize that reading motivation does not have a direct impact on one's text comprehension level, but that it moderates the effect cognitions have on expository text comprehension. To put it simply, we assume that people who are motivated to read expository texts fully exploit their cognitive resources for text understanding, whereas we do not expect less motivated readers to make full use of their cognitive resources. For example, a reader who is motivated to understand an expository text may use his metacognitive knowledge about reading strategies to overcome comprehension problems during reading, whereas an unmotivated reader with a comparable level of metacognitive knowledge is expected to engage less in appropriate reading strategies to overcome comprehension problems during reading, even when his knowledge about reading

strategies is sufficient to do so. The motivated reader thus is expected to benefit more from his metacognitive knowledge than his unmotivated peer. Figure 1.4 demonstrates that the moderating impact of reading motivation is hypothesized on six predictors of expository text comprehension: the three control variables (right hand side of the figure) and the three components of the preceding chapters (left hand side of the figure).

We consider reading motivation to be a multifaceted construct: one may hold various motivations to read, or to refrain from reading, expository texts. In chapter 5, we explore whether various motivations, drawn from various theoretical perspectives, have to be considered as separate constructs. In particular, the distinction between affirming motivations (i.e., motivations that correlate positively with text comprehension) and undermining motivations (i.e., motivations that correlate negatively with text comprehension) is of interest.

1.5.6 Language background as a moderator of the four components

The second research question in this dissertation is whether the contribution of knowledge of connectives, text reading fluency, text structure inference skill and reading motivation to expository text comprehension depends on a reader's language background and cognitive resources. We will investigate the role of language background by contrasting bilingual Dutch students with a language minority background with their monolingual peers. Because the former have been characterized by lower word and sentence reading fluency and less general vocabulary knowledge than their monolinguals peers (e.g., Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004; Páez et al., 2007; Swanson et al., 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000), they may need more attentional resources for word and sentence level processing. Given a limited working memory capacity, this may in turn restrict their ability to fully take advantage of their knowledge of connectives, text reading fluency and text structure inference skill. Furthermore, in order to fully benefit from fluent text reading, it has been argued that a certain linguistic knowledge level is required (e.g., Buly & Valencia, 2002; Crosson & Lesaux, 2010; Geva & Farnia,

2012; Marx et al., 2015; Trapman et al., 2014; Wiley & Deno, 2005), and the question is whether the bilinguals in our study have reached the required knowledge level to benefit from fluent text reading.

The bilinguals, being less fluent and having less general vocabulary knowledge, could also benefit more from text structure inference skill and reading motivation than their monolingual peers. Text structure inference skill could be more important for bilinguals, because they may direct their attention more to global text understanding as a compensating mechanism for problems at the word and sentence level (cf., Hacquebord, 1989; 1999). Reading motivation may play a larger role for bilinguals, as they are likely to need more effort and strategic behavior to grasp the meaning of a text than their monolingual peers do (due to less linguistic knowledge and lower reading fluency). Motivation may help bilinguals to persist despite comprehension problems, for example by initiating reading strategies to deal with comprehension problems during expository text reading.

1.5.7 Cognitive resources as moderators of the four components

We assume that it is not language background in itself, but rather lower levels of lower-order reading fluency and linguistic knowledge associated with certain language backgrounds, that potentially prevent readers from exploiting their knowledge of connectives, text reading fluency and text structure inference skill. We therefore consider it important to investigate whether the predictive value of knowledge of connectives, text reading fluency and text structure inference skill for expository text comprehension depends on readers' sentence reading fluency and general vocabulary knowledge.

For knowledge of connectives, we also put forward (chapter 2) that metacognitive knowledge may influence the advantage of knowing connectives. Readers with more metacognitive knowledge know better how texts are structured and know more about reading strategies than readers with less metacognitive knowledge. Readers with more metacognitive knowledge might therefore be more aware of the importance of connectives as markers of local and global text structure and, as a consequence, might be more inclined to focus on these words and use them

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to establish text coherence. Metacognitive knowledge might also play a role in the impact reading fluency and linguistic knowledge have on the contribution of knowledge of connectives; only for those readers with less knowledge about reading strategies (metacognitive knowledge) to cope with slow reading and vocabulary problems, insufficient reading speed or vocabulary knowledge may have a negative effect on the use of knowledge of connectives.

Lastly, for text structure inference skill and reading motivation, we also hypothesize that reading proficiency level may affect the association between these two components and expository text comprehension. There are two reasons why readers with relatively low reading skills might benefit less from their text structure inference skills than their more proficient peers. First, because poor readers require more cognitive resources for processes at the word and sentence level, they may not have enough capacity available to engage in higher order processes, such as text structure inference. Second, readers with poor comprehension skills are less likely to meet the prerequisites considered important to the successful execution of reading strategies such as text structure inference. These prerequisites are being aware of the relevance of strategies, being motivated to employ them and having had sufficient practice in applying them (e.g., Baker, 2005; Pintrich & Zusho, 2002; Veenman, van Hout-Wolters, & Afflerbach, 2006).

Reading motivation, on the other hand, may be a more distinctive feature for text comprehension within a subgroup of poor comprehenders than within a subgroup of good comprehenders. Although we acknowledge that poor readers in general have lower reading motivation than their more proficient counterparts (e.g., Ho & Guthrie, 2013; Wigfield et al., 2012), we consider it more likely that differences in reading motivation play a unique role (i.e. besides cognitive resources) in level of text comprehension for poor readers, than that they will play a unique role for good readers. As we assume that motivation works as an energizer to cope with difficulties during reading and to put effort into the reading task, we consider a higher reading motivation to be especially important for text comprehension among poor readers who experience most difficulties during reading and for whom text understanding requires the most effort. More specifically, two

poor readers equal in cognitive skills but different in motivational levels are therefore more likely to reach different text comprehension levels, whereas two good readers with a similar cognitive profile are less likely to differ in text understanding.

1.5.8 Overlap between chapters

There is considerable overlap between chapters 2 to 5 because these chapters were written as independent journal articles, which made it necessary to repeat descriptions of research methods and theoretical issues for every chapter. On a theoretical level, overlap exists with regard to cognitive resources as potential moderators of the four components central to this dissertation. On a methodological level, there is overlap because subsamples of the same sample were used for the analyses in each chapter, the same statistical tests were performed to answer our research questions (multilevel regression analyses), and the same instruments were used across chapters to measure the control variables: sentence reading fluency, general vocabulary knowledge and metacognitive knowledge. The advantage of the overlap between chapters is that every chapter can be read on its own (i.e., as an independent journal article).

Chapter 2 Knowledge of connectives

Abstract

The present study examined whether knowledge of connectives contributes uniquely to expository text comprehension above and beyond sentence reading fluency, general vocabulary knowledge and metacognitive knowledge. Furthermore, it was examined whether this contribution differs for readers with different language backgrounds or readers who vary in sentence reading fluency, general vocabulary knowledge or metacognitive knowledge levels. Multilevel regression analyses revealed that knowledge of connectives explained individual differences in eighth graders' text comprehension (n = 171) on top of the variance accounted for by the control variables. Moreover, the contribution of knowledge of connectives to text comprehension depended on a reader's level of metacognitive knowledge: more metacognitive knowledge resulted in a larger association between knowledge of connectives and text comprehension. Sentence reading fluency, vocabulary knowledge and language background did not interact with knowledge of connectives. Findings are interpreted in the context of the strategic use of connectives during expository text reading.

2.1 Rationale for the present study

Vocabulary knowledge has been identified as an important predictor of text comprehension in many studies (e.g., Beck et al., 1982; Carlisle, 2007; McKeown et al., 1983; Nagy, 2007; Stahl & Fairbanks, 1986; Van Gelderen et al., 2007) as well as in reading comprehension models, such as Perfetti et al.'s framework for reading comprehension (Perfetti, 1999; Perfetti et al., 2005) and Kintsch et al.'s construction-integration model (Kintsch, 1998; Kintsch & Rawson, 2005). However, the importance of knowledge of specific vocabulary, such as connectives, for understanding certain text types is less well established.

The present study focusses on the role of knowledge of connectives in understanding expository texts. Crosson and Lesaux (2013) found that in fifth grade knowledge of connectives was positively associated with English text comprehension controlling for word reading fluency and general vocabulary knowledge. In contrast to Crosson and Lesaux whose comprehension measure combined narrative and expository texts, we will examine whether this unique contribution of knowledge of connectives holds for expository texts in particular. Also, in contrast to Crosson and Lesaux, we will examine an older population of readers (eighth graders) and a different language (Dutch).

Although we assume that knowledge of connectives facilitates readers' expository text comprehension, we consider the possibility that not all readers may benefit to the same extent from knowing connectives. In the following section, we will first describe why knowledge of connectives is expected to be helpful for expository text understanding. Next, we will discuss five reader characteristics that may prevent readers from benefitting optimally from their knowledge of connectives: high topic knowledge, limited reading fluency, limited general vocabulary knowledge, a language background associated with limited reading fluency or general vocabulary knowledge and limited metacognitive knowledge (knowledge about text structure, and reading and writing strategies). To date, we know little about the last four characteristics, therefore the present study will put to

the test if these characteristics have an impact on the association between knowing connectives and text comprehension.

2.2 Connectives as guiding devices in text comprehension

Knowledge of connectives is expected to be particularly helpful for expository text comprehension. Given that expository texts often describe relationships between text ideas that are (yet) unknown to students, they often need to be informed about the way ideas are related in order to create a coherent representation of these ideas (cf., Degand et al., 1999; Degand & Sanders, 2002; Singer & O'Connell, 2003; Van Silfhout et al., 2014). Connectives provide this information. They indicate for example whether the relationship between text parts is additive, causal, temporal or adversative in nature (see, for example, Halliday & Hasan, 1976; McNamara, Graesser, & Louwerse, 2012; Sanders & Noordman, 2000; Sanders & Spooren, 2007). Connectives thus work as a processing instruction to the reader (cf., Cain & Nash, 2011; Van Silfhout et al., 2014); therefore it comes as no surprise that connectives speed up establishing a relationship between text parts (e.g., Cain & Nash, 2011; Van Silfhout et al., 2014; Kintsch & Keenan, 1973; Sanders & Noordman, 2000; Britton, Glynn, Meyer, & Penland, 1982). However, if readers do not know the meaning of connectives, they will not benefit from their presence: they have to infer the textual relations by themselves.

For expository texts, knowledge of connectives is also considered to be helpful to infer the overall structure of a text, that is, to establish global coherence in a text. Meyer (1985) identified five basic patterns to describe the overall organization of most expository texts: problem-solution, causation, description, comparison and collection. According to Meyer et al. (1980) connectives may signal these overall structures. For example, the connective 'because' may signal a causation top-level structure and 'however' a comparison overall structure. The more knowledge of connectives the better readers are expected to identify and interpret connectives that signal overall text structure.

2.3 Knowledge of connectives and reader characteristics

Not all readers may exploit their knowledge of connectives during reading to establish local or global coherence. Findings from McNamara and Kintsch (1996) suggest that readers with high knowledge about the topic of a text may not use their knowledge of connectives optimally if signaling in a text is too obvious, considering their high topic knowledge. Faced with 'too much' explicit signaling, highly knowledgeable readers may get the impression that the text is too easy for them and could start reading sloppily. If so, they will not utilize their knowledge of connectives fully. Results from O'Reilly and McNamara (2007a) specified McNamara's and Kintsch's assumption: only readers with high topic knowledge and low reading skills seem to be disadvantaged by too explicit signaling (and hence may not benefit optimally from their knowledge of connectives). The proficient readers with high topic knowledge attained better text comprehension for highly cohesive texts than for texts low in cohesion, which indicates that they benefit from their knowledge of connectives irrespective of their topic knowledge levels.

Besides topic knowledge, reading fluency might also affect the use of connectives. Connectives can be classified as predicates that take two complex text parts, often clauses, as arguments, for example [clause] because [clause] (see for example Kintsch, 1998, p. 60). In order for a connective to link two text parts both parts have to be in working memory for a successful linking operation (cf., Baddeley, 1986; 2007). If reading is too slow, the propositions that have to be combined may have faded from working memory (Kirby, 2007) which will prevent a connective from performing its linking function. Moreover, if word and sentence reading is slow and effortful, it requires substantial attentional resources and may not leave enough resources to execute other reading processes, such as the strategic use of connectives to establish global coherence. This suggestion is in line with research that acknowledges the limited capacity of working memory and the competition between reading processes for attentional resources, which results from this limited capacity (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001).

A sufficient general vocabulary knowledge base seems another prerequisite to benefit from knowing connectives. Although the meaning of words in propositions that have to be linked by a connective can be inferred to some extent from context, a certain vocabulary base is necessary in order to establish meaningful links. Moreover, in the context of a limited working memory capacity, Crosson and Lesaux (2013) and Geva (1986) argued that if too much attentional resources are required to find out the meaning of unknown words the processing of connectives could be hampered.

Given that a limited reading fluency and general vocabulary knowledge may block the use of connectives, readers with a language minority background may be hampered to a greater extent than their monolingual peers to benefit from connectives because the former have been shown to perform worse on fluency and vocabulary tests in the majority language (Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Páez et al., 2007; Trapman et al., 2014; Van Gelderen et al., 2003). The disability to maximally benefit from knowledge of connectives could be an additional reason (besides lower fluency and general vocabulary knowledge levels) why language minority readers have been shown to perform worse on reading comprehension tests in the majority language (for a review in North-American context, see August & Shanahan, 2006; for the situation in the Netherlands, see, for example, Aarts & Verhoeven, 1999; Trapman et al., 2014; Van Gelderen et al., 2003). Findings from Crosson and Lesaux (2013) support the view that language background may affect the association between knowing connectives and text comprehension. They found a significantly lower positive correlation between knowledge of connectives and text comprehension for fifth grade second language learners of English than for their monolingual peers and hypothesized that the second language learners may be hampered to a greater extent to use their knowledge of connectives.

Metacognitive knowledge is another characteristic that may have an impact on the advantage of knowing connectives, especially for expository text understanding. Readers with more metacognitive knowledge about the way expository texts are normally structured and with knowledge about strategies to deal

with these texts are expected to better understand the importance of connectives as devices to establish coherence and to make better use of them. Primary school readers or readers at the start of secondary school are still developing their metacognitive knowledge (e.g., Baker, 1989; Pressley & Afflerbach, 1995; Walczyk, 2000) and are not expected to understand the relevance of connectives fully (cf., Cain & Nash, 2011). Hence, they may not have optimal advantage of knowing connectives in reading extended dense texts. Findings from Geva and Ryan (1985) and Zinar (1990) support this assumption because knowing connectives was often not sufficient for fifth and seventh graders to employ this knowledge during reading: these readers needed to be directed to connectives by questioning techniques or by highlighting them in texts. Baker (2005) also pointed out that complex reading strategies may not develop until middle or high school; the strategic use of connectives may be one of them.

As readers progress in secondary school their metacognitive knowledge becomes more developed (e.g., Baker, 1989; Pressley & Afflerbach, 1995; Schoonen et al., 1998; Walczyk, 2000) and therefore it is expected that secondary school readers are better able than primary school readers to use their knowledge of connectives during reading, especially those with more metacognitive knowledge. In accordance with Meyer et al. (1980), it is assumed that readers with more metacognitive knowledge about text structure and reading strategies are expected to actively search for signaling markers such as connectives to infer the overall structure of a text. Readers with less metacognitive knowledge approach texts with less knowledge about the structure of expository texts and less knowledge about appropriate reading strategies for expository texts (for example, close reading). Therefore, they are expected not to take full advantage of connectives for creating coherence on different text levels.

Intervention studies seem to support the causal link between strategic use of connectives and text comprehension. Training students to attend to text structure and connectives has been shown to improve memory for texts and text understanding (e.g., Cook & Mayer, 1988; Gordon, 1989; Meyer, Young, & Bartlett, 1989; Meyer

& Poon, 2001; Paris, Cross, & Lipson, 1984; Wijekumar, Meyer, & Lei, 2013; Williams, Stafford, Lauer, Hall, & Pollini, 2009).

For secondary school readers, metacognitive knowledge might also affect whether slow reading or limited general vocabulary knowledge will restrict benefits from knowing connectives. Given enough time and motivation to compensate (e.g., Walczyk, 1995; 2000; Walczyk et al., 2007), readers with a broader repertoire of strategies to cope with slow reading and vocabulary problems may be able to compensate to a greater extent for suboptimal fluency and vocabulary skills that could affect their processing of connectives. The use of knowledge of connectives might therefore not be affected by disfluent reading or lack of sufficient word knowledge per se but rather by the extent to which a reader has knowledge about strategies to deal with fluency or vocabulary problems and is able to act accordingly.

2.4 The present study

The first research question this study aims to answer is whether knowledge of connectives explains unique variance in eighth graders' expository text comprehension above and beyond the influence of reading fluency, general vocabulary knowledge and metacognitive knowledge. In contrast to Crosson and Lesaux (2013) who controlled for the influence of word recognition fluency, we decided to control for the fluency of sentence comprehension, because this level of fluency was shown to be significantly related to seventh and eighth graders' reading comprehension, while word recognition fluency was not (Trapman et al., 2014; Van Gelderen et al., 2007), even for low achievers in seventh grade (Trapman et al., 2014). We also assume that a sentence-level fluency measure is more appropriate for eighth graders, as several studies have demonstrated that the relationship between word recognition and reading comprehension decreases with age (e.g., Adams, 1990; Francis et al., 2005; Hoover & Gough, 1990; Van Gelderen et al., 2007). We controlled for the influence of general vocabulary knowledge to examine whether knowledge of connectives is more than simply an indication of general vocabulary knowledge, which appeared to be the case for fifth graders in Crosson and Lesaux

(2013). The question is whether this also applies to the eighth graders in our study. Previous research with secondary school readers on the relation between knowledge of connectives and text comprehension did not address this issue because the contribution of general vocabulary knowledge was not taken into account (e.g., McClure & Steffensen, 1985). In addition, we also controlled for readers' metacognitive knowledge because this type of knowledge has been found to be an important predictor for text comprehension in secondary school (e.g., O'Reilly & McNamara, 2007; Schoonen et al., 1998; Trapman et al., 2014; Van Gelderen et al., 2004).

Our second research question is whether the contribution of knowledge of connectives to expository text comprehension depends on one's reading fluency, general vocabulary knowledge, language background and metacognitive knowledge. The present study will examine whether these four components have a direct impact on the relationship between knowledge of connectives and text comprehension; for metacognitive knowledge it will also be examined whether its impact could be indirect, i.e. via a potential influence of reading fluency and general vocabulary knowledge as described in the last paragraph of the previous section.

With respect to language background, Crosson and Lesaux (2013) found a difference between fifth grade second language learners and monolinguals: the correlation between knowledge of connectives and text comprehension was higher for the latter group. We want to put to the test whether the relationship between knowledge of connectives and text comprehension differs between monolingual and bilingual Dutch readers as well.

We also decided to differentiate between bilingual readers with or without Dutch as a dominant home language as we hypothesized that there may be knowledge or fluency differences between these two subgroups which may affect the role knowledge of connectives plays for text comprehension. For example, bilingual readers with Dutch as a dominant home language could have higher vocabulary knowledge and fluency levels in Dutch than their bilingual peers with another language than Dutch as their dominant home language, and may therefore employ their knowledge of connectives to a greater extent.

2.5 Method

2.5.1 Participants

Three hundred thirty-seven eighth graders from thirteen classes from three secondary schools in Amsterdam (the Netherlands) participated in the present study. Sixteen students were excluded from the analyses because they had reading or learning problems according to school reports. Of the 321 remaining participants, we only had valid scores for 191 students on the text comprehension test for various reasons. First, 59 students performed misbehavior during administration of the expository text comprehension test according to the test administrator's notes. The large attrition due to misbehavior is related to the challenging school population at the participating urban schools and the teachers' ability to manage the classroom during test administration. Second, test scores of five students were considered invalid because they skipped half or more of the items or scored below chance level, since both were regarded as an indication of test disturbance. Third, 66 students had missing test scores on the expository text comprehension test due to absence during a testing session; this large proportion of missing values due to absence was mainly caused by the decision of one school to discontinue participation in our study for 40 students.

Of the 191 students with a valid score on expository text comprehension, 171 students had no missing scores on the other tests either. We performed our analyses with this sample of 171 students, whose educational levels were distributed as follows: 36% received instruction at a low educational level (61 students), 24% at an intermediate educational level (42 students) and 40% at a high educational level (68 students). Table 2.1 shows the number of students per school, per class and the educational level of each class.

Students were regarded as monolingual Dutch (n = 54) if they had indicated in the background questionnaire (see Instruments section) that Dutch was their only mother tongue and as bilingual Dutch (n = 117) if one or more language(s) other than Dutch were involved in their initial language acquisition. All but seven of the bilingual students were born in the Netherlands, and only two of those had received

less than five years of primary education in the Netherlands. Bilinguals were split up into two groups. Students who indicated that their parents spoke Dutch to them 50% or more of the time were assigned to the *bilinguals Dutch dominant* at home group (n = 43), the others to the *bilinguals Dutch not dominant* group (n = 74). Bilinguals indicated that they spoke the following languages at home: Arabic (n = 56), Turkish (n = 34), Papiamentu (n = 4), Punjabi (n = 4), Portuguese (n = 3), Bosnian (n = 2), Chinese (n = 2), English and Punjabi (n = 2), Akan (n = 1), Bahasa Indonesia (n =1), Cantonese (n = 1), Spanish (n = 1), English (n = 1), English and Hindi (n = 1), English and Urdu (n = 1), Hindi (n = 1), Russian and Urdu (n = 1), or Urdu (n = 1).

School	Class	Educational level*		Number	
				of stude	nts
А	A1, A2, A3, A4	Low		54	
	A5	Intermediate		17	
	A6, A7	High		46	
			Total	1	17
В	B1	Low		7	
	B2	Intermediate		3	
	B3	High		6	
			Total		16
С	C1, C2	Intermediate		22	
	C3	High		16	
			Total		38
			Total all schools		171
*The adu	antional lavala norman	nond to the following advi	ational lavala in Dutah		

 Table 2.1 Students included in the analyses per school, class and the educational level of each class.

*The educational levels correspond to the following educational levels in Dutch secondary school: low = *vmbo-t* (prevocational level) or *vmbo-t/havo* (prevocational/general secondary educational level), intermediate = *havo* (general secondary educational level) or *havo/vwo* (general secondary educational/pre-university level), high = *vwo* (pre-university level).

2.5.2 Instruments

Students took five tests tapping into expository text comprehension, knowledge of connectives, sentence reading fluency, general vocabulary knowledge, and meta-cognitive knowledge. In addition they filled out a questionnaire about background information.

Expository text comprehension. The expository text comprehension test comprised six expository texts and 35 multiple choice questions about these texts (with three or four answer options). The texts addressed various topics (about energy systems in the body, the history of whaling, etc.) and varied in length between 184 to 449 words. One text was derived from the reading comprehension test used in a study by Van Gelderen et al. (2007). The other texts were selected from a database developed by the company *Diataal* from which texts are used to measure the reading comprehension of secondary school students (Hacquebord et al., 2005). These texts and questions were adapted slightly.

Knowledge of connectives. Knowledge of connectives was measured by means of a fill-in-the-blanks test consisting of six short expository texts which varied in length between 85 to 177 words and which addressed various topics (e.g., spiders, vitamins, the origin of the @-symbol, etc.). For each blank, students had to choose the appropriate connective out of three options. Relationships between the propositions that had to be connected were regarded as familiar to all students. To ensure that the texts did not posit any other vocabulary knowledge demands on the selection of the right connective (i.e. other than knowledge of connectives), texts contained for 95% words (or transparent derivations/inflections of these words) that belong to the 5000 most frequent words in written Dutch according to the Hazenberg and Hulstijn (1996) list (85% 0-2000; 10% 2000-5000). The remaining 5% of the words (predominantly proper names) were considered not to cause any difficulties for selecting the right connective.

The knowledge of 43 connectives from various semantic classes was tested. Connectives expressed *additive-positive* (7), *additive-negative* (6, also known as

contrastive), *temporal* (8), *causal* (10) and *adversative* (4) relationships (e.g., Crosson, Lesaux, & Martiniello, 2008; Halliday & Hasan, 1976; Sanders & Spooren, 2007; Sanders, Spooren, & Noordman, 1992). In addition, in accordance with McNamara et. al (2012), the test contained *additive-clarifying* (8) connectives. Connectives varied in difficulty level and were matched with distractors of corresponding difficulty levels in order to reduce the possibility that test takers could benefit from their knowledge of relatively easy distractors in their selection of the target connective. Distractors were chosen that could fit the blank syntactically, but only the targets fitted the blank semantically. Five expert readers (researchers) had 100% agreement on the correct responses.

To determine the difficulty level of connectives and distractors, results from Hacquebord et al. (2011) were used. In that study, 68 secondary school teachers were asked to rate the expected difficulty of words from school book texts on a scale from one (very easy, known at the end of primary school) to five (too hard and/or irrelevant, not known at the end of eight grade); for each word the mean difficulty level was computed. The test contained 22 connectives with a low (mean judgment from 1 to 2.3), 16 with a medium (mean judgment from 2.4 to 3.6) and 5 with a high difficulty level (mean judgment from 3.6 to 5). Each of the six semantic classes contained connectives from at least two difficulty levels. Most distractors differed between 0 and 1.3 points (within the range of a difficulty level) in difficulty from the target items, except for eight distractors which differed from 1.4 to 2 points in difficulty from the target. Appendix II shows the 43 connectives, their difficulty level and semantic class, and the difficulty level of the distractors.

Sentence reading fluency. Sentence reading fluency was measured by a sentence verification test similar to the one used by Van Gelderen et al. (2007). Students were presented sentences on laptop screens and had to indicate as quickly as possible whether the sentences made sense or not by pressing a red (sentence makes no sense) or a green stickered key (sentence makes sense) on their laptop keyboards. All students were expected to determine with ease whether sentences made sense or not (e.g., *Most bicycles have seven wheels* was a sentence that does not make sense).

The mean reading fluency was calculated by averaging the reaction times on the correct responses to the sensible sentences.

General vocabulary knowledge. A 70 items digital multiple choice test developed by *Diataal* (Hacquebord et al., 2005) measured general vocabulary knowledge. Items were selected from a corpus of school books. Selection criteria for the items were frequency in the corpus and difficulty level (as judged by teachers). The test included general academic words, e.g., *aspects*, as well as domain or subject specific words, e.g., *roam* (e.g., in a forest), *interior* (i.e., of a house) or *executed* (i.e. murdered). Four target items were connectives. One of these connectives was also a target in the knowledge of connectives test and two of these connectives were used as a distractor in the knowledge of connectives test. Target items were presented in sentences with neutral context (i.e. inferring the word meaning from context was not possible).

Metacognitive knowledge. Metacognitive knowledge was measured by means of a test based on the metacognitive knowledge test from Van Gelderen et al. (2007). The test was reduced to 45 statements about text structure (12 statements), reading (21 statements) and writing strategies (12 statements). Participants had to indicate whether or not they agreed with the statements. For example, a correct response would be if they agreed with the following statement: *if you do not understand the meaning of a word, it is useful to try to guess its meaning by looking at other words and sentences surrounding the unfamiliar word.*

Table 2.2 shows the internal consistency (Cronbach's alpha) of the five tests for each subgroup as a reliability estimate. Except for the metacognitive knowledge test, for which reliability estimates are around .60, tests show in general satisfactory reliability estimates between .73 or .96.

Background questionnaire. The background questionnaire requested the following information: sex, country of birth, mother tongue, language(s) the parents/caretakers speak to participants (and percentages of the time they speak these languages to

them), country of birth of parents/caretakers, the highest completed educational level of parents/caretakers and jobs of parents/caretakers.

2.5.3 Procedure

From March till June 2014 each test was administered in a separate testing session during regular classes, except for the sentence reading fluency test for which participants were taken out of their class in groups of four and led to a separate testing room. Students were given enough time to complete the tests. The approximate administration time for the fluency test was 10-15 minutes, for the expository text comprehension test 40-45 minutes, for the knowledge of connectives test 20-25 minutes, for the general vocabulary knowledge test 10-15 minutes and for the metacognitive knowledge test 20-25 minutes. Test administrators took notes on students' behavior during the plenary test administrations.

2.5.4 Scoring and missing value treatment

There were no missing items on the general vocabulary knowledge test and sentence reading fluency test because these digital tests required for response on every item. Skipped items from the text comprehension, knowledge of connectives and metacognitive knowledge test were scored as incorrect. For the reading fluency test the procedure described in Van Gelderen et al. (2003) was used for scoring and missing value treatment. First, to ensure that linguistic knowledge did not influence performance on the fluency test, nine of the 55 sentences with an accuracy rate lower than .875 were excluded from the analyses. Mean reaction times were calculated on the basis of the remaining 46 sentences. Second, inaccurate responses or potentially untrustworthy ones (too slow or too fast reaction times) were turned into missing values and estimated with the expectation maximization procedure in SPSS (SPSS Inc., Chicago, IL, USA). For our 171 participants, 5.7% of the reaction times were missing and estimated.

2.5.5 Analyses

Means and standard deviations on the five administered tests were computed for the whole sample and separately for the monolinguals, the bilinguals and the two bilingual subgroups. For all regression analyses a model with a random intercept for class served as the base model. Differences in scores on the five tests between subgroups were analyzed with regression models with the tests as dependent variable and two independent (i.e. orthogonal) contrasts as predictor variables: one predictor contrasting monolingual versus bilingual Dutch students and one contrasting the two bilingual groups. The two contrasts were added in a stepwise manner as predictors of a test; first it was investigated whether monolinguals differed significantly from bilinguals on their test outcomes, next whether the two bilingual groups differed significantly from each other. Effect sizes of the differences were reported as the increase in explained variance (with the symbol Δr^2). Furthermore, correlations between the test scores were calculated for the subgroups and the sample as a whole.

Before we investigated our research questions, we investigated whether each of the predictor variables (i.e. reading fluency, general vocabulary knowledge, metacognitive knowledge and knowledge of connectives) were curvilinearly related to text comprehension, because it has been shown that curvilinear relationships between predictors and dependent variables may affect the estimation of interaction effects (Ganzach, 1997).

To answer our first research question, we started with a model with reading fluency, general vocabulary knowledge and metacognitive knowledge, and we investigated whether knowledge of connectives improved model fit. The model with these four predictors was used as the base model to investigate our second research question, i.e. potential interaction effects with knowledge of connectives.

To test whether language background interacted with knowledge of connectives, a model with the abovementioned two language background contrasts and their interactions with knowledge of connectives were added to the base model. In a similar vein, interactions between knowledge of connectives and reading fluency, between knowledge of connectives and general vocabulary knowledge, and between knowledge of connectives and metacognitive knowledge were tested by adding them in a stepwise manner to the base model. Lastly, the effects of two threeway interactions were tested (i.e. knowledge of connectives x reading fluency x metacognitive knowledge, and knowledge of connectives x vocabulary size x metacognitive knowledge) to examine whether metacognitive knowledge moderates the effect reading fluency and general vocabulary knowledge have on the relationship between knowledge of connectives and text comprehension.

To check for the robustness of our outcomes we also performed the abovementioned regression analyses with a sample of 191 students. These 191 students all had a score on expository text comprehension and 20 of these students had a score missing on one (n = 18) or two (n = 2) of the predictor variables. For the robustness check, we created a dummy variable for each predictor variable that represented whether a score was missing (a score of 1) or not (a score of 0) for the associated predictor variables. These dummy variables were entered along with the associated predictor variables in our regression models. These models did not include a fixed intercept and missing scores on the standardized predictor variables were recoded into a score of 0 (see Koomen & Hoeksma, 1991). This method enabled us to investigate whether the outcomes of our models were affected, that is, different from the sample with 171 students, when controlling for the variance that was accounted for in text comprehension by differences between students who either missed or did not miss a score for every predictor variable.

2.6 Results

2.6.1 Descriptive statistics

Expository text comprehension scores were normalized with Blom's formula (Blom, 1958). Table 2.3 shows the means and standard deviations on our five measures for the whole sample and the subgroups. There were no floor or ceiling effects present in the data. Monolinguals outperformed the bilinguals on expository text comprehension (χ^2 (1) = 9.07, p = .00, $\Delta r^2 = .08$), knowledge of connectives (χ^2 (1) = 12.98, p = .00, $\Delta r^2 = .11$), general vocabulary knowledge (χ^2 (1) = 18.38, p = .00,

Table 2.3 Means (and	standard dev	viations) on the f	five measures for	all students and t	he subgroups.	
	Number of items	All students $(n = 171)$	Monolingual Dutch	Bilingual Dutch	Bilingual Dutch	Bilingual Dutch not
			(n = 54)	(n = 117)	dominant $(n = 43)$	dominant $(n = 74)$
Expository text	35	24.52	26.72	23.51	23.00	23.80
comprehension		(5.31)	(5.95)	(4.69)	(4.89)	(4.58)
Knowledge of	43	31.44	34.37	30.09	29.63	30.35
connectives		(5.99)	(5.83)	(5.59)	(5.22)	(5.81)
Sentence	46	2844	2804	2863	2685	2967
reading fluency (<i>RT in msec</i>)		(496)	(508)	(492)	(476)	(473)
General vocabulary	70	52.92	57.26	50.91	51.00	50.86
knowledge		(7.82)	(6.33)	(7.65)	(8.39)	(7.24)
Metacognitive	45	35.58	36.91	34.97	34.58	35.19
knowledge		(4.07)	(3.68)	(4.11)	(4.12)	(4.11)

 $\Delta r^2 = .14$) and metacognitive knowledge (χ^2 (1) = 4.43, p = .04, $\Delta r^2 = .05$), but there were no differences in sentence reading fluency between monolinguals and bilinguals (χ^2 (1) = 0.34, p = .56, $\Delta r^2 = .00$). The bilingual Dutch dominant group outperformed the bilingual Dutch not-dominant group on sentence reading fluency (χ^2 (1) = 9.24, p = .00, $\Delta r^2 = .05$), but there were no differences between these two groups on expository text comprehension (χ^2 (1) = 1.07, p = .30, $\Delta r^2 = .00$), knowledge of connectives (χ^2 (1) = 0.99, p = .32, $\Delta r^2 = .00$), general vocabulary knowledge (χ^2 (1) = 0.09, p = .76, $\Delta r^2 = .00$) and metacognitive knowledge (χ^2 (1) = 1.03, p = .31, $\Delta r^2 = .00$).

2.6.2 Correlations

Table 2.4 shows the correlations between test scores for the whole sample and for the subgroups. For all groups text comprehension related moderately to knowledge of connectives, vocabulary knowledge and metacognitive knowledge, and weakly to reading fluency. For knowledge of connectives, correlations ranged from .46 to .55, for vocabulary knowledge from .20 to .54, for metacognitive knowledge from .31 to .51 and for reading fluency from -.10 to -.15 (the higher reaction times the lower the text comprehension). Correlations of reading fluency with vocabulary knowledge, knowledge of connectives and metacognitive knowledge were weak to moderate (correlations were between -.15 and -.46). Interestingly enough, correlations between knowledge of connectives and vocabulary knowledge were not particularly strong, that is, between .31 to .51. Knowledge of connectives and metacognitive knowledge of connectives and metacognitive knowledge were metacognitive knowledge correlated around .40.

2.6.3 Curvilinear effects

We could not establish a curvilinear relationship with expository text comprehension for sentence reading fluency (χ^2 (1) = .50, p = .48, Δr^2 = .00), general vocabulary knowledge (χ^2 (1) = .68, p = .41, Δr^2 = .00), and metacognitive knowledge (χ^2 (1) = 1.30, p = .25, Δr^2 = .00), but we did find a curvilinear relationship between knowledge of connectives and expository text comprehension (χ^2 (1) = 6.84, p = .01,

	KOC	RF	VOC	MK
ository text comprehension				
All students	.55*	12	.40*	.43*
Monolingual Dutch	.54*	13	.34*	.51*
Bilingual Dutch	.48*	10	.34*	.34*
Bilingual Dutch dominant	.51*	10	.54*	.31*
Bilingual Dutch not dominant	.46*	15	.20	.35*
owledge of connectives (KOC)				
All students		29*	.48*	.43*
Monolingual Dutch		42*	.51*	.42*
Bilingual Dutch		22*	.37*	.38*
Bilingual Dutch dominant		34*	.47*	.41*
Bilingual Dutch not dominant		21	.31*	.36*
ence reading fluency (RF) – RT in msec.				
All students			32*	22*
Monolingual Dutch			46*	15
Bilingual Dutch			27*	24*
Bilingual Dutch dominant			38*	38*
Bilingual Dutch not dominant			20	20
eral vocabulary knowledge (VOC)				
All students				.40*
Monolingual Dutch				.24
Bilingual Dutch				.38*
Bilingual Dutch dominant				.50*
Bilingual Dutch not dominant				.31*

 $\Delta r^2 = .04$). The parameter estimates of the linear and quadratic term of knowledge of connectives were both positive, which means that the relationship between knowledge of connectives and expository text comprehension is positive and becomes stronger for higher levels of knowledge of connectives. We included both the linear and the quadratic term of knowledge of connectives in our regression models. Interactions with the quadratic term were tested only if there was a significant interaction with the linear term of knowledge of connectives.

2.6.4 Effects of knowledge of connectives

Table 2.5 and 2.6 show the results of the models to answer our research questions. Table 2.5 shows the fit of each model and its explained variance. Table 2.6 shows the parameter estimates of the models. The answer to our first research question, that is, whether knowledge of connectives had a unique contribution to text comprehension, was positive. Knowledge of connectives (linear + quadratic term) accounted for unique variance in expository text comprehension controlling for reading fluency, general vocabulary knowledge and metacognitive knowledge, compare model 2 (M2) to model 1 (M1) in Table 2.5; χ^2 (2) = 26.97, p = .00, $\Delta r^2 = .14$.

2.6.5. Interactions with knowledge of connectives

The answer to our second research question, that is, whether four components interact with knowledge of connectives, was positive only for one component. That is, the interaction between knowledge of connectives (linear term) and metacognitive knowledge improved model fit (M6 compared to M2: χ^2 (1) = 5.23, p = .02, $\Delta r^2 = .01$), whereas interactions between knowledge of connectives (linear term) and language background, reading fluency or vocabulary knowledge were not significant and did not lead to further model improvement (compare models 3, 4 and 5 to M2 in Table 2.5). The model with knowledge of connectives x metacognitive knowledge (Model 6) was the best fitting model because neither the interaction between the quadratic term of knowledge of connectives and metacognitive knowledge, nor the two three-way-interactions (i.e., knowledge of connectives x

reading fluency x metacognitive knowledge and knowledge of connectives x vocabulary size x metacognitive knowledge) did improve model fit further (see models 7, 8 and 9 in comparison to M6, Table 2.5).

Figure 2.1 shows how the interaction between knowledge of connectives and metacognitive knowledge has to be interpreted. This figure shows that the relationship between knowledge of connectives and expository text comprehension is stronger for readers with more metacognitive knowledge given at least an average



Knowledge of connectives (standardized)

Figure 2.1 Predicted expository text comprehension (y-axis) as a function of knowledge of connectives (x-axis) for readers with a high (two standard deviations above the mean), an average or a low (two standard deviations below the mean) metacognitive knowledge (MK). For all three groups sample means of vocabulary knowledge and sentence reading fluency were used to predict expository text comprehension.

		•		-	•	-	,				
Models		M0	M1	M2	M3	M4	M5	M6	M7	M8	M9
Variance	Class	.21(.11)	.10(.06)	.04(.04)	.05(.04)	.04(.03)	.05(.04)	.05(.04)	.05(.04)	.05(.04)	.05(.04)
	Students	.75(.08)	.64(.07)	.57(.06)	.56(.06)	.57(.06)	.56(.06)	.55(.06)	.55(.06)	.55(.06)	.55(.06)
	Total	.96	.74	.61	.61	.61	.61	.60	.60	.60	.60
Distribution of	Class (%)	21.9%	13.5%	6.6%	8.2%	6.6%	8.2%	8.3%	8.3%	8.3%	8.3%
variance	Students (%)	78.1%	86.5%	93.4%	91.8%	93.4%	91.8%	91.7%	91.7%	91.7%	91.7%
Explained	Class (%)		52.3%	81.0%	76.2%	81.0%	76.2%	76.2%	76.2%	76.2%	76.2%
variance	Students (%)		14.7%	24.0%	25.3%	24.0%	25.3%	26.7%	26.7%	26.7%	26.7%
	Total (%)		22.9%	36.5%	36.5%	36.5%	36.5%	37.5%	37.5%	37.5%	37.5%
Increase in	Class (%)		52.3%	28.7%		1	1				
explained	Students (%)		14.7%	9.3%	1.3%	,	1.3%	2.7%	ı	ı	ı
variance	Total (%)		22.9%	13.6%	ı	ı	ı	1.0%			
Fit in -2LL		456.37	423.90	396.93	394.58	396.62	396.49	391.70	391.61	390.69	391.61
Difference in -21	LL		32.47*	26.97*	2.35	0.31	0.44	5.23*	0.09	1.01	0.09
Difference in df			ŝ	7	4	1	1	1	1	ю	ŝ
Compared to mc	labo		M0	M1	M2	M2	M2	M2	M6	M6	M6

Table 2.5 Model fit and variance components of the models predicting expository text comprehension (N_{audents}=171, N_{enses}=13).

The difference in -2 Log Likelihood is chi-square distributed. M1 predictors: sentence reading fluency (RF), general vocabulary knowledge (VOC) and metacognitive knowledge (MK) M2 predictors: M1 + knowledge of connectives (KOC) M3 predictors: M2 + language background + KOC x language background M4 predictors: M2 + KOC x RF M5 predictors: M2 + KOC x RF M6 predictors: M2 + KOC x NC M6 predictors: M2 + KOC x VOC M6 predictors: M2 + KOC x VOC M6 predictors: M2 + KOC x VOC M6 predictors: M6 + KOC x VOC M7 predictors: M6 + KOC x NK M8 predictors: M6 + KOC x VOC + MK x VOC + KOC x VOC x MK M9 predictors: M6 + KOC x VOC + MK x VOC + KOC x VOC x MK M9 predictors: M6 + KOC x VOC + MK x VOC + KOC x VOC x MK M9 predictors: M6 + KOC x VOC + MK x VOC + KOC x VOC x MK The parameter estimates of each model are shown in Table 2.6.

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Table 2.6 Parameter estimates of th	ne models to J	predict expc	sitory text	compreher	ision (N _{stude}	$_{\rm ants}$ =171, $N_{\rm c}$	$_{\text{lasses}} = 13$).				
Parameter estimates models	M0	M1	M2	M3	M4	M5	M6	M7	M8	6M	
Intercept	10	05	13	13	13	14	15	15	14	15	
	(.15)	(.11)	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)	
Sentence reading fluency		.06	.10	.10	.10	.10	.11	.11	.11	.11	
		(.07)	(90)	(90)	(90)	(90)	(90)	(90)	(90)	(90)	
General vocabulary knowledge		.26*	.10	.10	.10	.12	.12	.12	.13	.13	
		(80)	(.08)	(.07)	(.07)	(80)	(.07)	(.07)	(.08)	(.08)	
Metacognitive knowledge		.27*	.20*	.20*	.20*	.20*	.22*	.21*	.23*	.22*	
1		(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.08)	(.07)	(.07)	
Knowledge of connectives			.43*	.43*	.44*	.42*	.41*	.40*	.41*	.41*	
)			(.08)	(.08)	(.08)	(80.)	(.08)	(60.)	(.08)	(.08)	
Knowledge of connectives ²			.11*	.10*	.12*	.10*	.06	90.	.07	.06	
1			(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(90)	(.05)	
Language background MD vs. BD	(LB1)			01							
				(.05)							
Language background BDdom vs.	BDndom (Ll	32)		.01							
				(.08)							
Knowledge of connectives x LB1				05							
				(.05)							
Knowledge of connectives x LB2				.05						ī	
				(.08)							
Knowledge of connectives x senter	nce reading fl	luency			.04				.04		
					(90)				(.07)		
Knowledge of connectives x gener	al vocabulary	/ knowledge	0			<u>4</u> .			ı	00	
						(90.)				(.07)	
Knowledge of connectives x metacognitive knowledge	.16*	.17*	.17*	.17*							
--	------------	-------------	--------------	-------							
•	(.07)	(.07)	(20.)	(60.)							
Knowledge of connectives ² x metacognitive knowledge		.02									
		(.05)									
Metacognitive knowledge x general vocabulary knowledge			ı	01							
•				(.08)							
Metacognitive knowledge x sentence reading fluency			<u>4</u>								
			(.08)								
Knowledge of connectives x sentence reading fluency x metacognitive knowledge			01								
•			(.08)								
Knowledge of connectives x general vocabulary knowledge x metacognitive knowledge				02							
				(.06)							
MD, monolingual Dutch; BD, bilingual Dutch; BDdom, bilingual Dutch dominant at home; BDndom,	ilingual D	utch not dc	ominant at h	ome.							

Predictors are standardized. Standard errors between brackets. Knowledge of connectives² = quadratic term of knowledge of connectives. *p < .05.

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level of knowledge of connectives. That is, metacognitive knowledge does not reinforce the effect of knowledge of connectives for readers with lower than average knowledge of connectives. Figure 2.1 shows that our best fitting model (i.e. M6 in Table 2.5 and 2.6) predicts that more knowledge of connectives does not substantially improve text comprehension for readers with low metacognitive knowledge levels (the dashed line in Figure 2.1), whereas more knowledge of connectives is associated with a substantial higher text comprehension for readers with high metacognitive knowledge levels (the solid line in Figure 2.1). More specifically, for readers who have low metacognitive knowledge levels, the difference in text comprehension between those with average (a score of 0 on the x-axis) or high knowledge of connectives levels (a score of 2 on the x-axis) is 'only' 0.4 standard deviation. For readers with high metacognitive knowledge levels the same difference in knowledge of connectives is related to a difference of 1.7 standard deviation in text comprehension.

2.6.6 Robustness check: models with 191 students

Regression analyses performed with a sample of 191 students revealed that there were no differences between expository text comprehension scores of students who either missed or did not miss a score on sentence reading fluency (t (191) = 1.66, p = .10), general vocabulary knowledge (t (191) = .66, p = .51), and knowledge of connectives (t (191) = -1.16, p = .25). However, students who missed a score on metacognitive knowledge performed lower on expository text comprehension than those with scores on metacognitive knowledge, outcomes from the models with a sample of 191 students led to the same conclusions as with a sample of 171 students in terms of model improvement: that is, a model that included knowledge of connectives in addition to the control variables led to model improvement (χ^2 (2) = 23.80, p = .00, Δr^2 = .11, compare to M2 versus M1 in Table 2.5) as well as adding the interaction knowledge of connectives x metacognitive knowledge (χ^2 (1) = 7.18, p = .00, Δr^2 = .03, compare to M6 versus M2 in Table 4). Furthermore, similar to the

sample with 171 students, inclusion of the other interactions in the regression model did not lead to model improvement.

Note that for the sample with 191 students, in contrast to the sample with 171 students, the quadratic term of knowledge of connectives was not included in the regression models. Although the quadratic term did lead to model improvement controlling for the linear term in the larger sample (χ^2 (1) = 4.36, p = .04, Δr^2 = .03), the curvilinear relationship was considered invalid for this sample since including the quadratic term in the model led to non-significance of the linear term (cf., Breetvelt, Van den Bergh, & Rijlaarsdam, 1994).

2.7 Discussion

The present study aimed to provide an answer to the question whether knowledge of connectives uniquely contributes to expository text comprehension controlling for sentence reading fluency, general vocabulary knowledge and metacognitive knowledge about text structure and reading and writing strategies. This appeared to be the case for the eighth graders in our study. Our findings concur with Crosson and Lesaux (2013) who found that knowledge of connectives explained unique variance in fifth graders' text comprehension above and beyond word reading fluency and general vocabulary knowledge. The present study shows that this unique contribution of knowledge of connectives also applies to an older population of readers, to a different language (i.e. Dutch), to expository texts in particular, and when metacognitive knowledge is taken into account as an additional control variable along with reading fluency and general vocabulary knowledge. Furthermore, the unique contribution of knowledge of connectives is substantial: of the variance explained by all predictor variables (36.5%), knowledge of connectives uniquely accounted for more than one third of the variance (13.6%). Moreover, our results in particular seem to suggest that knowledge of connectives is not merely an indication of general vocabulary knowledge in secondary school readers since the eighth graders in our study who differed in vocabulary knowledge, did not differ in a comparable way in their knowledge of connectives.

Our second research question was whether the contribution of knowledge of connectives to expository text comprehension depends on one's sentence reading fluency, general vocabulary knowledge, metacognitive knowledge, and language background. As regards language background, in contrast to Crosson and Lesaux (2013) who found that monolingual English fifth graders had a higher positive correlation between knowledge of connectives and text comprehension than second language learners of English, we found no such difference for monolingual and bilingual Dutch eighth graders. Nor did we find that eighth graders' levels of sentence reading fluency or their general vocabulary knowledge levels affected the relationship between knowledge of connectives and text comprehension. We did, however, find a significant interaction between knowledge of connectives and metacognitive knowledge which indicates that readers with more metacognitive knowledge have a stronger relationship between knowledge of connectives and text comprehension than readers with lower levels of metacognitive knowledge. Lastly, we hypothesized that metacognitive knowledge could influence the effect of sentence reading fluency and general vocabulary knowledge on the relationship between knowledge of connectives and text comprehension, but we found no support for this hypothesis.

Because sentence reading fluency levels, general vocabulary knowledge levels and language background did not influence the association between knowledge of connectives and text comprehension, we conclude that eighth graders with relatively smaller general vocabulary knowledge levels or lower reading fluency levels (or a bilingual background associated with one or more of these characteristics) are not significantly constrained by less fluent reading or vocabulary problems to process connectives and benefit from their knowledge of connectives. Furthermore, because the effect of sentence reading fluency and vocabulary knowledge on the relationship between knowledge of connectives and text comprehension did not depend on metacognitive knowledge, we assume that for the eighth graders in our study with relatively lower metacognitive knowledge levels, less fluent reading or vocabulary problems were not blocking the benefits of knowledge of connectives more than for eighth graders with higher levels of metacognitive knowledge.

The ability to compensate for fluency and vocabulary problems might be a key factor to explain our results and also the difference with Crosson and Lesaux's findings. We assume that the eighth graders in our study were better able to compensate for vocabulary or fluency problems (irrespective of their metacognitive knowledge levels) than the fifth graders in Crosson and Lesaux's study, and that they were therefore less likely to be disrupted by these problems in their processing of connectives. This is in line with several studies which have shown that relatively experienced readers have developed broader repertoires of behaviors and strategies to deal with reading problems than relatively beginning readers (e.g., Baker, 1989; Pressley & Afflerbach, 1995; Walczyk, 2000). On top of that, the monolingual and bilingual students in our study were more alike in their general vocabulary knowledge than the second language learners and monolingual English students in Crosson's and Lesaux's study: although our monolinguals and bilinguals differed on average approximately one standard deviation on the general vocabulary test, the language background groups in Crosson and Lesaux (2013) differed around two standard deviations on their general vocabulary knowledge test. Because of these differences, it is more likely that Crosson's and Lesaux's readers with distinct language backgrounds differed more substantially in the interference of vocabulary problems with processing connectives successfully than the monolingual and bilingual readers in our study.

Although we did not find effects of indicators of reading problems (i.e. reading fluency levels or vocabulary knowledge levels) on the relationship between knowledge of connectives and text comprehension, we did find support for the assumption that not all readers may have equal advantage of their knowledge of connectives. The finding that readers with more metacognitive knowledge show a stronger relationship between knowledge of connectives and text comprehension than readers with lower levels of metacognitive knowledge seems to suggest that readers with less metacognitive knowledge are less successful in processing connectives and hence do not benefit maximally from their knowledge of

connectives to establish local and global coherence. Readers with more metacognitive knowledge might be more successful in processing connectives because they know the importance of connectives as indicators of local and global coherence and they are better in using them strategically to establish coherence.

2.7.1 Limitations and further directions

There are several limitations to this study. First, in our study many participants were excluded due to inappropriate behavior during administration of the expository text comprehension test: this raises concerns about the representativeness of our sample. Second, our results have to be interpreted with caution because our metacognitive knowledge test had a relative low reliability and this may have influenced our outcomes (see, for example, Cole & Preacher, 2014). We consider it therefore important that this study is replicated with a metacognitive knowledge test with a higher reliability and a sample of students with less attrition on the text comprehension test.

A third limitation is that we did not tap into students' online reading behavior or mental processes. Therefore we were not able to test to what extent readers experienced vocabulary and fluency problems during reading and to what extent they compensated for these problems. In order to clarify whether the ability to compensate for reading problems is indeed an influential factor for the processing of connectives, and to what extent reading experience plays a role in the ability to compensate, we suggest that future research taps into the online reading behavior and mental processes of primary and secondary school students with different levels of reading fluency and general vocabulary knowledge. The role metacognitive knowledge plays in the processing of connectives could possibly be unraveled with a similar research method. Is it indeed the case that students with more metacognitive knowledge make better strategic use of connectives during reading as we hypothesized? And to what extent is this reflected in their reading behavior and their text comprehension? To answer these questions we need a design that uses not only online reading measures but also off-line comprehension scores of readers varying in metacognitive knowledge. The necessity of using a combination of online and offline measures has been stressed recently by Van Silfhout et al. (2014), who have shown that connectives do not only speed up inferences during reading but also lead to better answers to comprehension questions after reading.

Using a combination of online and offline measures could also show if more knowledge of connectives *causes* more text comprehension. Because this study used a correlational design, we cannot infer from our results that readers with more knowledge of connectives were more successful in processing connectives during reading than readers with relatively less knowledge of connectives. Proficient readers could also have had more knowledge of connectives because of more reading experience and may not need to use this better developed knowledge during reading. It is plausible, however, that readers used their knowledge of connectives to reach a better understanding of the texts in our reading comprehension test, given that texts contained on average 5.2 connectives per 100 words.

2.7.2 Educational implications and conclusions

In primary school, knowledge of connectives has been shown to be uniquely related to text comprehension controlling for reading fluency and general vocabulary knowledge. The present study found that knowledge of connectives also has a unique relation to expository text comprehension in secondary school readers above and beyond sentence reading fluency, general vocabulary knowledge, and metacognitive knowledge. Because of the correlational design of the present study, we are not able to tell whether better readers are simply characterized by a better knowledge of connectives or whether more knowledge of connectives actually causes better expository text comprehension. However, we assume that secondary school readers benefit from knowing connectives because these words are frequent in expository texts and signal relationships which students may often not infer without the help of these devices (i.e. with the use of background knowledge). This seems to apply in particular for expository texts which are intended to convey new information and relationships to students (see also Singer & O'Connell, 2003). Furthermore, we found a significant interaction between knowledge of connectives and metacognitive knowledge which seems to indicate that knowing more

connectives does not help much to improve expository text comprehension when metacognitive knowledge about text structure and reading strategies is low. These results suggest that it may be wise to combine instruction on the meaning of connectives with instruction about the structure of expository texts and ways to strategically deal with these texts.

Chapter 3 Text reading fluency⁴

Abstract

The present study examined whether silent text reading fluency predicts eighth graders' expository text comprehension when accounting for sentence reading fluency, linguistic knowledge and metacognitive knowledge. Furthermore, it was examined whether the predictive value of text reading fluency for text comprehension differs between monolingual and bilingual readers, and between readers who differ in linguistic knowledge and sentence reading fluency. Monolingual (n = 54) and bilingual eighth graders (n = 117) took tests tapping into fluency skills, linguistic knowledge and metacognitive knowledge. Contrary to previous studies on text reading fluency, we controlled for differences in comprehension in our text reading fluency measure in order to get a pure measure of fluency. Multilevel regression analyses revealed that text reading fluency did not have added predictive value for text comprehension, neither for the monolinguals, nor for the bilinguals. The contribution of text reading fluency to expository text comprehension was not moderated either by linguistic knowledge or sentence reading fluency levels. Our results do not support a prevalence of a specific fluency deficit at the text level among eighth graders. Results are compared with previous studies on text reading fluency.

⁴ As knowledge of connectives accounted for unique variance in expository text comprehension in chapter 2, we decided to include this component in the present study in addition to general vocabulary knowledge. By doing this, we better account for linguistic knowledge as a predictor of expository text comprehension.

3.1 Introduction

The simple view of reading (Gough et al., 1996; Gough & Tunmer, 1986; Hoover & Gough, 1990) describes reading comprehension as the product of two component skills, listening comprehension and word decoding, a specific reading related skill. In addition to these two skills several researchers have put forward that fluency is also essential: in the context of a limited working memory capacity, these researchers have stressed that word decoding needs to be both accurate and fluent (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). The idea is that reading processes compete with each other for attentional resources: if word reading is slow and effortful, requiring substantial attention, not enough attentional resources will be left for the execution of higher order comprehension processes.

In general, for secondary school readers, word decoding is not effortful anymore (cf., Adams, 1990; Francis et al., 2005; Hoover & Gough, 1990), but fluency in processing larger text units may still be problematic for these readers. So the question is: does fluency of sentence and text level processing matter for these students' text comprehension? If disfluent word reading can hamper higher order processes, higher-order processes may also hamper each other, especially when reading difficult texts, which require more attention and effortful processing. For example, a reader who is less fluent in sentence and text level processing, might not be able to engage in particular strategic reading processes, such as inferring the meaning of an unknown word from context.

The present study was set up in order to investigate which role fluency of above word level processes plays in secondary school readers' text comprehension. We focused in particular on the fluency of text level processes. More specifically, we examined whether fluency of text level processes is uniquely related to text comprehension, when accounting for sentence reading fluency, linguistic knowledge and metacognitive knowledge as predictors.

3.2 Measuring text reading fluency

Previous studies that examined the unique contribution of text reading fluency for secondary school readers (e.g., Adlof, Catts, & Little, 2006; Cutting, Materek, Cole, Levine, & Mahone, 2009; Tilstra, McMaster, Van den Broek, Kendeou, & Rapp, 2009) are characterized by three methodological issues. First of all, earlier studies did not distinguish between sentence and text reading fluency. Therefore, in these studies, it was not possible to determine whether the speed of text level processes was a unique predictor of text comprehension apart from the speed of sentence level processes. It makes sense to distinguish between sentence and text reading fluency, because reading a text involves processes that do not play a role in understanding isolated sentences, but do so at the text level.

Two processes unique to text level are activating information from the text representation constructed so far and retrieving this information from long term working memory into working memory, in order to update the mental model (see for example the construction-integration model: Kintsch, 1998; Kintsch & Rawson, 2005; or the event-indexing model: Zwaan & Radvansky, 1998). For example, successful comprehension of the sentence "Cliff orders a burger with cheese" requires access to a previously stored text representation, when this sentence is read in a story where Cliffs starts eating burgers when he is frustrated. Access to the previously stored model (and retrieving relevant information) is necessary to understand the causal relationship between Cliff orders a burger and him being frustrated. Understanding the sentence "Cliff orders a burger with cheese" in isolation does not involve access to a previously stored text representation.

A second methodological issue of previous studies on text reading fluency with secondary school readers, is that these studies measured oral text reading fluency (i.e., reading out loud), while silent reading is the default mode for most readers after the first years of reading acquisition (Wright, Sherman, & Jones, 2010). This questions the validity of the use of an oral fluency test, especially because the few studies that examined both oral and silent reading fluency seem to indicate that

these are separate constructs (Jenkins & Jewell, 1993; Kim, Wagner, & Foster, 2011).

A third concern with earlier studies is that grade appropriate texts were used to measure text reading fluency, which makes it likely that in these studies text reading fluency was affected by comprehension differences. Therefore, these studies cannot be sure that it is fluency per se which is associated with text comprehension, and that the measurement of reading fluency is not contaminated by text comprehension differences.

The present study tries to deal with these three issues present in previous studies. The distinction between sentence and text reading fluency was acknowledged by including sentence reading fluency as a control variable in order to examine whether the speed of two key text level processes, i.e. accessing and retrieving information from the previously stored text, are uniquely associated with text comprehension. Moreover, in the present study text reading fluency was assessed while participants read silently. Finally, below grade level texts were used to tap into text reading fluency, to prevent comprehension issues affecting fluency test performances.

3.3 Text reading fluency and language background

In the present study we also examined whether there are differences between monolinguals and bilinguals with a language minority background with regard to the unique contribution of text reading fluency to text comprehension. Text reading fluency may not have the same facilitative effect for both groups: it has been argued that a certain language proficiency is required to benefit from fluent text reading and language minority readers may still be below this threshold (e.g., Buly & Valencia, 2002; Crosson & Lesaux, 2010; Geva & Farnia, 2012; Marx et al., 2015; Trapman et al., 2014; Wiley & Deno, 2005). Not being able to benefit from fluent reading may be one of the reasons why primary and secondary school students with a language minority background perform lower on reading comprehension tests in the majority language than their monolinguals peers (for a review of the situation in the United

States and Canada, see August & Shanahan, 2006; for the situation in the Netherlands, see, for example, Aarts & Verhoeven, 1999; Trapman et al., 2014; Van Gelderen et al., 2003). More specifically, it may be the case that limited linguistic knowledge is not merely a problem in itself for language minority readers' text comprehension (cf., Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004; Páez et al., 2007; Swanson et al., 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000), but that limited language knowledge also impedes readers' benefitting from fluent text processing.

To date, it remains unclear whether the benefits from fluent reading are indeed hampered for readers with a language minority background. Consistent with this hampering view are the outcomes of Wiley and Deno (2005) and Trapman et al. (2014): the former found the predictive value of text reading fluency for reading comprehension to be lower for language minority readers than for monolinguals, and similar results were found by Trapman et al. who used a composite measure of fluency based on word and syntactic processing efficiency. Additionally, results from Crosson and Lesaux (2010) suggest that language knowledge could moderate the association between fluency and comprehension; in their study the positive relationship between text reading fluency and text comprehension only held for language minority students with high language knowledge (i.e., operationalized as listening comprehension in their study). Inconsistent with the threshold hypothesis are results from Geva and Farnia (2012) and Marx et al. (2015). They showed that the relation between text reading fluency and reading comprehension was similar for language minority readers in fifth (Geva's study) and eighth grade (Marx's study) as it was for their monolinguals peers - despite significant differences in language skills between these groups. These findings suggest that the language minority readers in these studies were not significantly constrained by their lower language skills, in terms of the benefits from fluent reading.

We hypothesize that, in addition to the issue of insufficient linguistic knowledge, readers with a language minority background could also benefit less from text reading fluency than their monolingual counterparts when these language minority readers have lower word and sentence reading fluency levels. In the

context of limited attentional resources, the fluency of lower-order processes has been argued to be a necessity for successful execution of higher order processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). In line with this idea, slow word and sentence reading may require substantial attentional resources, which can prevent readers from benefitting from the fluency of higher order (i.e., text) processes.

3.4 The present study

The aim of the present study was twofold. First, we wanted to examine whether text reading fluency uniquely contributes to eighth graders' expository text comprehension, accounting for sentence reading fluency, linguistic knowledge and metacognitive knowledge. Second, we wanted to examine potential differences between readers with a language minority background and monolinguals, in terms of the contribution of text reading fluency. As it has been hypothesized that linguistic knowledge is the key factor that leads to differences in the benefits of text reading fluency for readers with various language backgrounds, we also investigated whether linguistic knowledge levels moderated the effect of text reading fluency on text comprehension. Additionally, as we hypothesized - in the context of a limited working memory capacity - that lower-order reading fluency could moderate the influence of text reading fluency, we investigated interaction effects between sentence reading fluency and text reading fluency. Furthermore, we compared bilinguals with and without Dutch as a dominant language on the predictive value of text reading fluency, as these groups could differ in terms of sentence reading fluency and linguistic knowledge levels, and therefore, also in terms of the benefits they enjoy from text reading fluency.

We measured sentence reading fluency by means of a sentence verification task, which has been used in studies with primary (e.g., Kim, Wagner, & Lopez, 2012; Klauda & Guthrie, 2008) and secondary school readers (e.g., Trapman et al., 2014; Van Gelderen et al., 2007). Linguistic knowledge was assessed by means of a general vocabulary knowledge test and a test for knowledge of connectives

specifically. In addition to sentence reading fluency and linguistic knowledge, we decided to include metacognitive knowledge as a control variable in our design. Kirby and Savage (2008) argued that language knowledge (and decoding, cf. the simple view of reading) components are not sufficient to explain differences in reading comprehension and pointed out that metacognitive skills are an important factor as well. Other researchers also identified metacognitive knowledge and skills as important factors for text comprehension differences in secondary school, in addition to language skills (e.g., Cromley & Azevedo, 2007; Schoonen et al., 1998; Trapman et al., 2014; Van Gelderen et al., 2007). Including metacognitive knowledge as an additional control variable was therefore in line with our research goal: controlling as much as possible for linguistic and non-linguistic knowledge required to comprehend a text in order to examine unique relationships between fluency and text comprehension. The aims of the present study led to the following two research questions:

- Does text reading fluency contribute to eighth graders' expository text comprehension, controlling for sentence reading fluency, linguistic knowledge and metacognitive knowledge?
- 2) Does this contribution differ between monolingual and bilingual Dutch students, and between readers who differ in linguistic knowledge and sentence reading fluency levels?

In the following section we will describe the method we used to answer these research questions. Then, the results of our analyses will be described and discussed.

3.5 Method

3.5.1 Participants

The study started with 337 students from thirteen eighth grade classes from three secondary schools in Amsterdam (the Netherlands). Students were excluded from the analyses if they had learning or reading problems (n = 16), if they did not follow instructional procedures on one or more class administered tests according to the test administrator's notes (n = 72) or if they had one or more test scores missing due to absence during a testing session or exclusion of test scores (n = 38). Test scores were excluded for students who scored below chance level or skipped half or more of the items on a test, since both were regarded as an indication of test disturbance. In addition, after the first two testing sessions, one school decided to discontinue participation for most students (n = 40, school B in Table 3.1).

Due to exclusion of test scores, only 191 students had valid expository text comprehension scores. Most students were excluded for expository text comprehension because they did not follow instructional procedures (n = 59). This large attrition due to misbehavior is related to the challenging school population and consequently difficulties teachers experienced in classroom management. In our sample of 191 students with valid expository text comprehension scores, 171 students had no other test scores missing. Our analyses were performed with this sample of 171 students. Of these 171 students, 36% received instruction at a low educational level (n = 61), 24% at an intermediate educational level (n = 42) and 40% at a high educational level (n = 68). Table 3.1 shows the number of students per school, per class and the educational level of each class.

Students were regarded as monolingual Dutch (n = 54) if they had indicated in the background questionnaire (see Instruments section) that Dutch was their only mother tongue and as bilingual Dutch (n = 117) if one or more language(s) other than Dutch were involved in their initial language acquisition. All but seven of the bilingual students were born in the Netherlands and only two of those had received less than five years of primary education in the Netherlands. Bilinguals were assigned to the *bilinguals Dutch dominant* at home group (n = 43) if they had indicated that their parents spoke Dutch to them 50% or more of the time, the other bilinguals were assigned to the *bilinguals Dutch not dominant* group (n = 74).

School	Class	Educational level*		Numb	ber
				of stu	dents
А	A1, A2, A3, A4	Low		54	
	A5	Intermediate		17	
	A6, A7	High		46	
		-	Total		117
В	B1	Low		7	
	B2	Intermediate		3	
	B3	High		6	
			Total		16
С	C1, C2	Intermediate		22	
	C3	High		16	
			Total		38
			Total all schools		171

Table 3.1 Students included in the analyses per school, class and the educational level of each class.

*The educational levels correspond to the following educational levels in Dutch secondary school: low = vmbo-t (prevocational level) or vmbo-t/havo (prevocational/general secondary educational level), intermediate = havo (general secondary educational level) or havo/vwo (general secondary educational/pre-university level), high = vwo (pre-university level).

The socio-economic status (SES) of the participants was calculated based on educational level and job status of parents/caretakers following Scheele, Leseman and Mayo (2010), resulting in a score ranging from 1 (minimum level of SES) to 7 (maximum level of SES). Of 11 participants SES status could not be calculated due to missing data. On average participants came from low socio-economic backgrounds (m = 3.20, sd = 1.24), both monolinguals (m = 3.84, sd = 1.21) and bilinguals (m = 2.88, sd = 1.12).

3.5.2 Instruments

The students took six tests, which measured their expository text comprehension, vocabulary knowledge (two tests), metacognitive knowledge, sentence reading

fluency and text reading fluency. Students also filled out a questionnaire tapping into background information.

Expository text comprehension. The expository text comprehension test comprised 35 multiple choice questions (with three or four answer options) about five expository texts. These texts varied in length between 184 to 449 words and addressed various topics (about energy systems in the body, the history of whaling, etc.). Four texts were derived from the database of *Diataal* (Hacquebord et al., 2005). One text was derived from the reading comprehension test used in a study by Van Gelderen et al. (2007). Texts and questions were adapted slightly.

Linguistic knowledge. Linguistic knowledge was measured by means of two tests. One was a computer-administered general vocabulary test developed by Diataal (Hacquebord et al., 2005) that included 70 multiple choice items drawn from a corpus of school book texts. Test items varied in difficulty level (as judged by teachers) and frequency in the corpus. Items were general academic words, e.g. *aspects*, as well as domain or subject specific words, e.g. *roam* (e.g., in a forest), *interior* (i.e. of a house) or *executed* (i.e. murdered). The other test tapped into students' *knowledge of connectives* specifically, by means of a 43 item fill-in-the-blanks test. The test comprised six short expository texts which addressed various topics (e.g., spiders, vitamins, the origin of the @-symbol, etc.). The texts varied in length between 85 to 177 words. Each text comprised blanks, and for each of those blanks, students had to choose the appropriate connective out of three options. Relationships between the propositions that had to be connected were assumed to be familiar to all students.

Metacognitive knowledge. To measure students' metacognitive knowledge of text structure and reading and writing strategies we used an adapted version of the metacognitive knowledge test used by Van Gelderen et al. (2007). The original test was reduced to 45 statements. In this test, participants had to indicate whether or not they agreed with statements about text structure and writing and reading strategies. For example, a correct response would be if they agreed with the following

statement: if you do not understand the meaning of a word, it is useful to try to guess its meaning by looking at other words and sentences surrounding the unfamiliar word.

Sentence reading fluency. Sentence reading fluency was measured by a sentence verification test similar to the one used by Van Gelderen et al. (2007). Students were presented 110 sentences on a laptop screen and had to decide as fast as possible whether a sentence made sense or not by pressing a red (sentence makes no sense) or a green stickered key (sentence makes sense) on their laptops' keyboards. Half of the sentences made sense, the others did not. Sentences that did not make sense were in flagrant contradiction with encyclopedic knowledge all students were considered to share (e.g. *The Netherlands is the largest country in the world* was a sentence that did not make sense). Sentence reading fluency was calculated by averaging the reaction times on the correct responses to the sentences that make sense.

Text reading fluency. To test students text reading fluency students had to read 66 short narrative and expository stories of 13 to 44 words on a laptop screen and had to indicate whether an additional sentence that appeared on their screen was consistent with the preceding story or not.

To guarantee comprehension of the texts, stories and extra sentences were below grade level and contained only high frequent words. During the test students were instructed to keep the forefinger of their dominant hand on the green stickered space bar and their other forefinger on one of the two red stickered alt-keys next to the space bar (i.e., left-handers used the right red alt-key, right-handers the left one). First, students saw the instruction 'Wait for the story' on their laptop screen for two seconds followed by a fixation stimulus (three dots) for 500 milliseconds. When this fixation stimulus disappeared from the screen, a short story appeared. Students were instructed to carefully read the story once and to press the green-stickered space bar when they had finished reading. They were told that it was important to read every story carefully, because this would enable them to comprehend the story and to give accurate and quick responses to the target sentence.

Once students pressed the green space bar after reading the story an extra sentence appeared on the students' laptop screens below the story. Students had to read this sentence and had to indicate as quickly as possible whether this sentence was consistent with the story or not (by pressing the green or red stickered key). Because students were expected to determine with ease whether there was a match or a mismatch between the story and its continuation, they were told to respond as quickly as possible and not to pay attention to grammar or spelling of the sentences. After the test administrator had clarified the procedure several times by means of example stories, students practiced on their laptops with three trial stories and received feedback on their responses. In the actual test they did not get feedback.

Of the extra 33 consistent target sentences (half of the sentences), 11 sentences were causally related to the story and contained a connective that marked the causal relationship (e.g. *therefore*) with the last sentence of the story. The remaining 22 consistent sentences related in an implicit way (i.e. without a connective) causally to either information in the last sentence of the story (11 sentences) or to information in a sentence before the last sentence of the story (11 sentences). The mean response latency to the consistent target sentences served as the measure of text reading fluency.

Table 3.2 shows for each subgroup the internal consistency (Cronbach's Alpha) of the tests as a reliability estimate. Tests show generally satisfactory reliability estimates between .72 or .97, except for the metacognitive knowledge test, where reliability estimates are around .60.

Background questionnaire. The background questionnaire requested the following information: gender, country of birth, mother tongue, language(s) the parents/caretakers speak to participants (and percentages of the time they speak these languages to them), country of birth of parents/caretakers, the highest completed educational level of parents/caretakers and jobs of parents/caretakers.

Table 3.2 Reliabi	lity estimate	s of the tests	for the whole s	ample and the	e subsamples	
	Number of items	All students	Monolingual Dutch	Bilingual Dutch	Bilingual Dutch	Bilingual Dutch not
		(<i>n</i> = 171)	(n = 54)	(<i>n</i> = 117)	dominant $(n = 43)$	dominant $(n = 74)$
Expository text comprehension	35	.79	.85	.73	.75	.72
General vocabulary knowledge	70	.82	.78	.80	.84	.78
Knowledge of connectives	43	.83	.86	.79	.76	.81
Metacognitive knowledge	45	.63	. 60	.62	.61	.63
Sentence reading fluency (RT in msec)	46	.95	96.	.95	.95	.95
Text reading fluency (<i>RT in msec</i>)	32	.87	88.	.87	.89	.85

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3.5.3 Procedure

Data was collected from March till June 2014. Each test was administered in a separate testing session. Students were given enough time to complete the tests. The reading comprehension test, the general vocabulary knowledge test, the knowledge of connectives test and the metacognitive knowledge test were administered during

regular classes. All plenary administered tests were paper and pencil tests except for the general vocabulary test which was computer-administered. Test administrators took notes on students' behavior during plenary test administrations. For the reading fluency tests, participants were taken out of their regular classes in groups of four to a separate test room to perform these tests on laptop computers.

3.5.4 Scoring and missing value treatment

On the general vocabulary knowledge test and the reading fluency tests, there were no missing items because these digital tests required a response for every item. Skipped items from the expository text comprehension, knowledge of connectives and metacognitive knowledge tests were scored as incorrect. For the fluency tests, the procedure described in Van Gelderen et al. (2003) was used for scoring and missing value treatment. First, to ensure that linguistic knowledge and comprehension did not influence performance on the fluency test, sentences with an accuracy rate lower than .875 (Van Gelderen et al., 2003) were excluded from the analyses. Nine sentences in the sentence reading fluency test were deleted (hence mean reaction times were calculated on the basis of the remaining 46 sentences) and one item in the text reading fluency test (hence mean reaction times were calculated on the remaining 32 sentences). Second, inaccurate responses to sentences or items in the text reading fluency test or potentially untrustworthy ones (extremely slow responses, that is, reaction times three standard deviations above the mean, or extremely fast responses, that is, faster than the fastest reaction time of a group of five expert readers) were turned into missing values. In addition, responses to items in the text reading fluency measure were turned into missing values when the story preceding the item was read extremely fast (faster than the fastest reaction time of a group of experts) or extremely slow (three standard deviations above the mean reaction time of a story), because this was considered as an indication that the story was read sloppily and hence the reaction time to the item not a trustworthy response. Next, the missing values on the sentences in the sentence reading fluency test and on the items in the text reading fluency test were estimated with the expectation maximization procedure of SPSS (SPSS Inc., Chicago, IL, USA).

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3.5.5 Analyses

Means and standard deviations on all tests were computed for the whole sample, separately for the monolingual and the bilingual sample, and separately for the two bilingual subgroups (Dutch dominant versus Dutch not dominant). Because participants were from different classes, all regression analyses were performed with a random intercept for class. Differences between monolinguals and bilingual Dutch students and between the two bilingual subgroups on the tests were investigated by the use of regression analyses with the tests as dependent variables and two independent (i.e. orthogonal) contrasts as predictor variables: one predictor contrasting monolingual versus bilingual Dutch students and one contrasting the two bilingual groups. These contrasts were added in a stepwise manner as predictors of a test; first it was examined whether monolinguals differed from bilinguals on a test, next potential differences between the two bilingual groups were examined. Effect sizes of the differences are reported as the percentage of increase in explained variance (Δr^2). Furthermore, for the whole sample and for the subsamples, correlations between the test scores were calculated.

Before we examined our research questions, we investigated whether each of the predictor variables (i.e. sentence reading fluency, text reading fluency, general vocabulary knowledge, knowledge of connectives and metacognitive knowledge) were curvilinearly related to text comprehension, because it has been shown that curvilinear relationships between predictors and dependent variables may affect the estimation of interaction effects (Ganzach, 1997). We investigated this by examining whether the quadratic terms of the predictors led to model improvement for each of the predictors separately.

To examine our first research question, we investigated whether text reading fluency could explain text comprehension, when controlling for sentence reading fluency, linguistic knowledge and metacognitive knowledge. Next, to examine our second research question, we investigated interactions between language background and text reading fluency, between linguistic knowledge and text reading fluency, and between sentence reading fluency and text reading fluency.

We also performed the abovementioned regression analyses with a sample of 191 students to check for the robustness of our outcomes. All these 191 students had a score on expository text comprehension and 20 of these students had a score missing on one (n = 18) or two (n = 2) of the predictor variables. For the robustness check, we created a dummy variable for each predictor variable that represented whether a score was missing (a score of 1) or not (a score of 0) for the associated predictor variables. These dummy variables were entered along with the associated predictor variables in our regression models. These models did not include a fixed intercept and missing scores on the standardized predictor variables were recoded into a score of zero (see Koomen & Hoeksma, 1991). This method enabled us to investigate whether the outcomes of our models were affected, that is, different from the sample with 171 students, when controlling for the variance that was accounted for in text comprehension by differences between students who either missed or did not miss a score for every predictor variable.

3.6 Results

3.6.1 Descriptive statistics

Expository text comprehension scores were normalized with Blom's formula (Blom, 1958). Table 3.3 shows the means and standard deviations on the six tests for the whole sample and for the various subgroups. Regression analyses indicated that the monolinguals outperformed the bilinguals in expository text comprehension (χ^2 (1) = 9.07, p = .00, $\Delta r^2 = .08$), general vocabulary knowledge (χ^2 (1) = 18.38, p = .00, $\Delta r^2 = .14$), knowledge of connectives (χ^2 (1) = 12.98, p = .00, $\Delta r^2 = .11$) and metacognitive knowledge (χ^2 (1) = 4.43, p = .04, $\Delta r^2 = .05$), but there were no

significant differences between the monolinguals and bilinguals on sentence reading fluency (χ^2 (1) = 0.34, p = .56, Δr^2 = .00) and text reading fluency (χ^2 (1) = 0.78, p = .38, Δr^2 = .00). Furthermore, regression analyses did show that the bilingual Dutch dominant group read faster than the bilingual Dutch not dominant group, both on sentence level (χ^2 (1) = 9.24, p = .00, Δr^2 = .05) and text level (χ^2 (1) = 4.67, p = .03,

Table 3.3 Means (and (standard devia	ttions) on the six	measures for the	whole sample ar	nd the subgroup	s.
	Number of items	All students $(n = 171)$	Monolingual Dutch	Bilingual Dutch	Bilingual Dutch	Bilingual Dutch not
			(n = 54)	(n = 117)	dominant $(n = 43)$	dominant $(n = 74)$
Expository text	35	24.52	26.72	23.51	23.00	23.80
comprehension		(5.31)	(5.95)	(4.69)	(4.89)	(4.58)
General vocabulary	70	52.92	57.26	50.91	51.00	50.86
knowledge		(7.82)	(6.33)	(7.65)	(8.39)	(7.24)
Knowledge of	43	31.44	34.37	30.09	29.63	30.35
connectives		(5.99)	(5.83)	(5.59)	(5.22)	(5.81)
Metacognitive	45	35.58	36.91	34.97	34.58	35.19
knowledge		(4.07)	(3.68)	(4.11)	(4.12)	(4.11)
Sentence reading	46	2844	2804	2863	2685	2967
fluency (RT in msec)		(496)	(508)	(492)	(476)	(473)
Text reading	32	1606	1571	1623	1540	1670
fluency (<i>RT in msec</i>)		(320)	(313)	(324)	(341)	(305)

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 $\Delta r^2 = .03$). The two bilingual groups did not differ on other test performances (text comprehension (χ^2 (1) = 1.07, p = .30, $\Delta r^2 = .00$), knowledge of connectives (χ^2 (1) = 0.99, p = .32, $\Delta r^2 = .01$), general vocabulary knowledge (χ^2 (1) = 0.09, p = .76, $\Delta r^2 = .00$) and metacognitive knowledge (χ^2 (1) = 1.03, p = .31, $\Delta r^2 = .00$).

3.6.2 Correlations

Table 3.4 shows the correlations between the constructs in our study for the whole sample and for the subgroups. In general, the knowledge measures general vocabulary knowledge, knowledge of connectives and metacognitive knowledge correlated moderately with expository text comprehension (correlations between .20 and .55). This indicates that students with more knowledge had higher expository text comprehension scores. Between the fluency tests and expository text comprehension correlations were very low (see Table 3.4). This finding indicates that readers who were more fluent in sentence or text reading did not have a higher expository text comprehension than their peers who read slower. Fluency measures correlated moderately with each other and low to moderate with general vocabulary knowledge, knowledge of connectives and metacognitive knowledge.

3.6.3 Curvilinear effects

We could not establish a curvilinear relationship with text comprehension for sentence reading fluency (χ^2 (1) = .50, p = .48, Δr^2 = .00), text reading fluency (χ^2 (1) = 1.30, p = .25, Δr^2 = .00), general vocabulary knowledge (χ^2 (1) = .68, p = .41 Δr^2 = .00), and metacognitive knowledge (χ^2 (1) = 1.30, p = .25, Δr^2 = .00), but we did find a curvilinear relationship between knowledge of connectives and text comprehension (χ^2 (1) = 6.84, p = .01, Δr^2 =.04). The parameter estimate of the quadratic term of knowledge of connectives was positive, which means that the relationship between knowledge of connectives. We included both the linear and the quadratic term of knowledge of connectives in our regression models.

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	General vocabulary	Knowledge of	Metacognitive knowledge	Sentence reading	Text reading
	knowledge	connectives	lillowieuge	fluency	fluency
Text comprehension	-	-		-	-
All students	.40*	.55*	.43*	12	06
MD	.34*	.54*	.51*	13	20
BD	.34*	.48*	.34*	10	.04
BDdom	.54*	.51*	.31*	10	.08
BDndom	.20	.46*	.35*	15	01
General vocabulary					·
All students		.48*	.40*	32*	15*
MD		.51*	.24	46*	34*
BD		.37*	.38*	27*	06
BDdom		.47*	.50*	38*	18
BDndom		.31*	.31*	20	.04
Knowledge of connec	tives				
All students			.43*	29*	16*
MD			.42*	42*	27
BD			.38*	22*	08
BDdom			.41*	34*	17
BDndom			.36*	21	05
Metacognitive knowle	edge				
All students	0			22*	23*
MD				15	28*
BD				24*	20*
BDdom				38*	41*
BDndom				20	10
Sentence reading flue	ncy	·		·	·
All students					.55*
MD					.58*
BD					.53*
BDdom					.57*
BDndom					.46*

Table 3.4 Correlations between the six variables for the whole sample and the subgroups.

MD, Monolingual Dutch (n = 54); BD, Bilingual Dutch (n = 117); BDdom, Bilingual Dutch dominant at home (n = 43); BDndom, Bilingual Dutch not dominant at home (n = 74). *p < .05.

text comprehension ($N_{\rm students}$ =171, $N_{\rm classes}$ =1	3).							
Research questions		RQ 1			RQ 2				
Models		M0	M1	M2	M3	M4	M5	M6	M7
Variance	Class	.21(.11)	.04(.04)	.04(.04)	.04(.04)	.04(.03)	.04(.04)	.04(.04)	.04(.04)
	Students	.75(.08)	.57(.06)	.57(.06)	.56(.06)	.56(.06)	.56(.06)	.56(.06)	.56(.06)
	Total	.96	.61	.61	.60	.60	.09	.60	.60
Distribution of	Class	21.9%	6.6%	6.6%	6.7%	6.7%	6.7%	6.7%	6.7%
variance	Students	78.1%	93.4%	93.4%	93.3%	93.3%	93.3%	93.3%	93.3%
Explained variance	Class		81.0%	81.0%	81.0%	81.0%	81.0%	81.0%	81.0%
	Students		24.0%	24.0%	25.3%	25.3%	25.3%	25.3%	25.3%
	Total		36.5%	36.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Increase in	Class		81.0%		1	1			
explained variance	Students		24.0%		1.3%		ı	·	
	Total		36.5%	ı	1.1%	,	ı	ı	ı
Fit in -2LL		456.37	396.93	396.85	396.45	393.83	395.08	396.85	396.29
Difference in -2LL			59.44*	.08	.40	2.62	1.80	00.	.56
Difference in df			5	1	2	2	1	1	1
Compared to model			M0	MI	M2	M3	M2	M2	M2
Parameter estimates									
Intercept		10	13	13	11	11	15	13	16
		(.15)	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)
Sentence reading flu-	ency		.10 (.06)	.00 (70.)	.08 (80)	.08 (.08)	.00 (70.)	.09 (70.)	.00 (70.)

Table 3.5 Model fit, variance components and parameter estimates for our two research questions predicting expository

General vocabulary knowledge	.10	.10	60.	.10	.08	.10	.10
	(20.)	(.08)	(.08)	(80.)	(.08)	(.08)	(.08)
Knowledge of connectives	.43*	.43*	.42*	.42*	.44*	.43*	.43*
	(.08)	(.08)	(.08)	(80.)	(.08)	(.08)	(.08)
Knowledge of connectives ²	.11*	.11*	.11*	.10*	.12*	.11*	.11*
)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)
Metacognitive knowledge	.20*	.21*	.20*	.21*	.20*	.21*	.21*
	(.07)	(.07)	(20.)	(20.)	(.07)	(.07)	(.07)
Text reading fluency		.02	.02	.03	.03	.02	.02
		(.07)	(.07)	(20.)	(.07)	(.07)	(.07)
Language background MD vs. BD (LB1)			03	02		1	
			(.05)	(.05)			
Language background BDdom vs. BDndom (LB2)			-00	.01			
			(.07)	(80.)			
Text reading fluency x LB1				.04			
				(.04)			
Text reading fluency x LB2				.10	ı	1	
				(20.)			
Text reading fluency x general vocabulary knowledge					09 (70.)	1	1
Text reading fluency x knowledge of connectives						00.	1
						(20.)	
Text reading fluency x sentence reading fluency							.04
							(90)
MD, monolingual Dutch; BD, bilingual Dutch; BDdom, Predictors are standardized. Standard errors between brac Knowledge of connectives ² = quadratic term of knowled.	bilingual Du ckets. The di ge of connec	utch dominant fference in -2] tives.	at home; BI Log Likelih	Dndom, biling ood is chi-squ	gual Dutch ne 1are distribut	ot dominant a ed.	t home.
$^{*}p$ < .05.							

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Interactions with the quadratic term were tested only if there was a significant interaction with the linear term of knowledge of connectives.

3.6.4 Effects of text reading fluency

Table 3.5 shows the regression analyses to answer our research questions. Given the low correlations between text reading fluency and reading comprehension, it comes as no surprise that text reading fluency did not account for extra variance in reading comprehension, compare model 2 with model 1 in Table 3.5, χ^2 (1) = .08, p = .37, Δr^2 = .00.

3.6.5 Interactions with text reading fluency

Table 3.5 also shows that language background did not improve model fit controlling for sentence reading fluency, linguistic knowledge, metacognitive knowledge and text reading fluency, compare model 3 with model 2, χ^2 (2) = .40, p = .82, Δr^2 = .01. Differences in text comprehension between the monolinguals and bilinguals in our study are therefore likely to be related to the differences found between these readers in linguistic knowledge and metacognitive knowledge (but not in fluency, see descriptive statistics). Our results also show that monolinguals and bilinguals did not differ substantially in the unique contribution of text reading fluency to reading comprehension: interactions between language background and text reading fluency appeared to be non-significant and did not improve model fit, compare model 4 with model 3, $\chi^2(2) = 2.62$, p = .26, $\Delta r^2 = .00$. Lastly, linguistic knowledge and sentence reading fluency did not interact with text reading fluency; compare model 5 with model 2 for the interaction with general vocabulary knowledge (χ^2 (1) = 1.80, p = .18, Δr^2 = .00), model 6 with model 2 for the interaction with knowledge of connectives (χ^2 (1) = .00, p = 1.00, $\Delta r^2 = .00$) and model 7 with model 2 for the interaction with sentence reading fluency ($\chi^2(1) = .56$, $p = .45, \Delta r^2 = .00).$

3.6.6 Robustness check: models with 191 students

Regression analyses performed with a sample of 191 students revealed that there were no differences between expository text comprehension scores of students who either missed or did not miss a score on sentence reading fluency (t(191) = 1.66, p =.10), general vocabulary knowledge (t (191) = .66, p = .51), knowledge of connectives (t (191) = -1.16, p = .25) and text reading fluency (t (191) = .85, p = .25).40). However, students who missed a score on metacognitive knowledge performed lower on expository text comprehension than those with scores on metacognitive knowledge (t (191)= -2.87, p = .01). Despite these results for metacognitive knowledge, outcomes from the models with a sample of 191 students led to the same conclusions as with a sample of 171 students in terms of model improvement: that is, a model that included text reading fluency in addition to the control variables did not lead to model improvement (χ^2 (2) = .85, p = .37, Δr^2 = .01) and text reading fluency did not interact significantly with language background (χ^2 (2) = 3.16, p = .21, $\Delta r^2 = .00$), general vocabulary knowledge (χ^2 (1) = .58, p = .45, $\Delta r^2 = .00$), knowledge of connectives (χ^2 (1) = .47, p = .49, Δr^2 = .00) or sentence reading fluency ($\chi^2(1) = 1.75$, p = .19, $\Delta r^2 = .01$).

In contrast to the sample with 171 students, the quadratic term of knowledge of connectives was not included in the regression models for the sample with 191 students. Although the quadratic term did lead to model improvement controlling for the linear term in the larger sample (χ^2 (1) = 4.36, p = .04, Δr^2 = .03), the curvilinear relationship was considered invalid for this sample because including the quadratic term in the model led to non-significance of the linear term (cf., Breetvelt et al., 1994).

3.7 Discussion

The present study examined whether silent text reading fluency predicts eighth graders' expository text comprehension, controlling for sentence reading fluency, linguistic knowledge and metacognitive knowledge. Furthermore, the present study investigated whether language background (monolingual versus bilingual Dutch),

linguistic knowledge or sentence reading fluency had an impact on the contribution of text reading fluency. Our results indicate that text reading fluency did not account for unique variance in expository text comprehension, when taking into account sentence reading fluency, linguistic knowledge and metacognitive knowledge. Neither was the predictive value of text reading fluency moderated by language background, linguistic knowledge or sentence reading fluency.

The lack of unique predictive value of silent text reading fluency concurs with the findings of Cutting et al. (2009), Adlof et al. (2006) and Veenendaal et al. (2015), who did not find an additional contribution of oral text reading fluency, accounting for decoding and language skills for readers from seventh to ninth grade (Cutting et al.'s and Adlof's study) and for fourth graders (Veenendaal's study). However, our findings are in contrast with Tilstra et al. (2009), who did find a unique contribution of oral text reading fluency for seventh and ninth graders, on top of the variance accounted for by decoding and language skills.

An explanation for these contrasting findings may be found in the differences in the difficulty of the texts used to tap into text reading fluency. If texts are difficult, comprehension differences between readers are likely to occur which will affect fluency performance. For difficult texts, fluency is therefore more likely to reflect comprehension level and will consequently be correlated stronger with text comprehension skill. In our study we used (very simple) below grade level texts to measure text reading fluency - to get a pure measure of fluency - whereas Tilstra et al used grade appropriate tests. Therefore, we consider it possible that in Tilstra et al.'s study differences in fluency performances were also reflecting comprehension differences.

Although Adlof et al. (2006), Cutting et al. (2009) and Veenendaal et al. (2015) did not find unique contributions of text reading fluency using grade appropriate texts either, it may be that these texts were not as challenging as in Tilstra et al. (2009). Correlations between the text reading fluency tests and text comprehension tests in these studies seem to support this assumption. Tilstra et al. used the *Curriculum Based Measurement* (CBM) oral reading task (Deno, 1985) to tap into text reading fluency, for which correlations with text comprehension were

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.62 and .69 in seventh and ninth grade, whereas Adlof et al. and Cutting et al. used the *Gray Oral Reading Test* (GORT: Wiederholt & Bryant, 1994), for which correlations with text comprehension for secondary school readers were weaker, from .37 to .63. In Veenendaal et al.'s study the correlation between fluency and comprehension was even weaker, r = .14.

Besides text difficulty, the language in which fluency was tested may also play a role. In our study and in Veenendaal et al.'s Dutch was tested, which is characterized by a relatively high orthographic transparency compared to English. Knowledge of word spelling (and decoding skills) are therefore less likely to play a role in accurate and fluent reading in Dutch than in English, resulting in lower relationships between fluency and comprehension for Dutch readers. This may explain why correlations between text reading fluency and reading comprehension in our study and Veenendaal et al.'s study are particularly low, compared to the studies that tested associations between fluency and comprehension in English.

An additional cause for the varying results on text reading fluency could be the amount of time students were given to complete the reading comprehension test. In our study, as well as in Veenendaal et al.'s, Adlof et al.'s and Cutting et al.'s studies, students had enough time to complete their reading comprehension tests, while in Tilstra et al. time was restricted. Time may be crucial, as it has been shown that reading comprehension is correlated stronger with fluency skills when reading under restricted time (e.g., Walczyk & Raska, 1992; Walczyk, 1993; 1995; Walczyk et al., 2007). When time is restricted, students have little opportunity to compensate for relatively inefficient reading processes with strategic behavior, such as rereading (e.g. Walczyk, 1995; 2000; Walczyk et al., 2007). The students in Tilstra et al. might therefore not have been able to deal with inefficient reading processes to the same extent as the students in our study (and the other studies), where there was no time pressure.

In the introductory section we put forward the hypothesis that readers with a language minority background, due to limited language skills, may not be able to benefit from fluent text processing to achieve a better text comprehension to the same extent as their monolingual peers. In our study, however, we did not find a

difference between language minority readers and monolinguals in the contribution of text reading fluency to reading comprehension, despite the lower language skills of these bilingual students (see descriptive statistics in results section). It seems, therefore, that the lower language skills of the bilinguals were not causing them to benefit less from their fluency skills than their monolingual peers. Also, linguistic knowledge components themselves did not moderate the effect of text reading fluency on reading comprehension. This means that students with relatively more linguistic knowledge did not benefit more from text reading fluency than their peers with lower levels of linguistic knowledge. The same holds true for readers with relatively better developed sentence reading fluency; as sentence reading fluency and text reading fluency did not interact, relatively faster readers at the sentence level do not benefit more from faster text reading than their peers with relatively slower sentence reading skills. In fact, text reading fluency was not at all predictive of expository text comprehension, since correlations were (very) low and nonsignificant.

Based on our results, there is little reason to assume the prevalence of Dutch eighth graders with a specific fluency deficit at the text level. That is, a specific fluency 'disadvantage' without comprehension problems, which has implications for expository text comprehension levels. In the theoretical section we argued that text reading fluency is dependent on two text level processes that do not play a role at sentence level, namely accessing and retrieving previously stored text information. Apparently, the speed with which these two text level processes are executed is not predictive of expository text comprehension levels. The results of our study therefore do not support the idea that the speed of higher-order comprehension processes is important for Dutch eighth graders' expository text comprehension.

More research is required to investigate under which conditions our results hold; as mentioned in the paragraphs above, results might differ depending on orthographic transparency of the language under investigation, as well as the time available to complete the reading comprehension task. Furthermore, many students were excluded from the analyses (due to misbehavior), which warrants a recommendation for our study to be replicated.

We want to stress here - as mentioned above - that the absence of a relationship between text reading fluency and expository text comprehension in our study is likely to be caused by our use of easy texts to measure fluency. We acknowledge that the use of easy, below-grade level texts does not correspond with the actual text reading fluency for grade appropriate expository texts and that this raises question about the ecological validity of our text fluency test. However, if we had used grade appropriate expository texts to tap into readers' fluency levels, comprehension differences, and, consequently, differences in the successful execution of reading processes, might have played a role. Therefore, by using grade appropriate texts we would not have obtained a measure of fluency unaffected by comprehension.

With more difficult texts, additional text level processes related to comprehension skill are expected to come into play, for example inferring the overall (or top-level) structure of a text, in which good comprehenders have shown to outperform their peers with poorer comprehension skills (e.g., Meyer et al., 1980). That is, good comprehenders are more likely to infer the overall structure of expository texts like description or problem-solution (see Meyer, 1985 for an overview of top-level structures). Once an overall structure is inferred, it has been argued that this structure is used as a guiding principle to process and store text information. One would therefore expect that once a text's overall structure is inferred, information that fits within this structure is likely to be processed faster. As such, inferring text structure is assumed to increase text reading fluency. Besides inferring text structure, also other (top-down) comprehension processes, such as background knowledge activation during reading (as a necessity to infer relationships between text parts), are also likely to differ predominantly for difficult texts, thereby affecting reading fluency levels.

In sum, it does not seem possible to use grade appropriate texts and at the same time rule out comprehension differences. On the other hand, controlling for comprehension differences in the fluency test inevitably leads to the use of easy

texts, which potentially renders the validity of the texts. But even though text reading fluency may be more or less related to text comprehension, depending on its comprehension challenges, it is important to note that several longitudinal and crosssectional studies have shown that the relationship between fluency and text comprehension decreases with age. On the other hand, the variance text comprehension shares with skills that fall under the umbrella of the language comprehension component of the simple view of reading increases with age (e.g., Hoover & Gough, 1990; Tilstra et al., 2009; Yovanoff, Duesbery, Alonzo, & Tindal, 2005). The results of our study are in line with this developmental trend. For the eighth graders in our study, vocabulary knowledge, knowledge of connectives and metacognitive knowledge were strong predictors of reading comprehension, whereas sentence and text reading fluency did not have predictive value. Therefore, in terms of reading instruction, it seems more effective to focus on vocabulary knowledge and metacognitive knowledge than on fluency, when trying to improve eighth graders' text comprehension.
Chapter 4 Text structure inference skill⁵

Abstract

The present study investigated whether text structure inference skill (i.e., the ability to infer overall text structure) has unique predictive value for expository text comprehension, on top of the variance accounted for by sentence reading fluency, linguistic knowledge and metacognitive knowledge. Furthermore, it was examined whether the unique predictive value of text structure inference skill differs between monolingual and bilingual Dutch students, or between students who vary in reading proficiency, reading fluency or linguistic knowledge levels. Eighth graders (n =151) took tests that tapped into their expository text comprehension, sentence reading fluency, linguistic knowledge, metacognitive knowledge, and text structure inference skill. Multilevel regression analyses revealed that text structure inference skill has no unique predictive value for eighth graders' expository text comprehension, when controlling for reading fluency, linguistic knowledge and metacognitive knowledge. However, text structure inference skill has unique predictive value for expository text comprehension in models that do not include both knowledge of connectives and metacognitive knowledge as control variables, stressing the importance of these two cognitions for text structure inference skill. The predictive value of text structure inference skill did not depend on readers' language backgrounds or on their reading proficiency, reading fluency or vocabulary knowledge levels.

⁵As knowledge of connectives accounted for unique variance in expository text comprehension in chapter 2, we decided to include this component in the present study in addition to general vocabulary knowledge. By doing this, we better account for linguistic knowledge as a predictor of expository text comprehension.

4.1 Introduction

Although several theories about reading comprehension have identified the knowledge and skills required to comprehend a text (Gough et al., 1996; Gough & Tunmer, 1986; Hoover & Gough, 1990; Kintsch & Rawson, 2005; Kintsch, 1998; Perfetti, 1999; Perfetti et al., 2005), less is known about the knowledge and skills required to understand specific text genres. The present study is set up in order to get a better understanding of the knowledge and skills important for expository text comprehension. In particular, the present study focuses on one specific skill: the ability to infer text structure, which we consider an especially helpful skill for expository text comprehension. Furthermore, the present study examines whether language background, reading proficiency, sentence reading fluency and linguistic knowledge might affect the contribution of text structure inference skill to text comprehension. In what follows, we will first explain why we assume that the ability to infer text structure is an especially helpful skill for expository text comprehension. Next, we will argue why benefits of this skill might vary, depending on a reader's language background, reading proficiency, reading fluency or linguistic knowledge.

4.2 Text structure inference in expository text comprehension

Meyer (1985) reported that the overall organization, or top-level structure, of most expository texts can be described by one of five patterns: problem-solution, causation, description, comparison and collection/sequence. If a text is organized by one of these top-level structures, we expect readers who infer this top-level structure to have a better text comprehension than readers who do not. In line with Meyer et al. (1980), we assume that inferring a text's top level structure helps readers to build a coherent representation of a text, because it helps the reader to store text information hierarchically. That is, once a top-level structure is inferred we assume that a reader will use this structure (or schema) as a guiding principle to distinguish between more and less important text information and to store text information accordingly. More specifically, text information linked to the text's top level structure is stored at the highest level in the hierarchy of a text representation, while details supporting the overall structure are stored at lower levels in the representation. A reader who does not infer the top-level structure of a text will not have a schema to help store the text information he encounters in a hierarchical fashion; his text representation is therefore expected to be list-like, lacking a hierarchical organization of ideas.

Findings from Meyer et al. (1980) support the link between text structure inference skill and text comprehension. In their study, readers who were better able to infer the top-level structure of a text also scored higher on text comprehension. Moreover, intervention studies seem to suggest a causal link between text structure inference skill and text comprehension, because training students to attend to text structure during reading (e.g., underlining words that signal text structure and searching for the overall structure of a text) is associated with better scores on standardized reading comprehension tests, as well as with better recall of a text's main ideas and of text information in general (e.g., Cook & Mayer, 1988; Gordon, 1989; Meyer et al., 1989; Meyer & Poon, 2001; Paris et al., 1984; Wijekumar et al., 2013; Williams, Hall, & Lauer, 2004; Williams, 2005; Williams et al., 2009).

4.3 Characteristics that may hamper text structure inference

Readers may not benefit equally from their text structure inference skills, in terms of improved text comprehension. Four factors in particular may influence the benefits of inferring text structure: language background, reading proficiency, reading fluency and linguistic knowledge.

As regards language background, Hacquebord (1989; 1999) assumed that readers with a language minority background may focus more on higher levels of text processing, compared to their monolingual peers, as a compensating mechanism for language problems at lower levels of text processing, that is, at the word and sentence level. Her assumption was based on the finding that language minority readers did not perform worse than their monolingual peers on questions that tapped into global text comprehension, whereas they did score worse on text comprehension questions that assessed word and sentence level comprehension.

From this compensatory view, the relationship between text structure inference skill and reading comprehension is expected to be stronger for language minority readers than for their monolingual peers, as it is expected that language minority readers use this skill to compensate for text comprehension problems at lower text levels.

Results from Stevenson et al. (2003) do not support Hacquebord's compensatory view. They found, by means of a think-aloud study, that in comparison to their monolingual peers, language minority readers used more reading strategies that focused directly on their language problems, instead of compensating for these problems by focusing on higher text levels. Other studies also concur with the findings of Stevenson et al. (2003): readers with problems at the word and sentence level do not seem to use a more top-down approach of text processing, but instead seem to focus directly on their problems at the word and sentence level (e.g., Davis & Bistodeau, 1993; Horiba, 1990; 1996; 2000). If language minority readers indeed direct more attention to word and sentence level processing (due to their limited reading fluency or linguistic knowledge), the attentional resources this requires may hamper them in engaging in higher order processing, such as text structure inference (e.g., Bernhardt & Kamil, 1995; Cummins, 1979; Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001; Segalowitz, Watson, & Segalowitz, 1995). Assuming limited attentional resources and a 'non-compensatory' view, the relationship between text structure inference skill and reading comprehension may be less strong for language minority readers (compared to monolinguals), because cognitive load for other text processes could prevent language minority readers from inferring text structure.

In addition, if cognitive load for other processes diminishes attention for text structure, it could be the case that in addition to language background, reading proficiency, reading fluency and vocabulary knowledge influence text structure inference. Readers with relatively low reading proficiency, reading fluency or vocabulary knowledge are expected to require more cognitive resources for processes at the word and sentence level compared to their more proficient, fluent and knowledgeable peers and may therefore not have enough capacity available for higher order processes, such as inferring text structure (cf., Bernhardt & Kamil, 1995; Cummins, 1979; Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001; Segalowitz et al., 1995). Research has shown that other factors may play a role as well, for readers with lacking reading proficiencies: the use of strategies during reading has been demonstrated to rely on an understanding of the relevance of strategies, the motivation to employ them and sufficient practice in employing them (e.g., Baker, 2005; Pintrich & Zusho, 2002; Veenman et al., 2006). Poor comprehenders are expected to meet these demands to a lesser extent than their more competent peers and therefore may not direct their attention to text structure to the same extent as their better comprehending peers.

4.4 The present study

Based on previous findings, we assume that text structure inference skill is an important factor for expository text comprehension in secondary school. In the present study, we aimed to examine the unique contribution of this skill to eighth graders' expository text comprehension, controlling for reader characteristics that have been put forward by various theories as important predictors of text comprehension. Furthermore, we aimed to investigate whether the unique predictive value of text structure inference skill differs between readers with different language backgrounds or between readers who vary in reading proficiency, reading fluency or vocabulary knowledge. With regard to language background, we compared monolingual Dutch with bilingual Dutch language minority students. We also differentiated between bilinguals with Dutch as a dominant and those without Dutch as a dominant language at home, as we hypothesized that these groups might have differing fluency skills and linguistic knowledge, which could have an impact on the relationship between text structure skill and reading comprehension.

To examine the additional contribution of text structure inference skill, we controlled for reading fluency, linguistic knowledge and metacognitive knowledge. We controlled for reading fluency and linguistic knowledge, because these factors

have been put forward as important contributors to reading comprehension in models of reading comprehension, such as Kintsch et al.'s construction-integration model (Kintsch, 1998; Kintsch & Rawson, 2005) and Perfetti et al.'s framework for reading comprehension (Perfetti, 1999; Perfetti et al., 2005). We also controlled for metacognitive knowledge, because several studies have shown that metacognitive knowledge and skills account for unique variance in secondary school readers' text comprehension, above and beyond the effects of linguistic knowledge (e.g., Cromley & Azevedo, 2007; Schoonen et al., 1998; Trapman et al., 2014; Van Gelderen et al., 2007). Including metacognitive knowledge as an additional control variable also made it possible to examine to what extent having knowledge about text structure (metacognitive knowledge) and the application of this knowledge (inferring text structure) relate uniquely to expository text comprehension. Our aims led to the following two research questions:

- Does text structure inference skill contribute to eighth graders' reading comprehension, above and beyond the effects of reading fluency, linguistic knowledge and metacognitive knowledge?
- 2) Does the unique contribution of text structure inference skill depend on readers' language backgrounds or their reading proficiency, reading fluency or linguistic knowledge levels?

In the next section, we will discuss the method we used to answer these questions, followed by the results and discussion sections.

4.5 Method

4.5.1 Participants

The study started with 337 eighth graders from thirteen classes in three secondary schools. Students were excluded from the analyses if they had learning or reading problems according to school reports (n = 16) or if they showed disobedient

behavior during one or more class administered tests according to the test administrator's notes (n = 92). The large attrition due to misbehavior is related to the challenging school population and teachers' difficulties in classroom management during test administration. Most attrition of test scores was on the expository text comprehension test (n = 59). Furthermore, students were also excluded when they had one or more test scores missing due to absence during a testing session or exclusion of their test scores (n = 38). Test scores were excluded when students had skipped half or more of the items on a test or scored below chance level, since this was regarded as an indication of test disturbance. In addition, after the first two testing sessions, one school decided to discontinue participation for most students (n = 40, school B in Table 4.1).

Due to exclusion of test scores, only 191 students had valid expository text comprehension scores. We performed our analyses with a sample of 151 students⁶ with no missing scores on the other tests as well. In our final sample, students received instruction at various educational levels: 34% of the students received instruction at a low educational level (n = 51), 22% of the students at an intermediate educational level (n = 33) and 44% of the students at a high educational level (n = 67). Table 4.1 shows the number of students per school, per class and the educational level of each class.

Students were regarded as monolingual Dutch (n = 53) if they had indicated in the background questionnaire (see instruments section) that Dutch was their only mother tongue, and as bilingual Dutch (n = 98) if one or more other languages than Dutch were involved in their initial language acquisition. All but seven of the bilingual students were born in the Netherlands and only two of them had received less than five years of primary education in the Netherlands. Bilinguals were assigned to the *Bilinguals Dutch dominant* at home group (n = 36) if they indicated that their parents spoke Dutch to them at least 50% of the time, the other bilinguals were assigned to the *Bilinguals Dutch not dominant group* (n = 62).

⁶ Compare to chapters 2 and 3 with a sample of 171 students. An additional 20 students did not have valid scores for text structure inference skill, hence our final sample size of 151 students in this chapter.

School	Class	Educational level*		Numl of stu	ber dents
А	A1, A2, A3, A4	Low		44	
	A5	Intermediate		16	
	A6, A7	High		45	
			Total		105
В	B1	Low		7	
	B2	Intermediate		3	
	B3	High		6	
			Total		16
С	C1, C2	Intermediate		14	
	C3	High		16	
			Total		30
			Total all schools		151

 Table 4.1 Students included in the analyses per school, class and the educational level of each class.

*The educational levels correspond to the following educational levels in Dutch secondary school: low = vmbo-t (prevocational level) or vmbo-t/havo (prevocational/general secondary educational level), intermediate = havo (general secondary educational level) or havo/vwo (general secondary educational/pre-university level), high = vwo (pre-university level).

4.5.2 Instruments

The students were submitted to six tests, which measured their expository text comprehension, vocabulary knowledge (two tests), metacognitive knowledge, reading fluency and their text structure inference skill. Students also filled out a questionnaire tapping into background information.

Expository text comprehension. The reading comprehension test comprised 35 multiple choice questions (with three or four answer options) about five expository texts. The first text about energy systems in the body had a comparison overall structure. The second text, in which the history of whaling was described, had a sequence overall structure. The third (about athletics), the fourth (about the way muscles work) and the fifth text (about sustainable house construction) were mainly descriptive, but contained elements of other structures at the paragraph level. In the

fourth text, for example, one of the four paragraphs compared three types of muscle contraction and in the fifth text two types of house construction were compared whereas the last two paragraphs of this fifth text could be classified as describing a problem (not enough sustainable house construction) and a solution for this problem (informing constructors about the benefits of sustainable house construction). Texts varied in length between 184 to 449 words. Four texts were derived from the database of *Diataal*, a Dutch test institute (Hacquebord et al., 2005). One text was derived from the reading comprehension test used in a study by Van Gelderen et al. (2007). Texts and questions were adapted slightly.

Linguistic knowledge. Two tests measured linguistic knowledge. One was a digitally administered *general vocabulary knowledge* test developed by *Diataal* (Hacquebord et al., 2005) that included 70 multiple choice items drawn from a corpus of school book texts. Test items varied in difficulty level (as judged by teachers) and frequency in the corpus. Items were general academic words, for example 'aspects', as well as domain or subject specific words, for example 'roam' (e.g., in a forest), 'interior' (i.e. of a house) or 'executed' (i.e. murdered). The other vocabulary knowledge test tapped into students' *knowledge of connectives*, by means of a 43 item fill-in-the-blanks test. The test comprised six short expository texts, which addressed various topics (e.g., spiders, vitamins, the origin of the @-symbol, etc.), and varied in length between 85 to 177 words. In these texts students had to choose the appropriate connective out of three options. Relationships between the propositions that had to be connected were regarded as familiar to all students. For a more detailed description of this test see Chapter 2.

Metacognitive knowledge. To measure students' metacognitive knowledge of text structure and reading and writing strategies, we used an adapted version of the metacognitive knowledge test used by Van Gelderen et al. (2007). The original test was reduced to 45 statements. In this test, participants had to indicate whether or not they agreed with statements about text structure and writing and reading strategies. For example, a correct response would be if they agreed with the following

statement: if you do not understand the meaning of a word, it is useful to try to guess its meaning by looking at other words and sentences surrounding the unfamiliar word.

Sentence reading fluency. Sentence reading fluency was measured by a sentence verification test similar to the one used by Van Gelderen et al. (2007). Students were presented 110 sentences on a laptop screen and had to decide as fast as possible whether a sentence made sense or not by pressing a red (sentence makes no sense) or a green stickered key (sentence makes sense) on their laptops' keyboards. Half of the sentences made sense, the others did not. Sentences that did not make sense were in flagrant contradiction with encyclopedic knowledge all students were considered to share (e.g., *Most bicycles have seven wheels* and *The Netherlands is the largest country in the world* were sentences that did not make sense). Reading fluency was calculated by averaging the reaction times on the correct responses to the sentences that make sense.

Text structure inference skill. Before students started with the text structure inference skill test they received an oral instruction by a trained test-assistant. This instruction was also printed in their booklets, but some students might skip this instruction and therefore it was provided orally to ascertain that students knew what was expected from them. Students had to indicate the 'main structure' (i.e. top-level structure) of short texts by means of answering a multiple choice question and they had to summarize these texts in no more than two sentences. The 'main structure' of the text was explained as follows (translated from Dutch):

The main structure of a text is the most important structure of a text, the way in which a text is organized. You will read a short text. Afterwards you will have to indicate what the main structure of the text is. You can choose from the following options:

The text:

- a) describes a cause and one or more consequences
- b) describes a problem and one or more solutions
- c) gives more information about a subject
- *d)* gives more information about a subject in a certain order (e.g., sequence in time)
- e) compares matters with each other

Note that in this test you have to indicate **the most important structure** of the text. It may be that there are also other relationships between sentences in the text; for example, a text could have a main structure problemsolution but matters in the text may be compared as well.

Most important in this test is thus the general organization of the text, the main structure.

Students were also told that they had to write a summary of no more than two sentences after they had chosen the 'main structure' of the text out of the five options mentioned in the example above. Next they were provided with an example of a short text and an appropriate summary for this text. As a wrap up of the instruction they were told that the test comprised three steps: i) reading the text, ii) indicating the 'main structure' of the text and iii) summarizing the text in no more than two sentences. It was stressed that only one answer had to be chosen in the multiple choice question about the main structure of the text.

The test consisted of 15 short expository texts of one or two paragraphs. The texts varied in length from 78 to 244 words (the average text length was 110 words) and addressed various topics (animals, boats, history of the car, obesity, etc.). Texts were organized with one of the five basic patterns of expository texts identified by Meyer (1985). Four texts had a cause-consequence structure, three a problem-solution, three were descriptions (more information about a topic), two

were descriptions in a certain sequence and three texts made comparisons between matters.

The summaries students wrote about the texts were scored by two independent raters. Summaries could be awarded 0, 1, 1.5 or 2 points. Zero points were awarded when the top-level structure was not present in the summary. Two points were allocated when the main structure was present: for main structures comprising two parts (cause-consequence, problem-solution, comparison of two things) both parts had to be present; for summaries from the texts with a description or sequence top-level structure two points were awarded when it was clear from the summary that the appropriate text structure was inferred. Summaries from causation, problem-solution or comparison texts were awarded one point when the summary comprised one of the two parts of the main structure (e.g., only the problem in a problem-solution text). Two texts could be awarded 1.5 points. One text had a problem-solution top-level structure with two solutions; if the problem and only one of the solutions was mentioned in the summary 1.5 points were awarded. One texts had a cause-consequence structure with three consequences; if the cause and only one consequence was mentioned in the summary 1.5 points were allocated (none of the summaries mentioned the cause and two consequences for this text). The average score of the two raters was used for further analysis. Rater reliability was computed as Intra Class Correlation (ICC) and turned out to be .97. The total score on the test, with a maximum of 45, was computed by adding up the correct scores on the multiple choice questions (one point per correct answer) and the scores on the summaries.

Table 4.2 shows the internal consistency (Cronbach's Alpha) as reliability estimates of the tests for each subgroup. In general, the tests show satisfactory reliability estimates between .70 and .97, except for the metacognitive knowledge test and the text structure inference skill test, for which reliability estimates are between .60 and .65, and .59 and .73 respectively.

Table 4.2 Reliabi	lity estimate	s (Cronbach	's Alpha) of the	tests for the	whole sampl	e and the
subsamples.						
	Number of items	All students	Monolingual Dutch	Bilingual Dutch	Bilingual Dutch	Bilingual Dutch not
		(<i>n</i> = 151)	(<i>n</i> = 53)	(<i>n</i> = 98)	dominant $(n = 36)$	dominant $(n = 62)$
Expository text comprehension	35	62.	.85	.72	.74	.70
General vocabulary knowledge	70	.81	.76	.79	.81	.78
Knowledge of connectives	43	.83	.86	.78	.73	.81
Metacognitive knowledge	45	.64	<u>.</u>	.64	.62	.65
Sentence reading fluency (RT in msec)	46	.96	.96	.96	.95	.95
Text structure inference skill	15	.67	.73	.64	.70	.59

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Background questionnaire. The background questionnaire requested the following information: gender, country of birth, mother tongue, language(s) the parents/care-takers speak to participants (and percentages of the time they speak these languages

to them), country of birth of parents/caretakers, the highest completed educational level of parents/caretakers and jobs of parents/caretakers.

4.5.3 Procedure

From March till June 2014, tests were administered, each in a separate testing session. Students were given enough time to complete the tests. All tests were administered during regular classes, except for the sentence reading fluency test, for which participants were taken out of their regular classes in groups of four to a separate test room. Test administrators took notes on students' behavior during plenary test administrations.

4.5.4 Scoring and missing value treatment

On the general vocabulary knowledge test and the sentence reading fluency test, there were no missing responses, because these digital tests required a response for every item. Skipped items from the expository text comprehension, knowledge of connectives, metacognitive knowledge and the text structure inference skill test were scored as incorrect. For the sentence reading fluency test, the procedure described in Van Gelderen et al. (2003) was used for scoring and missing value treatment. First, to ensure that linguistic knowledge and comprehension did not influence performance on the fluency test, sentences with an accuracy rate lower than .875 (i.e., in accordance with Van Gelderen et al., 2003) were excluded from the analyses. Nine sentences in the reading fluency test were deleted (hence mean reaction times were calculated on the basis of the remaining 46 sentences). Second, inaccurate responses to sentences or potentially untrustworthy ones (extremely slow responses, i.e. three standard deviations above the mean, or extremely fast responses, i.e. faster than the fastest reaction time of a group of five expert readers) were turned into missing values. Next, missing values for the sentences in the reading fluency test were estimated with the expectation maximization procedure of SPSS (SPSS Inc., Chicago, IL, USA). After this procedure, the mean reaction time for the sentence reading fluency test was calculated per participant.

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4.5.4 Analyses

Means and standard deviations on all tests were computed for the whole sample and separately for the one monolingual and two bilingual subgroups (Dutch dominant versus Dutch not dominant). Because students came from different classes, all regression analyses were performed with a random intercept for class. Differences between monolinguals and bilingual Dutch students, and between the two bilingual subgroups on the tests, were investigated by the use of regression analyses with the tests as dependent variables and two independent (i.e. orthogonal) contrasts as predictor variables: one contrasting monolingual versus bilingual Dutch students and one contrasting the two bilingual groups. These contrasts were added in a stepwise manner as predictors of the test concerned; first it was examined whether monolinguals differed from bilinguals on a test, next potential differences between the two bilingual groups were examined. Effect sizes of the differences are reported as the percentage of explained variance (Δr^2). Furthermore, correlations between the test scores were calculated for the whole sample and for the various subsamples.

Before we investigated our research questions we investigated whether each of the predictor variables (i.e., sentence reading fluency, general vocabulary knowledge, knowledge of connectives, metacognitive knowledge and text structure inference skill) were curvilinearly related to text comprehension, because it has been shown that curvilinear relationships between predictors and dependent variables may affect the estimation of interaction effects (Ganzach, 1997). We investigated this by examining whether the quadratic terms of the predictors led to model improvement for each of the predictors separately.

To answer whether text structure inference skill contributed uniquely to text comprehension (our first research question), we performed a stepwise regression analysis with text comprehension as dependent variable. As a first step, reading fluency, vocabulary knowledge (general vocabulary knowledge and knowledge of connectives) and metacognitive knowledge were added as predictors of text comprehension, and as a second step, text structure inference skill was added

as an additional predictor, to examine whether text comprehension was better accounted for with a model that also includes text structure inference skill.

To examine whether the additional contribution of text structure inference skill to text comprehension differs between monolingual and bilingual students, and between readers who vary in reading proficiency, reading fluency and vocabulary knowledge (our second research question), we tested in a stepwise manner whether including an interaction of text structure inference skill with one of the potential moderators (language background, reading proficiency, etc.) predicted text comprehension better than a model without this interaction. The interaction between text structure inference skill and reading proficiency level was tested by means of two dummy variables that differentiated between the 50% best scoring (n = 76) and the 50% worst scoring (n = 75) students on the text comprehension test. Good comprehenders had a score of 1 and poor comprehenders a score of 0 on the variable 'dummy good' and scoring was vice versa for the variable 'dummy poor'. These two dummy variables were entered as predictors of text comprehension, along with text structure inference skill, reading fluency, vocabulary knowledge and metacognitive knowledge. As a second step, the interaction between text structure inference skill and 'dummy poor' was entered to investigate if poor and good comprehenders differ significantly from each other in terms of the relationship between text structure inference skill and text comprehension (see for a similar method Rijkeboer, van den Bergh, & van den Bout, 2011).

We also performed the abovementioned regression analyses with a sample size of 191 students to check for the robustness of our results. These 191 students all had a score on expository text comprehension, and 40 of these students had a score missing on one (n = 32), two (n = 7) or three (n = 1) of the predictor variables. For our regression analyses with this sample, we created dummy variable for each predictor that represented whether a score was missing (a score of 1) or not (a score of 0) for the associated predictor. We entered these dummy variables along with the associated predictor variables in our regression models. These regression models did not include a fixed intercept and missing scores on the standardized predictor variables were recoded into a score of 0 (see Koomen & Hoeksma, 1991). This

method enabled us to investigate whether the outcomes of our models were different from those with the sample of 151 students, when our models controlled for the variance accounted for in text comprehension by differences between students who either missed or did not miss a score for every predictor variable.

4.6 Results

4.6.1 Descriptive statistics

Expository text comprehension scores were normalized with Blom's formula (Blom, 1958). Table 4.3 shows the means and standard deviations on the six tests for the whole sample and for the various subgroups. Regression analyses indicated that the monolinguals outperformed the bilinguals in expository text comprehension (χ^2 (1) = 6.07, p = .01, $\Delta r^2 = .06$), general vocabulary knowledge (χ^2 (1) = 15.56, p = .00, $\Delta r^2 = .14$), knowledge of connectives (χ^2 (1) = 9.98, p = .00, $\Delta r^2 = .09$) and metacognitive knowledge (χ^2 (1) = 4.03, p = .04, $\Delta r^2 = .05$), but not in sentence reading fluency (χ^2 (1) = .01, p = .92, $\Delta r^2 = .00$) and text structure inference skill (χ^2 (1) = .35, p = .55, $\Delta r^2 = .00$). The bilingual Dutch dominant group outperformed the bilingual Dutch not dominant group in sentence reading fluency (χ^2 (1) = 7.44, p = .01, $\Delta r^2 = .04$), but there were no differences between the two bilingual groups on expository text comprehension (χ^2 (1) = 1.10, p = .29, $\Delta r^2 = .01$), knowledge of connectives (χ^2 (1) = 0.26, p = .61, $\Delta r^2 = .00$), general vocabulary knowledge (χ^2 (1) = .80, p = .37, $\Delta r^2 = .00$), metacognitive knowledge (χ^2 (1) = 2.41, p = .12, $\Delta r^2 = .01$) and text structure inference skill (χ^2 (1) = .22, p = .64, $\Delta r^2 = .00$).

4.6.2 Correlations

Table 4.4 shows the correlations between the six variables for the whole sample and for the subgroups. The knowledge variables general vocabulary knowledge, knowledge of connectives and metacognitive knowledge correlated positively with reading comprehension: correlations were low to moderate (between .32 and .65). Positive correlations between reading comprehension and text structure inference skill were also low to moderate (between .28 and .60). Reading comprehension

Table 4.3 Means (and	l standard deviati	ions) on the six m	neasures for the wh	ole sample and 1	the subgroups.	
	Number of items	All students $(n = 151)$	Monolingual Dutch	Bilingual Dutch	Bilingual Dutch	Bilingual Dutch not
			(n = 53)	(<i>n</i> = 98)	dominant $(n = 36)$	dominant $(n = 62)$
Expository text	35	25.11	26.78	24.20	23.53	24.59
comprehension		(5.22)	(5.98)	(4.54)	(4.84)	(4.35)
General vocabulary	70	53.24	57.04	51.18	51.89	50.77
knowledge		(7.51)	(6.17)	(7.40)	(7.68)	(7.26)
Knowledge of	43	31.89	34.34	30.57	30.33	30.71
connectives		(5.85)	(5.88)	(5.42)	(4.84)	(5.77)
Metacognitive	45	35.79	37.00	35.13	34.39	35.56
knowledge		(4.08)	(3.64)	(4.16)	(4.20)	(4.11)
Sentence reading	46	2828	2816	2835	2659	2937
fluency (RT in msec)		(500)	(504)	(500)	(459)	(498)
Text structure	15	26.02	25.81	26.14	25.69	26.40
inference skill	(max. score 45)	(5.64)	(5.98)	(5.47)	(6.05)	(5.13)

	General	Knowledge	Metacognitive	Sentence	Text
	knowledge	connectives	Kilowieuge	fluency	inference
				-	skill
Expository text comprehension					
All students	.44*	.56*	.47*	12	.38*
MD	.38*	.55*	.51*	15	.36*
BD	.41*	.52*	.42*	10	.42*
BDdom	.56*	.65*	.55*	17	.60*
BDndom	.32*	.47*	.32*	12	.28*
General vocabulary					
All students		.52*	.45*	33*	.37*
MD		.51*	.31*	44*	.47*
BD		.44*	.45*	31*	.38*
BDdom		.65*	.74*	40*	.71*
BDndom		.34*	.29*	24	.16
Knowledge of connecti	ves				
All students			.44*	29*	.38*
MD			.44*	42*	.53*
BD			.38*	23*	.33*
BDdom			.51*	32	.38*
BDndom			.32*	22	.31*
Metacognitive knowled	lge	·		·	
All students				22*	.36*
MD				19	.42*
BD				23*	.35*
BDdom				40*	.55*
BDndom				22	.21
Sentence reading fluen	cy	· · · · · ·		•	<u>. </u>
All students					22*
MD					26
BD					19
BDdom					39*
BDndom					11

Table 4.4 Correlations between the six variables for the whole sample and the subsamples.

MD, Monolingual Dutch (n = 53); BD, Bilingual Dutch (n = 98); BDdom, Bilingual Dutch dominant at home (n = 36); BDndom, Bilingual Dutch not dominant at home (n = 62).

*p < .05.

correlated weakly with sentence reading fluency (correlations between -.10 and -.17). Correlations between text structure inference skill and the knowledge variables ranged from low to strong (correlations between .16 to .71); between text structure inference skill and reading fluency correlations were low (between -.11 and -.39). The correlations between the knowledge variables ranged from low to high (from .29 to .74) and reading fluency correlated weakly to moderately with the knowledge variables (correlations from -.19 to -.44).

4.6.3 Curvilinear effects

We could not establish a curvilinear relationship with text comprehension for sentence reading fluency (χ^2 (1) = .00, p = 1.00, $\Delta r^2 = .00$), general vocabulary knowledge (χ^2 (1) = 3.17, p = .08, $\Delta r^2 = .02$), metacognitive knowledge (χ^2 (1) = 1.95, p = .16, $\Delta r^2 = .00$) and text structure inference skill (χ^2 (1) = .70, p = .40, $\Delta r^2 = .00$). For knowledge of connectives the quadratic term did lead to model improvement on top of the linear term (χ^2 (1) = 3.97, p = .04, $\Delta r^2 = .01$), but we considered the curvilinear relationship invalid because adding the quadratic term to the model led to non-significance of the linear term (cf., Breetvelt et al., 1994).

4.6.4 Effects of text structure inference skill

Table 4.5 shows the results of the regression analyses to answer our research questions. This table demonstrates that adding text structure inference skill as a predictor of text comprehension in addition to sentence reading fluency, general vocabulary knowledge, knowledge of connectives and metacognitive knowledges does not improve model fit significantly, compare model 2 versus model 1, χ^2 (1) = 2.79, p = .09, $\Delta r^2 = .01$.

As we found that text structure inference skill correlated significantly with expository text comprehension (see Table 4.4), it must be one or more of the control variables that did have an impact on the relationship between text structure inference skill and expository text comprehension. Additional regression analyses were performed to clarify this issue. These regression analyses included sentence reading fluency (non-significant) as a predictor and combinations of the other predictors. The analyses revealed that knowledge of connectives and metacognitive knowledge were the crucial factors: on top of these two factors, text structure inference skill was not a significant predictor of expository text comprehension (χ^2 (1) = 3.37, p = .06, Δr^2 = .01), whereas text structure inference skill did predict expository text comprehension uniquely controlling for knowledge of connectives (χ^2 (1) = 6.75, p = .01, Δr^2 = .04), metacognitive knowledge (χ^2 (1) = 8.01, p = .00, Δr^2 = .04), both general vocabulary knowledge and metacognitive knowledge (χ^2 (1) = 5.56, p = .02, Δr^2 = .02), and both general vocabulary knowledge and knowledge of connectives (χ^2 (1) = 5.06, p = .02, Δr^2 = .02).

Noteworthy is that our choice to include knowledge of connectives as an additional control variable in the regression models in this chapter, led to a lack of unique predictive value of text structure inference skill. In a model with the three control variables as indicated in the introduction of this thesis (i.e., sentence reading fluency, general vocabulary knowledge and metacognitive knowledge), text structure inference skill accounted for unique variance (2% as indicated above). However, with these three control variables, the unique variance text structure inference skill accounted for in terms of the total explained variance, was far lower than for knowledge of connectives (see chapter 2), namely 6.7% for text structure inference skill (total variance is 29.9%), versus 37.3% for knowledge of connectives (total variance is 36.5%).

4.6.5 Interactions with text structure inference skill

Table 4.5 also demonstrates that the effect of text structure inference skill (controlling for sentence reading fluency, general vocabulary knowledge, knowledge of connectives and metacognitive knowledge) did not differ between monolinguals and bilinguals, between the two bilingual groups and between the poor and good comprehenders. Compare model 4 with model 3 for the examination of the interaction between text structure inference skill and language background (χ^2 (2) = 1.03, p = .31, $\Delta r^2 = .00$) and model 6 with model 5 for the examination of the interaction between text structure inference skill and reading proficiency level (χ^2 (1)

Table 4.5 Model fit,	variance com	ponents and	parameter e	stimates for	r our two re	search quest	tions (N _{studen}	$_{ m ts}=151, N_{ m clas}$	_{ses} =13) =13	Ġ	
Research questions		RQ I			RQ 2						
Models		M0	MI	M2	M3	M4	M5	M6	M7	M8	6M
Variance	Class Students Total	.18(.10) .79(.09) .97	.03(.03) .56(.07) .59	.03(.03) .55(.07) .58	.03(.03) .55(.07) .58	.03(.03) .55(.07) .58	.01(.01) .29(.04) .30	.01(.01) .29(.03) .30	.03(.03) .55(.07) .58	.03(.03) .56(.07) .59	.02(.03) .55(.07) .57
Distribution of variance	Class Students	18.6% 81.4%	5.0% 95%	5.2% 94.8%	5.2% 94.8%	5.2% 94.8%	3.3% 96.7%	3.3% 96.7%	5.2% 94.8%	5.1% 94.9%	3.5% 96.5%
Explained variance	Class		83.3%	83.3%	83.3%	83.3%	94.4%	94.4%	83.3%	83.3%	88.8%
	Students Total		29.1% 39.2%	30.4% 40.2%	30.4% 40.2%	30.4% 40.2%	63.3% 69.1%	63.3% 69.1%	30.4% 40.2%	29.1% 39.2%	30.4% 41.2%
Increase in explained variance	Class Students		83.3% 29.1%	- 1.3%			11.1% 32.9%				5.5%
	Total		39.2%	1.0%	ī	ī	28.9%	ı	ī	I	1.0%
Fit in -2LL		408.12	348.30	345.51	344.97	343.94	246.15	244.85	344.90	345.26	344.27
Difference in -2LL			59.82*	2.79	.54	1.03	97.79*	1.30	.61	.25	1.24
Difference in df Compared to model			4 M0	1 M1	2 M2	2 M3	1 M2	1 M5	1 M2	1 M2	1 M2
Parameter estimates											
Intercept		11 (.14)	02 (.08)	01 (.08)	02 (.08)	02 (.08)	67* (.08)	65* (.08)	00 (.08)	02 (.08)	03 (.08)
Sentence reading flue	ncy		.11 (.07)	.11 (.07)	.10 (.07)	.10 (.07)	.03 (.05)	.04 (.05)	.12 (.07)	.12* (.07)	.10 (.07)
General vocabulary ki	nowledge		.13 (.08)	.11 (.08)	.10 (.08)	.08) (80)	.08 (90.)	.08 (90.)	.13 (.08)	.11 (.08)	.10 (.08)

Knowledge of connectives	.40* (.08)	.3/* (.08)	.36*	.37* (.08)	.08 (90.)	60 [.]	.36* (.08)	.37* (.08)	.38* .08)
Metacognitive knowledge	.25* (.07)	.22* (.07)	.22* (.07)	.21* (.07)	.09 (20.)	.09 (30.)	.22* (.07)	.22* (.07)	.22* (.07)
Text structure inference skill		.12 (.07)	.13 (.07)	.14 (.07)	.09 (.05)	.03 (.07)	.12 (.07)	.12 (.07)	.13 (.07)
Language background MD vs. BD (LB1)			03 (.05)	04 (.05)		,			
Language background BDdom vs. BDndom	(LB2)		03 (.08)	02 (.08)					
Text structure inference skill x LB1				.02 (+0)				1	
Text structure inference skill x LB2				.08 (80.)				1	
Dummy good					1.33* (.11)	1.32* (.11)		1	
Dummy poor					0ª	0ª			
Dummy poor x text structure inference skill						11. (90.)	1	1	
Text structure inference skill x sentence read	ding fluency						.06 (80.)	1	
Text structure inference skill x general vocal	bulary knowl	edge						.03 (.06)	1
Text structure inference skill x knowledge of	f connectives								.06 (.05)

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= 1.30, p = .25, $\Delta r^2 = .00$). Also for readers who vary in sentence reading fluency, general vocabulary knowledge and knowledge of connectives, the unique contribution of text structure inference skill to text comprehension did not differ significantly. Compare in Table 4.5 model 7 with model 2 for the interaction of text structure inference skill with sentence reading fluency (χ^2 (1) = .61, p = .43, $\Delta r^2 = .00$), model 8 with model 2 for the interaction with general vocabulary knowledge (χ^2 (1) = .25, p = .62, $\Delta r^2 = .00$) and model 9 with model 2 for the interaction with knowledge of connectives (χ^2 (1) = 1.24, p = .27, $\Delta r^2 = .01$).

4.6.6 Robustness check: models with 191 students

Regression analyses performed with a sample of 191 students revealed that there were no differences between expository text comprehension scores of students who either missed or did not miss a score on sentence reading fluency (t (191) = 1.66, p = .10), general vocabulary knowledge (t (191) = .66, p = .51) and knowledge of connectives (t (191) = -1.16, p = .25). However, students who missed a score on metacognitive knowledge or text structure inference skill performed lower on expository text comprehension than those students with valid scores on metacognitive knowledge (t (191) = -2.87, p = .01) and text structure inference skill (t (191) = -3.49, p = .00). The results of models with a sample of 191 students were mostly similar to those with a sample of 151 students. One discrepancy was that text structure inference skill accounted for unique variance in addition to the control variables with a sample of 191 students (χ^2 (2) = 13.73, $p = .00, \Delta r^2 = .05$), whereas this was not the case with the sample of 151 students (see section 4.6.4). However, this discrepancy was small; the standardized parameter estimate of text structure inference skill in the model with 151 students was .12, with a standard error of .07 and a p-value of .08, while the standardized parameter estimate of text structure inference skill in the model with 191 students was .13, with a standard error of .06 and a p-value that was just below significance level, p = .044.

Similar to the models with 151 students, in our models with a sample size of 191 students, text structure inference skill accounted for more unique variance when our models did not include both metacognitive knowledge and knowledge of connectives as predictors, stressing the importance of these two factors for text structure inference skill. More precisely, in a model that included both metacognitive knowledge and knowledge of connectives as predictors, text structure inference skill accounted for five percent unique variance in expository text comprehension (χ^2 (2) = 13.49, p = .00, $\Delta r^2 = .05$), whereas its unique variance was between six and nine percent in regression models that did not include both these predictors⁷. Furthermore, similar to the models with 151 students, in models with 191 students, the effect of text structure inference skill was also not moderated by language background (χ^2 (2) = .66, p = .42, $\Delta r^2 = .00$), reading proficiency (χ^2 (1) = 1.01, p = .31, $\Delta r^2 = .00$), sentence reading fluency (χ^2 (1) = .39, p = .53, $\Delta r^2 = .00$), general vocabulary knowledge (χ^2 (1) = .49, p = .48, $\Delta r^2 = .00$) or knowledge of connectives (χ^2 (1) = 1.46, p = .23, $\Delta r^2 = .01$).

4.7 Discussion

The present study examined whether text structure inference skill, i.e. the ability to infer the overall structure of a text, predicts eighth graders' expository text comprehension, on top of the variance accounted for by sentence reading fluency, linguistic knowledge and metacognitive knowledge. Moreover, it was examined whether the predictive value of text structure inference skill for expository text comprehension differs between monolingual and bilingual Dutch students or between readers with varying reading proficiency, reading fluency or linguistic knowledge levels. We found that text structure inference skill has no unique predictive value for eighth graders' expository text comprehension. Our findings also revealed that the predictive value of text structure inference skill does not differ

⁷ Adding text structure inference skill as a predictor in models that included sentence reading fluency, and one or two of the following predictors as control variables, led to the following results: knowledge of connectives (χ^2 (2) = 19.21, *p* = .00, Δr^2 = .08), metacognitive knowledge (χ^2 (2) = 20.27, *p* = .00, Δr^2 = .09), general vocabulary knowledge and metacognitive knowledge (χ^2 (2) = 19.21, *p* = .00, Δr^2 = .09), general vocabulary knowledge and knowledge of connectives (χ^2 (1) = 18.69, *p* = .00, Δr^2 = .06).

significantly between either monolingual and bilingual readers or on the basis of reading proficiency, sentence reading fluency or linguistic knowledge levels.

As we found that text structure inference skill correlated with expository text comprehension, we performed regression analyses with several combinations of control variables to investigate when text structure inference skill predicted expository text comprehension and when it did not. We found that text structure inference skill had no unique predictive value with both metacognitive knowledge and knowledge of connectives as control variables. On the other hand, text structure inference skill did predict expository text comprehension with only knowledge of connectives or only metacognitive knowledge as a control variable, or when accounting for general vocabulary knowledge in addition to knowledge of connectives or metacognitive knowledge.

We found, then, that differences in text structure inference skill are not associated with differences in expository text comprehension when accounting for knowledge of connectives and metacognitive knowledge. This seems to indicate that readers who are equal in metacognitive knowledge and knowledge of connectives do not seem to differ in text structure inference skill to the extent that this results in differences in inferring text structure during expository text reading, and, consequently, to differences in text comprehension levels. More specifically, we argue that readers with low metacognitive knowledge and knowledge of connectives levels do not have enough text structure inference skills to infer text structure during expository text reading, whereas we assume the opposite to be the case for readers with high metacognitive knowledge and knowledge of connectives levels. This assumption is in line with Meyer and colleagues, who have argued consistently that metacognitive knowledge and knowledge of connectives are crucial factors for inferring text structure (e.g., Meyer et al., 1980; Meyer & Rice, 1982). What the present study underlines too is that general vocabulary knowledge does not play a crucial role for inferring text structure; that is, readers with equal general vocabulary knowledge levels appear to differ substantially in their text structure inference skills and these differences are related to text comprehension levels.

We have argued that - given a limited working memory capacity - readers with low reading fluency, linguistic knowledge or reading proficiency levels may be limited in their use of text structure inference skills, as these readers' attention may be required for the execution of other reading processes. The lack of interaction effects, however, indicates that the relationship between text structure inference skill and expository text comprehension was not significantly weaker for readers with lower sentence reading fluency, linguistic knowledge and reading proficiency levels. Given these results, it seems that these readers are as able to infer text structure during reading as their more knowledgeable and fluent peers are.

Lastly, no interaction between language background and text structure inference skill was found. In our introductory section, we hypothesized that for bilinguals with a language minority background, compared to their monolingual peers, the relationship between text structure inference skills and expository text comprehension might be either weaker, from a limited working memory capacity point of view, or stronger, from a compensatory perspective. Because no interaction between text structure inference skill and language background was established, we can conclude that the bilinguals in our sample benefitted neither more, nor less, from their text structure inference skills than their monolingual peers did. It seems that the bilinguals in our sample were not hampered in their use of text structure inference skills because of effortful word and sentence processing, nor did their text structure inference skills play a larger role for their text comprehension performances, as the compensation hypothesis would suggest.

It is noteworthy that monolinguals and bilinguals do not differ in their text structure inference skills, despite differences in knowledge of connectives and metacognitive knowledge, the two factors that have been put forward as pivotal to text structure inference skills. One explanation for these seemingly contradicting results could be that the differences between monolinguals and bilinguals, in terms of knowledge of connectives and metacognitive knowledge, are not large enough to result in differences in text structure inference skill. Compared to differences between monolinguals and bilinguals in general vocabulary knowledge, effect sizes for the difference in knowledge of connectives and metacognitive knowledge are

quite small: about twice as small for knowledge of connectives (9 percent versus 14 percent) and almost three times as small for metacognitive knowledge (5 percent versus 14 percent). Another explanation might be that text structure inference skill, apart from knowledge of connectives and metacognitive knowledge, depends on other, language-independent skills, such as reasoning skills or general intelligence, on which the bilinguals may outperform the monolinguals.

4.7.1 Limitations and further directions

The present study had a rather large amount of test scores attrition, so we would like to stress the importance of replicating our study, to test the validity of our results. Furthermore, our correlational design prevents us from drawing conclusions about causality. This means we are unable to clarify whether higher text structure inference skill leads to better text comprehension or vice versa. Moreover, in order to investigate whether knowledge of connectives and metacognitive knowledge are indeed underlying text structure inference, text structure inferences of readers during expository text reading have to be examined by readers with differing knowledge of connectives and metacognitive knowledge levels.

Furthermore, we consider it important to stress the result of the robustness check we performed with a slightly larger sample size of 191 students (see section 4.6.6): this check indicated that the effect of text structure inference skill on expository text comprehension is not accounted for by knowledge of connectives and metacognitive knowledge for every reader. This result concurs with the assumption that other language independent skills besides knowledge of connectives and metacognitive knowledge are important for text structure inference. On top of that, this result also indicates that, for some readers, there is a discrepancy between having the knowledge to infer text structure (i.e., knowledge of connectives and metacognitive knowledge) and applying this knowledge for text structure inference. Future research is therefore required to examine which other cognitions relate to students' ability to infer text structure during reading.

A method that may be used to tap into online text structure inferences is measuring students' reaction times to target words or sentences related to text structure (cf., Long, Oppy, & Seely, 1994; Lorch, Lorch, & Mogan, 1987; Ritchey, 2011). Collecting data about online text structure inferences could also be combined with intervention studies, to examine whether readers who are trained specifically in knowledge of connectives and metacognitive knowledge are better at inferring text structure than peers who did not get specialized instruction in connectives, text structure and reading strategies to infer structure.

Both online and intervention studies will contribute to a better understanding of the conditions under which text structure inferences are made and which knowledge and skills are necessary to make these inferences. Such studies serve practical purposes as well: they may help teachers improve students' text structure inference skills and, consequently, their ability to create a coherent text representation.

Chapter 5 Reading motivation⁸

Abstract

The present study examined whether various types of motivations to read expository text predicted eighth graders' expository text comprehension, accounting for cognitive subskills. Of special interest was the question whether motivational aspects moderate the effect cognitive skills have on expository text comprehension. Furthermore, it was examined whether the effect of motivational dimensions on expository text comprehension differed between monolingual and bilingual Dutch students, and between poor and good readers. Hundred fifty-two eighth graders took tests measuring their expository text comprehension, sentence reading fluency, linguistic knowledge, metacognitive knowledge and motivations to read expository texts. Ten motivational aspects, drawn from several theoretical perspectives, were measured. None of these ten motivational aspects predicted expository text comprehension uniquely, nor did they moderate the effect of cognitive skills on expository text comprehension. Furthermore, there were no differences between monolingual and bilingual Dutch students, or between poor and good readers, in terms of the relationship between motivational dimensions and expository text comprehension. Our results are compared with previous studies that examined the predictive value of motivational aspects while controlling for cognitive skills. Differences between our findings and results from other studies are interpreted in the context of measurement specificity and the school system.

⁸As knowledge of connectives accounted for unique variance in expository text comprehension in chapter 2, we decided to include this component in the present study in addition to general vocabulary knowledge. By doing this, we better account for linguistic knowledge as a predictor of expository text comprehension.

5.1 Introduction

In trying to understand individual differences in text comprehension, most researchers have focused either on cognitive predictors (e.g., Trapman et al., 2014; Van Gelderen et al., 2007) or on motivational predictors (e.g., Ho & Guthrie, 2013; Wigfield et al., 2012). However, both types of predictors are rarely examined together (see also Taboada, Tonks, Wigfield, & Guthrie, 2009). In our view, it is important to take cognitive skills into account when studying the effects of motivations on text comprehension, because we assume that the cognitive skills underlying text comprehension fully mediate the influence of motivational factors.

In this context, we consider two non-competing models. The first model is shown in Figure 5.1 and concerns the *development* of reading comprehension. According to this model, motivations to read affect behavioral engagement (time, effort and persistence in reading), cognitive engagement (willingness to exert mental effort) and emotional engagement in reading (positive or negative affective reactions). These factors, in turn, influence the development of the cognitive subskills required for reading comprehension. The first model is identical to Guthrie, Wigfield and You's model of reading engagement (see Guthrie et al., 2012), with one exception: whereas in our model the development of cognitive skills underlying text comprehension fully mediate the effect of engagement on reading comprehension development, there is a direct relationship between engagement in reading and reading competence in Guthrie et al.'s model. Our modification of Guthrie et al.'s model takes into account the complex componential nature of reading comprehension development: not reading comprehension as a whole, but subskills, such as vocabulary knowledge and reading fluency, are assumed to be directly affected by engagement.9 To our knowledge studies on motivation have not addressed this issue: only relationships between engagement and reading comprehension as a whole have been examined so far (for an overview see Guthrie et al., 2012).

⁹ Note that reciprocal relationships (i.e., adding arrows from right to left) are not displayed in Figure 5.1. However, the development of cognitive skills is also likely to increase engagement, for example.



Figure 5.1 Model that explains how motivations to read influence the development of reading comprehension indirectly (adapted from Guthrie et al., 2012).

The second model (shown in Figure 5.2), in contrast to the first model, does not concern the *development* of reading comprehension skill, but explains how the comprehension level of texts is affected by motivations to read. Motivations to read are assumed to affect behavioral, cognitive and emotional engagement when reading a particular text, which in turn affects the contribution of cognitive subskills to the level of reading comprehension. We based this model on findings from four studies predicting text comprehension with cognitive skills and motivational aspects (i.e., Anmarkrud & Bråten, 2009; Logan, Medford, & Hughes, 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). All four studies found that motivational aspects had unique predictive value for text comprehension controlling for cognitive skills. Therefore, it was assumed that this finding reflected that readers who hold more positive motivations to text reading employ their cognitive capacities to a greater extent when reading than their less motivated peers do. It was, however, not tested statistically in these studies whether motivations to read were indeed moderating the effect cognitive skills had on text comprehension, for example by examining interaction effects between motivational dimensions and cognitive subskills.

We expect that motivations to read will moderate the effect of cognitive skills on text comprehension, as depicted in Figure 5.2. A reader not motivated to

grasp the meaning of a text may not fully exploit his cognitive resources; for example, he may read sloppily, skipping text parts, and therefore may not fully



Figure 5.2 Model that explains how motivations to read affect reading comprehension level of texts.

benefit from his vocabulary knowledge. Or he may not use context to infer the meaning of an unknown word, even though he has adequate metacognitive knowledge about strategies to find out the meaning of unknown words. Conversely, readers who are positively motivated to read are expected to fully benefit from their cognitive resources. The effect cognitive skills have on text comprehension is therefore expected to be stronger for readers who are relatively more motivated to understand expository texts. Apart from our expectation that positive motivations *facilitate* the optimal use of available cognitive skills, Walczyk and colleagues (cf., Walczyk, 1995; 2000; Walczyk et al., 2007) have also put forward that positive resources by rereading text parts to compensate for a lack of sufficient cognitive resources to infer the meaning of words to deal with vocabulary difficulties (cf., Walczyk, 1995; 2000; Walczyk et al., 2007).

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5.2 The importance of motivational aspects for subgroups

The likely role of motivations to read in compensating for lack of reading skills, may cause motivations to have a stronger predictive value for text comprehension level within groups of readers with less than optimal cognitive resources. In this line of reasoning, Logan et. al (2011) expected that motivations to read may be important to differentiate between text comprehension levels of relatively poor readers (with comparably low cognitive subskills), but not for differentiating between relatively strong readers (with better developed cognitive subskills). Motivation may work as an energizer to persist despite difficulties, more for poor readers than for strong readers, for example triggering them to initiate compensating behavior to deal with fluency or vocabulary difficulties.

Although Logan et al. (2011) found that nine to eleven year old poor readers in general have slightly - but not significantly – lower intrinsic motivation (i.e. enjoying reading for its own sake) than their peers with better comprehension skills, intrinsic motivation was a more important factor for the poor readers in their study: it predicted text comprehension differences on top of the variance accounted for by cognitive skills (decoding and verbal IQ) within the group of poor readers but not for a subgroup of good readers.

If readers with fewer cognitive resources indeed benefit more from better motivation with regards to text comprehension, the predictive value of motivation may also depend on readers' language backgrounds. It has been shown that bilinguals with a language minority background have lower linguistic knowledge levels in the majority language than their monolingual peers do (e.g., Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004; Páez et al., 2007; Swanson et al., 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000). Therefore, it is expected that bilinguals with a language minority background experience reading as more difficult and challenging, and require more effort and strategic behavior to grasp the meaning of a text. Motivation may therefore have stronger predictive value for these bilingual readers, from a

"motivation-as-a-compensator-perspective" (cf., Walczyk, 1995; 2000; Walczyk et al., 2007).

5.3 The present study

The present study has two aims. The first one is to investigate whether motivations to read moderate the contribution of cognitive skills to eighth graders' expository text comprehension, as depicted in Figure 5.2. We view reading motivation as a multifaceted construct and adhere to Guthrie and Wigfield's (2000, p. 406) definition of reading motivation, which is as follows: "Reading motivation is the individual's personal goals, values and beliefs with regard to the topics, processes and outcomes of reading". We measured a total of ten motivational goals, values and beliefs, which we hypothesized to be potential moderators of the effect of cognitive skills on expository text comprehension. These motivational aspects will be discussed in the next part of this introductory section, as well as the theoretical perspectives they are drawn from. To conclude the introductory section, we will discuss the cognitive skills included in this study.

To examine motivations as moderators of cognitive skills, we perform regression analyses with three of the four components included in Figure 5.2: the component 'behavioral, cognitive and emotional engagement during reading' is not taken into account. Examining motivations to read, and their relationship with expository text comprehension, seems especially important for secondary school readers, since motivation for academic activities, such as reading expository texts in school books, has been shown to decrease at secondary school (Schunk, Pintrich, & Meece, 2008; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006).

A second aim of the present study is to examine whether the contribution of motivational dimensions to expository text comprehension differs between poor and good readers, and between Dutch monolingual and bilingual readers with a language minority background. Differences between bilinguals with and without the majority language (Dutch) as a dominant language were also explored, as we hypothesized that these two groups could differ in terms of the cognitive language resources of the
majority language, which may affect the role motivation plays for these two subgroups. Our two aims led to the two following research questions:

- 1) Do motivations to read expository texts moderate the effect of cognitive skills on expository text comprehension?
- 2) Does the predictive value of motivational aspects for expository text comprehension differ between poor and good readers and between monolingual and bilingual Dutch readers?

5.4 Motivations to read expository texts

Eight of the ten motivations we measured have been derived from the *Motivations* for Reading Information Books School Questionnaire (MRIB-S: Guthrie et al., 2009). We tapped into these eight motivations, which have been argued to play a role in the development of reading comprehension, as outlined in Figure 5.1 (for an overview see Wigfield et al., 2012). In this section, we will explain for each motivation how it is assumed to be associated with reading comprehension development. We put to the test whether these eight motivations could also play a role as moderators of cognitive skills during reading, as depicted in Figure 5.2.

We tapped into four affirmative and four undermining motivations, which respectively have been argued to either support or hamper reading comprehension development (for an overview, see Wigfield et al., 2012). Intrinsic motivation, value, self-efficacy and peer value are the four affirmative motivations; avoidance, devalue, perceived difficulty and peer devalue are the undermining ones. From these motivations four pairs can be constructed, each consisting of an affirmative and an undermining motivation: 1) intrinsic motivation and avoidance, 2) valuing and devaluing, 3) self-efficacy and perceived difficulty, 4) peer value and peer devalue.

Although the motivations of each pair are related, these motivations are empirically distinct: for each pair, factor analyses of the items have shown that a two factor solution was a better fit than a one factor solution (e.g., Coddington, 2009;

Guthrie & Coddington, 2009; Guthrie, Coddington, & Wigfield, 2009; Guthrie, Klauda, & Ho, 2013; Guthrie & Klauda, 2014; Ho & Guthrie, 2013; Van Steensel, Oostdam, & Van Gelderen, 2013; Wigfield et al., 2012). The empirical distinction between motivations also leads to a theoretical distinction, as the score on an affirmative motivation of each pair does not necessarily correspond with the opposite score on the related undermining motivation. For example, a reader who does not enjoy expository text reading (low intrinsic motivation) does not necessarily avoid expository text reading (high avoidance motivation).

Intrinsic motivation is conceptualized as enjoyment in reading expository texts and having a desire to read them often (Gottfried, Fleming, & Gottfried, 2001; R. M. Ryan & Connell, 1989; Unrau & Schlackman, 2006). This construct is drawn from self-determination theory (R. M. Ryan & Deci, 2000), which argues that intrinsic motivation is maintained only when people feel competent and self-determined. According to self-determination theorists, less autonomy in choosing an activity, for example exerting external control, is likely to reduce intrinsic motivation. Avoidance is conceptualized as an aversion towards reading expository texts for school and trying to spend as little time and effort reading expository texts as possible. Avoidance stems from goal orientation theories, which have identified work avoidance as one of the goals students hold (Dowson & McInerney, 2003; Meece & Miller, 2001).

Valuing is classified as believing that reading expository texts for school is useful and important for one's future (Trautwein, Lüdtke, Schnyder, & Niggli, 2006; Wigfield & Eccles, 2000), whereas a devaluing reading motivation means holding the view that reading expository texts is not important or useful for one's future (Legault, Green-Demers, & Pelletier, 2006). Valuing and devaluing are based on expectancy-value theory (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) which argues that choices to engage in a task and task performance depend on complex interactions between personal expectancies and values associated with the task. Note that although we define valuing and devaluing as opposites here, they load on different factors (e.g., Wigfield et al., 2012) and are not assessed as opposite ends of the same scale. Reading self-efficacy is conceptualized as the belief in one's ability to read expository texts with success (Schunk, 2003; Usher & Pajares, 2006) and stems from self-efficacy theory (Bandura, 1997), which discusses various factors that contribute to a person's perceived self-efficacy for a certain task, such as his or her previous task performance. Perceived difficulty is defined as the view that reading expository text is a difficult task. Chapman and Turner (2003) show that perceived difficulty develops in particular among struggling readers and that this development in turn contributes to a lack of self-efficacy for these readers. Note, however, that perceived difficulty and self-efficacy, as mentioned before, are separate factors in factor analyses (Chapman & Turner, 1995; Wigfield et al., 2012).

Lastly, peer value and peer devalue are defined as the belief that peers either value or devalue someone's viewpoints about reading and reading habits. These two constructs have been based on research that shows that peers or groups can positively or negatively influence an individual's motivations and academic outcomes (Kindermann, 2007; A. M. Ryan, 2001; Wentzel, 1996). Again, although we define peer value and peer devalue as opposites here, they are not assessed as opposite ends of the same scale and appear to load on different factors (e.g., Wigfield et al., 2012).

In addition to the eight motivations of the MRIB-S questionnaire, we measured two additional motivations that could moderate the impact of cognitive skills on expository text comprehension, namely preference for challenge and mastery goal. We define preference for challenge as having a preference for reading and mastering difficult and challenging expository texts. We considered preference for challenge to be an important construct for expository text reading in particular, as secondary school students appear to find these texts difficult and challenging (see for example Wigfield et al., 2012). Our items were based on the preference for challenge items from the Motivation for Reading Questionnaire (Wang & Guthrie, 2004; Wigfield & Guthrie, 1997), which measured preference for challenging texts irrespective of genre. We adapted items to address expository texts specifically.

The second added motivation, mastery goal, was defined as being motivated to understand expository texts as thoroughly as possible (cf., Guthrie et

al., 2013) and to become better at this task irrespective of how interesting texts are. We expected that a mastery goal towards expository text comprehension overrules students' possible feelings that texts are difficult or uninteresting (see for example Wigfield et al., 2012). We hypothesized that holding a mastery goal towards expository text reading results in increased behavioral and cognitive engagement, and, consequently, in a better level of text understanding even though students might not be intrinsically motivated to read expository texts. The motivation mastery goal was based on goal orientation theory (Patrick, Ryan, & Pintrich, 1999; Pintrich, 2000): people with a mastery goal orientation have a desire to gain understanding, insight or skill as a goal in itself.

5.5 Cognitive skills required for expository texts

In the present study we tapped into reading fluency, linguistic knowledge and metacognitive knowledge about reading strategies and text structure to account for the cognitive skills required to comprehend a text. These three skills have been shown to be associated with reading comprehension skill in various studies (e.g., Cromley & Azevedo, 2007; O'Reilly & McNamara, 2007; Schoonen et al., 1998; Trapman et al., 2014; Van Gelderen et al., 2007) and several well-acknowledged reading models (e.g., Kintsch et al.'s construction integration model: Kintsch, 1998; Kintsch & Rawson, 2005; and Perfetti et al.'s framework for reading comprehension: Perfetti, 1999; Perfetti et al., 2005).

Reading fluency has been considered important in the context of a limited working memory capacity. As attentional resources are limited, fluent word and sentence processing have been put forward as a necessity for a readers' execution of higher order comprehension processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). The relationship between linguistic knowledge and reading comprehension is also widely acknowledged (e.g., Beck et al., 1982; Carlisle, 2007; McKeown et al., 1983; Nagy, 2007; Stahl & Fairbanks, 1986; Van Gelderen et al., 2007): although it is possible to infer the meaning of unknown words in a text to some extent, a large proportion of

words in a text needs to be known to achieve sufficient comprehension; estimates range from 95% to 98% (Hu & Nation, 2000; Laufer, 1989; Schmitt, Jiang, & Grabe, 2011). Lastly, metacognitive knowledge was included because it has been shown to be a predictor of text comprehension, even after controlling for language skills (e.g., Cromley & Azevedo, 2007; Schoonen et al., 1998; Trapman et al., 2014; Van Gelderen et al., 2007).

5.6 Method

5.6.1 Participants

The study started with 337 students from thirteen eight grade classes in three secondary schools. Students were excluded from the analyses if school reports indicated they had learning or reading problems (n = 16), if the test administrators' notes indicated that they demonstrated disobedient behavior during one or more class administered tests (n = 91) or if they had one or more test scores missing due to absence during a testing session or exclusion of their test scores (n = 38). Test scores were excluded for students who skipped half or more of the items on a test and for students who scored below chance level, since both were regarded as an indication of test disturbance. In addition, after the first two testing sessions, one school decided to discontinue participation for most students (n = 40, school B in Table 5.1).

The large attrition due to misbehavior is related to the challenging school population at the participating urban schools and the teachers' ability to manage the classroom during test administration. Most misbehavior was on expository text comprehension (n = 59), and coupled with the other reasons for exclusion of test scores, this left us with 191 students with valid scores on the expository text comprehension test. Our analyses were performed on a sample of 152 students who had no missing scores for the other tests either. In our final sample, the distribution in terms of educational levels was as follows: 38% received instruction at a low educational level (n = 58), 20% at an intermediate educational level (n = 30) and

42% at a high educational level (n = 64). Table 5.1 shows the number of students per school, per class and the educational level of each class.

School	Class	Educational level*		Numb	ber
				of stu	dents
А	A1, A2, A3, A4	Low		51	
	A5	Intermediate		14	
	A6, A7	High		46	
			Total		111
В	B1	Low		7	
	B2	Intermediate		3	
	B3	High		6	
			Total		16
С	C1, C2	Intermediate		13	
	C3	High		12	
			Total		25
			Total all schools		152

 Table 5.1 Students included in the analyses per school, class and the educational level of each class.

*The educational levels correspond to the following educational levels in Dutch secondary school: low = *vmbo-t* (prevocational level) or *vmbo-t/havo* (prevocational/general secondary educational level), intermediate = *havo* (general secondary educational level) or *havo/vwo* (general secondary educational/pre-university level), high = *vwo* (pre-university level).

Students were regarded as monolingual Dutch (n = 51) if they indicated in the background questionnaire (see Instruments section) that Dutch was their only mother tongue, and as bilingual Dutch (n = 101) if one or more languages other than Dutch were involved in their initial language acquisition. All but seven of the bilingual students were born in the Netherlands and only two of them had received less than five years of primary education in the Netherlands. The bilingual students were assigned to the Bilinguals Dutch dominant at home group (n = 39) if they indicated that their parents spoke Dutch to them at least 50% of the time, the other bilinguals were assigned to the Bilinguals Dutch not dominant group (n = 62).

5.6.2 Instruments

The students were administered five tests, which measured their expository text comprehension, linguistic knowledge (two tests), metacognitive knowledge and sentence reading fluency. In addition, students also filled out two questionnaires, one tapping into motivations to read, the other into background information.

Expository text comprehension. The expository text comprehension test comprised 35 multiple choice questions (with three or four answer options) about five expository texts. Texts varied in length between 184 and 449 words and addressed various topics. Four texts were derived from the database of *Diataal*, a Dutch testing institute (Hacquebord et al., 2005). One text was derived from the reading comprehension test used in a study by Van Gelderen et al. (2007). Texts and questions were adapted slightly.

Linguistic knowledge. Two tests measured linguistic knowledge. One was a digitally administered *general vocabulary knowledge* test developed by *Diataal* (Hacquebord et al., 2005) that consisted of 70 multiple choice items. The 70 target words were drawn from a corpus of school book texts. The other linguistic knowledge test tapped into students' *knowledge of connectives* specifically, by means of 43 fill-in-the-blank items. The test comprised six short expository texts with blanks. For each blank, students had to choose the appropriate connective out of three options. Relationships between the propositions that had to be connected were regarded as familiar to all students.

Metacognitive knowledge. To measure students' metacognitive knowledge of text structure and reading and writing strategies, we used an adapted version of the metacognitive knowledge test used by Van Gelderen et al. (2007). The original test was reduced to 45 statements. In this test, participants had to indicate whether or not they agreed with statements about text structure and writing and reading strategies. For example, a correct response would be if they agreed with the following statement: *if you do not understand the meaning of a word, it is useful to try and*

guess its meaning by looking at other words and sentences surrounding the unfamiliar word.

Sentence reading fluency. Sentence reading fluency was measured by a sentence verification test similar to the one used by Van Gelderen et al. (2007). Students were presented 110 sentences on a laptop screen and had to decide as fast as possible whether a sentence made sense or not by pressing a green or a red stickered key, respectively, on their laptops' keyboards. Half of the sentences made sense, the others did not. Sentences that did not make sense were in flagrant contradiction with encyclopedic knowledge all students were considered to share (e.g., Alligators are adorable and harmless pets and In the Netherlands, Christmas is always celebrated in the summer were sentences that did not make sense). Reading fluency was calculated by averaging the reaction times on the correct responses to the sentences that make sense.

Motivations to read. Motivations to read expository texts were assessed by means of a 76 item questionnaire, which taps into the following 10 motivational aspects (between brackets the number of items): *intrinsic motivation* (8), *avoidance* (7), *value* (7), *devalue* (7), *self-efficacy* (7), *perceived difficulty* (7), *peer value* (7), *peer devalue* (7), *preference for challenge* (7) and *mastery goal* (12). The first eight motivations are based on the *Motivations for Reading Information Books School* questionnaire (MRIB-S: Guthrie et al., 2009), which was translated into Dutch. In contrast to the MRIB-S, which referred to information texts at school specifically, we referred to information text reading in general (i.e., both at school and elsewhere). In a pilot study, eight items of our questionnaire appeared to reduce the reliability of our motivational subscales and were revised.

Students who took the questionnaire had to indicate on a 5 point Likert scale to what extent they agreed with 76 statements (i.e., to what extent the statements applied to their situation). They could choose one of the following options: totally disagree, disagree, neither disagree nor agree, agree and totally agree. Students received an oral instruction by a test assistant; the instruction was

also printed in their questionnaire. The instruction stressed that there were no wrong or right answers; that is, students were requested to give their own opinion about the statements.

Table 5.2 shows the internal consistency (Cronbach's Alpha) of the tests and the motivational subscales for the whole sample and for subgroups based on language background. Expository text comprehension and the control variables generally showed satisfactory reliability estimates between .70 and .96, except for metacognitive knowledge, for which reliability estimates were between .60 and .66. Reliability estimates of the motivational subscales were also satisfactory, with three exceptions: for the monolingual Dutch and for bilingual Dutch dominant group peer devalue's reliability estimates were .66 and .64 respectively, and for the monolingual Dutch group self-efficacy had a reliability estimate of .67.

Background questionnaire. The background questionnaire requested the following information: gender, country of birth, mother tongue, language(s) the parents/care-takers speak to participants (and percentages of the time they speak these languages to them), country of birth of parents/caretakers, the highest completed educational level of parents/caretakers and jobs of parents/caretakers.

5.6.3 Procedure

From March till June 2014 tests and questionnaires were administered, each one in a separate testing session. Students were given enough time to complete them. Tests and questionnaires were administered during regular classes, except for the reading fluency test, for which participants were taken out of their regular classes in groups of four and led to a separate testing room. Test administrators took notes on students' behavior during plenary test administrations.

	Number of items	All students $(n = 152)$	Monolingual Dutch $(n = 51)$	Bilingual Dutch $(n = 101)$	Bilinguals Dutch dominant (n = 39)	Bilingu Dutch domin: (n = 6
Expository text comprehension	35	.79	.84	.74	LT.	.70
		Contre	ol variables: Cogni	tive skills		
General vocabulary	70	.83	.79	.80	.84	<i>TT.</i>
Knowledge of connectives	43	.83	.84	.79	.78	.80
Metacognitive knowledge	45	.66	.60	.65	.64	.66
Sentence reading fluency (<i>RT</i> in msec)	46	96.	96.	96.	.95	.95
			Motivations to rea	ad		
Intrinsic	8	.83	.83	.82	.84	.81

.78	.79	.84	.81	.75	LL.	.80	.84	.87
.81	.86	.90	.78	69.	.74	.64	.71	.93
.79	.82	.85	<i>PL</i>	.73	.75	.75	.78	06.
.85	.83	.84	.67	.82	.76	.66	.82	.88
.82	.83	.84	.75	.76	.75	.72	.79	89.
7	7	L	L	L	7	7	L	12
Avoidance	Value	Devalue	Self-efficacy	Perceived difficulty	Peer value	Peer devalue	Preference for challenge	Mastery goal

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5.6.4 Scoring and missing value treatment

On the general vocabulary test and the reading fluency test, there were no missing responses, because these digital tests required a response for every item. Skipped items in the expository text comprehension, knowledge of connectives and metacognitive knowledge test were scored as incorrect. For the reading fluency test, the procedure described in Van Gelderen et al. (2003) was used for scoring and missing value treatment. First, to ensure that linguistic knowledge and comprehension did not influence performance on the fluency test, sentences with a an accuracy rate lower than .875 were excluded from the analyses. Nine sentences in the reading fluency test were deleted (hence mean reaction times were calculated on the basis of the remaining 46 sentences). Second, inaccurate responses to sentences or potentially untrustworthy ones (extremely slow responses, i.e. three standard deviations above the mean, or extremely fast responses, i.e. faster than the fastest reaction time of a group of five expert readers) were turned into missing values. Next, missing values for the sentences in the reading fluency test (5.7% missing reaction times) were estimated with the expectation maximization procedure of SPSS (SPSS Inc., Chicago, IL, USA). After applying this procedure, the mean reaction time for the reading fluency test was calculated per participant. Skipped items in the motivation questionnaire were estimated with items of the corresponding motivation subscale only.

5.6.5 Analyses

To examine the validity of the separate factors in reading motivation, confirmatory factor analyses by structural equation modeling were performed (in LISREL). Since sample size was too small to fit a 10-factor model to the 76 item scores representing the ten motivational aspects, analyses were performed with subsets of the data. First, for each of the four pairs with an affirming and a corresponding undermining counterpart it was examined whether - as previously has been established - a two factor solution gave a better fit to the data than a one factor model. Second, it was examined whether the two motivations we added to the MRIB-S questionnaire, that

is, preference for challenge and mastery goal, were to be considered a single factor together with intrinsic motivation or whether a three factor model was more appropriate. We examined this because, in the reading motivation literature, it has been questioned whether these three constructs differ from each other (e.g., Eccles & Wigfield, 2002; Wang & Guthrie, 2004; Wigfield & Guthrie, 1997). Third, through the use of sum scores for the separate motivational aspects (i.e. parcel scores), it was examined whether the ten parcel scores could be accounted for by a one-factor or a two-factor model. In the latter model, the two factors represented affirming (6 parcel scores) and undermining motivations (4 parcel scores), respectively. A six-factor model (for the four pairs of the MRIB-S and the two added dimensions) could not be fitted, because of the low number of indicator variables per factor (1-2). The parcel scores were treated as ordinal five point Likert scales, and therefore polychoric correlations were computed in PRELIS.

Motivational subscales were constructed based on the results of the confirmatory factor analyses. Means and standard deviations on all tests and on the motivational subscales were computed for the whole sample and separately for the one monolingual and two bilingual subgroups (Dutch dominant versus Dutch not dominant). Because students came from different classes, all regression analyses were performed with a random intercept for class. Differences between monolinguals and bilingual Dutch students and between the two bilingual subgroups on the tests and the reading motivations were investigated by the use of regression analyses, with the tests as dependent variables and two independent (i.e. orthogonal) contrasts as predictor variables: one predictor contrasting monolingual versus bilingual Dutch students and one contrasting the two bilingual groups. These contrasts were added in a stepwise manner as predictors of the test concerned; first it was examined whether monolinguals differed from bilinguals on a test, next potential differences between the two bilingual groups were examined. Effect sizes of the differences are reported as the increase in total explained variance (Δr^2). Furthermore, correlations between the test scores were calculated for the whole sample and for the various subsamples.

Before we investigated our research questions we investigated whether each of the predictor variables (cognitive skills and motivational subscales) were curvilinearly related to expository text comprehension, because it has been shown that curvilinear relationships between predictors and dependent variables may affect the estimation of interaction effects (Ganzach, 1997).

To answer whether motivations to read moderated the effect of cognitive skills on expository text comprehension (our first research question), we performed various hierarchical regression analyses. First, each distinct motivational aspect was included into a regression analysis after the cognitive skills were entered. Next, for each of these cognitive skills, interactions with each motivational aspect were examined separately.

To examine whether the additional contribution of motivational aspects to expository text comprehension differs between students with different language backgrounds and between readers who vary in reading proficiency levels (our second research question), we examined interaction effects between each of the motivational aspects and language background, and between each of the motivational aspects and reading proficiency levels. The interactions between reading motivations and reading proficiency level were tested by means of two dummy variables that differentiated between the 50% best scoring (n = 76) and the 50% worst scoring (n = 76) students on the expository text comprehension test: good readers had a score of 1 and poor readers a score of 0 on the dummy variable 'good', while scoring was vice versa for the dummy variable 'poor'. These two dummy variables were entered as predictors of expository text comprehension, along with a particular reading motivation, reading fluency, linguistic knowledge and metacognitive knowledge. As a second step, the interaction between the reading motivation and 'dummy poor' was entered, to investigate whether poor and good readers differ significantly from each other with regards to the relationship between the reading motivation and expository text comprehension (for a similar method see Rijkeboer et al., 2011).

The abovementioned regression analyses were also performed with a sample size of 191 students to check for the robustness of our results. These 191

students all had a valid score on expository text comprehension, while 39 of these students had a score missing on one (n = 31), two (n = 6) or three (n = 2) of the predictor variables. For our robustness check, we created a dummy variable for each predictor that represented whether a score was missing (a score of 1) or not (a score of 0) for the associated predictor. We entered these dummy variables in our regression models along with the associated predictor variables. These regression models did not include a fixed intercept and missing scores on the standardized predictor variables were recoded into a score of 0 (see Koomen & Hoeksma, 1991). This method enabled us to investigate whether the outcomes of our models were affected (i.e., different from the sample with 152 students) when our models controlled for the variance accounted for in text comprehension by differences between students who either missed or did not miss a score for every predictor variable.

5.7 Results

5.7.1 Confirmatory factor analyses

The factor analyses showed that two factor solutions were a better fit than one factor solutions for three out of four motivation pairs, as was indicated by the difference in χ^2 goodness of fit: intrinsic-avoidance (χ^2 (1) = 26.8, *p* = .00) valuing-devaluing (χ^2 (1) = 53.38, *p* = .00) and peer value-peer devalue (χ^2 (1) = 50.82, *p* = .00). For the pair self-efficacy-perceived difficulty a two factor model was not a significant better fit than a model comprising one factor (χ^2 (1) = 2.26, *p* = .13). Although our main interest is a comparison of the fit of the one-factor and the two-factor models, the absolute fit of the two-factor models was reasonable, i.e. ratio of Satorra-Bentler scaled χ^2 /df was <2 in all cases and RMSEA ranged from .033 to .092.

In comparison to a one- or two-factor model, a three factor model was the best solution for the 27 items representing the motivational aspects preference for challenge, mastery goal and intrinsic motivation (χ^2 (321) = 535.85, *p* = .00, RMSEA .067). A three factor model was a better solution than a two factor model that collapsed the relatively strongly correlated preference for challenge and intrinsic

motivation ($\chi^2(1) = 22.29$, p = .00). A one-factor model, of course, fitted the data far worse. Lastly, a two factor model for reading motivation with a distinction between affirming and undermining motivations appeared to be a better fit than a one factor model with no such distinction ($\chi^2(1) = 207.58$, p = .00). Because most results support a differentiation between positive and undermining motivations, we decided to treat the ten motivational aspects as separate factors in further analyses, as was intended.

5.7.2 Descriptive statistics for cognitive skills

Expository text comprehension scores were normalized with Blom's formula (Blom, 1958). The upper part of Table 5.3 shows the means and standard deviations on the cognitive skills for the whole sample and the various subgroups. Regression analyses revealed that the monolinguals scored higher than the bilinguals on expository text comprehension (χ^2 (1) = 9.85, p = .00, $\Delta r^2 = .08$), general vocabulary knowledge (χ^2 (1) = 21.57, p = .00, $\Delta r^2 = .17$), knowledge of connectives (χ^2 (1) = 13.8, p = .00, $\Delta r^2 = .12$) and metacognitive knowledge (χ^2 (1) = 6.20, p = .01, $\Delta r^2 = .07$), but there was no significant difference in sentence reading fluency (χ^2 (1) = .20, p = .65, $\Delta r^2 = .00$). The bilingual Dutch dominant group read faster than the bilingual Dutch not dominant group (sentence reading fluency, χ^2 (1) = 6.24, p = .01, $\Delta r^2 = .04$), but on the other skills there were no significant differences between these two subgroups (expository text comprehension, χ^2 (1) = 2.13, p = .14, $\Delta r^2 = .01$; general vocabulary knowledge, χ^2 (1) = .71, p = .40, $\Delta r^2 = .00$; knowledge of connectives, χ^2 (1) = 1.20, p = .27, $\Delta r^2 = .00$; metacognitive knowledge, χ^2 (1) = .66, p = .42, $\Delta r^2 = .00$).

5.7.3 Descriptive statistics for motivations to read

The lower part of Table 5.3 shows the means and standard deviations on the reading motivations for the whole sample and the various subgroups. All groups scored around average (around 3) on the six affirming motivations (i.e. intrinsic motivation, value, self-efficacy, peer value, preference for challenge and mastery goal), with

scores on intrinsic motivation and preference for challenge slightly below the average and scores on the other four motivations slightly above the average. Scores for the four undermining motivations (i.e. avoidance, devalue, perceived difficulty and peer devalue) also were around the mean, with peer devalue approaching an average of 2. Regression analyses indicated that the monolinguals did not differ from the bilinguals on any of the reading motivations: intrinsic motivation, χ^2 (1) = 3.60, p = .06, $\Delta r^2 = .02$; avoidance, χ^2 (1) = 3.07, p = .08, $\Delta r^2 = .02$; value, χ^2 (1) = 1.09, p = .30, $\Delta r^2 = .00$; devalue, χ^2 (1) = .17, p = .68, $\Delta r^2 = .00$; self-efficacy, χ^2 (1) = .24, p = .62, $\Delta r^2 = .00$; perceived difficulty, χ^2 (1) = .00, p = 1.00, $\Delta r^2 = .00$; peer value, χ^2 (1) = 1.93, p = .16, $\Delta r^2 = .01$; peer devalue, χ^2 (1) = .14, p = .71, $\Delta r^2 = .00$; preference for challenge, χ^2 (1) = .17, p = .68, $\Delta r^2 = .00$; mastery goal, χ^2 (1) = 1.16, p = .28, $\Delta r^2 = .00$.

We did not find differences between the two bilingual groups on motivational aspects either: intrinsic motivation, χ^2 (1) = .54, p = .46, Δr^2 = .01; avoidance, χ^2 (1) = 1.31, p = .25, Δr^2 = .01; value, χ^2 (1) = .03, p = .86, Δr^2 = .00; devalue, χ^2 (1) = .01, p = .92, Δr^2 = .00; self-efficacy, χ^2 (1) = .03, p = .86, Δr^2 = .00; perceived difficulty, χ^2 (1) = 1.03, p = .31, Δr^2 = .00; peer value, χ^2 (1) = .04, p = .84, Δr^2 = .00; peer devalue, χ^2 (1) = .00, p = 1.00, Δr^2 = .00; preference for challenge, χ^2 (1) = .00, p = 1.00, Δr^2 = .00; mastery goal, χ^2 (1) = .01, p = .92, Δr^2 = .00.

5.7.4 Correlations

Table 5.4 displays the correlations between expository text comprehension and its predictors (cognitive skills and motivations to read) for the whole sample and for the subgroups. Cognitive skills, representing linguistic knowledge and metacognitive knowledge correlated moderately and significantly with expository text comprehension (correlations ranging from .31 to .65), while correlations of reading fluency and motivations to read with expository text comprehension were low and non-significant (-.20 < r < .20) with one exception: peer value correlated at .30 with expository text comprehension for the bilingual Dutch dominant readers (although non-significant). Many correlations between motivations to read and expository text comprehension were close to zero. Affirmative and undermining motivations

	illinguals Dutch not lominant (n = 62)	24.42 (4.37)		50.35	(7.17)	30.53	(5.71)	35.05	(4.26)	2963	(489)		2.91	(65)
nd various	BilingualsEDutch dominantI $(n = 39)$ 0	23.01 (5.13)		50.95	(8.42)	29.72	(5.40)	34.56	(4.30)	2715	(489)		2.80	(.75)
ne whole sample a	Bilingual Dutch $(n = 101)$	23.87 (4.70)	ive skills	50.58	(7.64)	30.22	(5.58)	34.86	(4.26)	2867	(501)	pu	2.87	(69)
the tests for th	Monolingual Dutch $(n = 51)$	27.03 (5.80)	l variables: Cognit	57.59	(6.35)	34.49	(5.44)	37.12	(3.63)	2809	(513)	Motivations to rea	2.64	(67)
deviations) on	All students $(n = 152)$	24.93 (5.29)	Contro	52.93	(7.94)	31.65	(5.87)	35.62	(4.18)	2848	(505)		2.79	(69)
(and standard	Number of items or scale range	35		70		43		45		46			1-5	
Table 5.3 Means		Expository text comprehension		General	vocabulary	Knowledge of	connectives	Metacognitive	knowledge	Sentence reading	fluency (<i>RT in msec</i>)		Intrinsic	motivation

dance	1-5	2.70	2.83	2.63	2.53	2.69
		(.68)	(.73)	(.65)	(.68)	(.63)
e	1-5	3.61	3.53	3.64	3.63	3.65
		(.64)	(.64)	(.64)	(.72)	(.58)
lue	1-5	2.52	2.55	2.51	2.52	2.50
		(.74)	(.74)	(.75)	(.83)	(69)
efficacy	1-5	3.53	3.50	3.54	3.53	3.55
,		(.56)	(.52)	(.58)	(.58)	(.58)
eived	1-5	2.53	2.54	2.53	2.46	2.58
culty		(.59)	(.62)	(.58)	(.55)	(.59)
value	1-5	3.26	3.17	3.31	3.32	3.30
		(.59)	(.58)	(09.)	(09.)	(09.)
devalue	1-5	2.34	2.36	2.33	2.32	2.33
		(.58)	(.52)	(.61)	(.53)	(99)
srence for	1-5	2.83	2.80	2.85	2.85	2.84
enge		(.70)	(.72)	(.70)	(.81)	(.62)
ery goal	1-5	3.57	3.50	3.61	3.62	3.60
		(.67)	(.64)	(69)	(.80)	(.62)

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)						-		-			
		Cogni	tive skills			Motiva	tions to re	ead							
		RF	VOC	KOC	MK	IM	AVO	VAL	DEV	SE	PD	Pval	Pdev	PFC	MAS
sIli	Expository te:	xt compr	ehension												
ys ə	All students	15	.46*	.64*	.45*	10	.12	02	05	.02	04	.02	02	12	.08
viti	MD	19	.32*	.61*	.49*	06	.12	-09	04	.04	13	00	20	14	60.
ugo	BD	11	.44*	:60	.38*	06	.07	.06	07	.02	.02	.08	.06	10	.11
Э	BDdom	11	.55*	.53*	.32*	.01	.12	.08	14	.19	14	.30	04	.01	.20
	BDndom	18	.37*	.65*	.42*	14	01	.03	01	10	.10	07	.12	19	.02
	Reading fluen	ncy (RF)	RT in mse	30											
	All students		35*	31*	23*	.08	00.	.08	.07	10	.11	.17*	14	10	.06
	MD		49*	42*	15	.11	.08	.04	60.	33*	.25	.11	04	12	60.
	BD		31*	25*	25*	.05	03	.10	.07	00	.03	.19	18	-09	.05
	BDdom		41*	.37*	40*	11	.06	.05	.07	06	.14	.17	17	37*	02
	BDndom		24	22	19	.14	14	.13	.07	.03	08	.22	20	.14	.11
	Vocabulary k	nowledg	e (VOC)												
	All students			.53*	.40*	10	60.	02	10	.04	11	16*	.12	.01	00.
	MD			.53*	.20	-09	03	04	12	.24	40*	12	.03	.06	07
	BD			.42*	.38*	01	.06	.05	12	00	.01	13	.15	.03	.08
	BDdom			.55*	.50*	.16	.00	.14	19	.13	16	.03	.24	.28	.19
	BDndom			.34*	.30*	15	.12	04	06	10	.13	25*	=	22	03
	Knowledge of	f connec	tives (KO	C)											
	All students				<u>4</u> .	15	11.	06	03	03	.02	16*	.14	06	01

Table 5.4 Correlations between the cognitive skills and motivations to read for the whole sample and the subgroups

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	MD	39*	- 22	13	-17	- 05	05	-10	- 06	03	-11	- 15
	BD	.39*	05	.03	.03			.07	17	.18	03	60.
	BDdom	.42*	.19	.01	.22	23	.16	06	.08	.07	.24	.33*
	BDndom	.36*	22	.02	11	60.	16	.13	31*	.23	23	-09
	Metacognitive knowledge (MK)											
	All students		18*	.08	12	03	08	02	05	02	15	10
	MD		.03	10	06	24	05	-09	.23	34*	18	06
	BD		21*	.12	13	.05	08	.01	13	.08	13	-00
	BDdom		04	02	16	05	07	17	12	03	.12	04
	BDndom		35*	.20	10	.13	08	.10	14	.14	34*	13
ps	Intrinsic motivation (IM)											
o te	All students			70*	.73*	61*	.38*	23*	.34*	11	.73*	.62*
suc	MD			84*	.61*	72*	.25	23	.12	-00	.75*	.49*
vatio	BD			62*	.78*	56*	.44*	23*	.43*	11	.73*	.68*
ritol	BDdom			69*	.83*	68*	.52*	25	.42*	20	.72*	.72*
M	BDndom			60*	.74*	47*	.38*	24	.44*	06	.74*	.65*
	Avoidance (AVO)											
	All students				61*	.71*	34*	.40*	30*	.21*	62*	52*
	MD				66*	.87*	29*	.31*	14	.03	77*	57*
	BD				58*	.64*	36*	.45*	37*	.29*	54*	49*
	BDdom				60*	.74*	39*	.34*	27	.26	62*	48*
	BDndom				57*	.56*	35*	.52*	45*	.32*	47*	50*
${}^{\rm HI}_{p}$	D, Monolingual Dutch $(n = 51)$; BD, Bilii ingual Dutch not dominant at home $(n = 62)$ < 05.	ingual D ¹ 2).	itch (n =	= 101); F	3Ddom,	Bilingua	l Dutch	dominant	t at home	n = 3	9); BDnd	lom,

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tin	ued) Coi Cogn	relations iti ve skill	between th	le cognit	nve skill Motiv	s and mot ations to 1	read	to read fo	or the who	ole samp	le and the	e subgrou	sdi	
RF	5	VOC	KOC	MK	IM	AVO	VAL	DEV	SE	DD	Pval	Pdev	PFC	MAS
								65*	.41*	24*	.38*	II.	.59*	.74*
								70*	.20	18	.18	08	.56*	.76*
								62*	.51*	28*	.46*	12	.61*	.73*
								70*	.60*	29	.49*	27	.56*	.72*
								54*	.43*	28*	.44	03	.66*	.73*
()														
									43*	.36*	34*	.20*	48*	63*
									28*	.18	22	E.	64*	60*
	1								49*	.46*	39*	.23*	39*	64*
	1								47*	.36*	44*	.30	48*	70*
	1								51*	.54*	36*	.20	30*	60*
(SE)	1													
										70*	.25*	07	.45*	.46*
	1									64*	<u>4</u> .	.13	.42*	.25
	1									73*	.35*	15	.46*	.54*
	1									68*	.37*	32*	.40*	.58*
	1									77*	.33*	06	.52*	.51*
ficulty	\sim	PD)												
											17*	.19*	26*	28*
	Ĺ													

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MD	.03	-00	22	16
BD	28*	.28*	29*	34*
BDdom	25	.30	30	29
BDndom	30*	.28*	29*	39*
Peer value (Pval)				
All students		50*	.22*	.37*
MD		20	.06	.18
BD		63*	.30*	.45*
BDdom		60*	.21	.44*
BDndom		65*	.39*	.46*
Peer devalue (Pdev)				
All students			60.	11
MD			.23	.05
BD			.03	.17
BDdom			.13	30
BDndom			03	-09
Preference for challenge (PFC)				
All students				.55*
MD				.52*
BD				.57*
BDdom				.53*
BDndom				.62*
D, Monolingual Dutch $(n = 51)$; BD, Bilingual Dutch $(n = 101)$; BDdom, Bilingual Dutch dominant	at home	(n = 39)); BDnd	om,

MD, Monolingual Dutch (n = 51); BD, Bilingual Dutch (n = 101); BDdom, Bilingual Dutch dominant at home (n = Bilingual Dutch not dominant at home (<math>n = 62). *p < .05.

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correlated as expected: affirmative motivations correlated positively with each other (between .04 and .83), and the undermining motivations did so to (between .03 and .87). Furthermore, affirmative and undermining motivations correlated negatively with each other (between -.04 and -.84).

5.7.5 Curvilinear effects

For two predictors, the test for a curvilinear effect (i.e. inclusion of the quadratic term) appeared to be significant in terms of model improvement, namely for knowledge of connectives ($\chi^2(1) = 6.19$, p = .01, $\Delta r^2 = .04$) and self-efficacy ($\chi^2(1)$) = 4.04, p = .04, $\Delta r^2 = .01$). For knowledge of connectives, however, the parameter estimates revealed that the quadratic term led to non-significance of the linear term. Therefore, we did not consider this curvilinear relationship valid (cf., Breetvelt et al., 1994). For self-efficacy, we did not take the quadratic term into account as the linear term did not have predictive value as a sole predictor. The other predictors were not curvilinearly related to expository text comprehension (reading fluency, χ^2 (1) = .23, p = .63, $\Delta r^2 = .00$; general vocabulary knowledge, χ^2 (1) = .69, p = .41, $\Delta r^2 = .00$; metacognitive knowledge, χ^2 (1) = 1.19, p = .27, $\Delta r^2 = .02$; intrinsic motivation, $\chi^2(1) = .27$, p = .06, $\Delta r^2 = .00$; avoidance, $\chi^2(1) = .17$, p = .68, $\Delta r^2 =$.00; value, $\chi^2(1) = 1.04$, p = .31, $\Delta r^2 = .01$; devalue, $\chi^2(1) = 2.24$, p = .13, $\Delta r^2 = .01$; perceived difficulty, $\chi^2(1) = .35$, p = .55, $\Delta r^2 = .01$; peer value, $\chi^2(1) = 1.84$, p = .17, $\Delta r^2 = .02$; peer devalue, χ^2 (1) = .32, p = .57, $\Delta r^2 = .00$; preference for challenge, χ^2 (1) = .66, p = .42, $\Delta r^2 = .00$; mastery goal, χ^2 (1) = 3.74, p = .05, $\Delta r^2 = .01$).

5.7.6 Research questions: predictive value of motivational aspects

Table 5.5 shows the results of our analyses to answer our research questions. Models 1a to 1j of Table 5.5 show the results of the regression analyses in which each one of the motivations to read was included in a regression model in addition to the base model including sentence reading fluency, linguistic knowledge and metacognitive knowledge as predictors. Given the low correlations between motivations to read and expository text comprehension, it comes as no surprise that none of the ten reading motivations led to a better model fit for expository text comprehension, controlling for the variance accounted for by the predictors in the base model (χ^2 (4) = 74.31, p = .00, $\Delta r^2 = .45$). Apparently, the motivational aspects could not account significantly for a portion of the remaining unexplained total variance (55%).

Table 5.5 also presents the results of models in which interactions effects between cognitive skills and motivations to read were examined, in addition to the predictors of the base model and one of the motivations to read: none of the ten motivational aspects did moderate the effect of cognitive skills on expository text comprehension (reading fluency, see models 2a-2j; general vocabulary knowledge, see models 3a-3j; knowledge of connectives, see models 4a-4j; and metacognitive knowledge, see models 5a-5j).¹⁰

The last two columns of Table 5.5 show our analyses in which differences in the predictive value of motivations to read were examined for readers with distinct language backgrounds (column 6) and reading proficiency levels (column 7). For none of the ten motivational aspects differences could be established between readers with distinct language backgrounds (monolinguals versus bilinguals and bilingual Dutch dominant versus bilingual Dutch not dominant), see Table 5.5, models 6a-6j.

The poor and good readers did not differ either in the associations between motivations to read and expository text comprehension with one exception (see Table 5.5 models 7a-7j): value related to expository text comprehension for the poor readers, but not for the good readers, χ^2 (1) = 3.99, p = .04, $\Delta r^2 = .00$. Other than expected, however, the relationship between value and expository text comprehension was negative for poor readers (the parameter estimate was -.18 with a standard error of .09), indicating that a higher value was related to a slightly lower expository text comprehension. Note that, although the interaction term between

¹⁰ Also interactions between motivational aspects and text reading fluency (key component in chapter 3 of this dissertation) and between motivational aspects and text structure inference skill (key component in chapter 4 of this dissertation) were examined. None of these interactions were significant. For a description of the text reading fluency test, see section 3.5.2. For a description of the text structure inference skill test, see section 4.5.2.

	7j	x (d	+ + 0		Δr^2	00.	00.	00.	00.	00.	00	00
	dels 7a-'	reading iency (rj otivatior	e model ivation nmies r	-	d	<u>4</u> .	.43	.04	.62	-84	.61	.92
	Moc	profic Mc	base mot		χ^2	.59	.61	3.99*	.25	.04	.26	.01
	j	x (c	+ + 0		Δr^2	.01	.01	.01	.01	00.	.01	00.
	lels 6a-6	anguage ound (ll tivation	model ivation nmies lb	6	d	.58	.46	69.	.67	.91	.94	.25
	Moc	+ l, backgr mc	base mot dur		χ^2	1.10	1.54	.74	.81	.18	.13	2.77
ng proficiency.	j	x	+		Δr^2	00 [.]	00.	.01	00.	00.	00 [.]	00 [.]
	lels 5a-5	acogniti wledge tivation	tivation	-	d	.28	.82	.19	.43	.39	.26	.51
	Moć	+ met kno mo	base mo		χ²	1.18	.05	1.76	.63	.75	1.26	.43
		, et			Δr^2	00.	00.	00.	00.	.01	.01	00.
	odels 4a-4	nowledge of an ectives y notivation	se model + notivation	-	d	.66	.13	.92	.78	1.00	.27	.31
	We	н сол н	par II		χ ²	.20	2.29	.01	80.	00.	1.20	1.03
	-3j	хх	+ =		Δr^2	00.	.01	.01	.01	.01	00.	00.
	odels 3a	ocabular	se model loti vatio	-	d	.31	.31	.08	.25	.20	.21	.71
	Mc	× EI +	bas		χ²	1.02	1.04	3.06	1.35	1.63	1.60	.14
	і́с × п	+ _		Δr^2	00.	00.	.01	.01	00.	00 [.]	00.	
	dels 2a-	fluency	e model otivation	-	d	68.	.57	.32	.37	.40	1.00	.73
	Mo	÷ ü	base		χ²	.02	.32	86.	67.	.71	00 [.]	.12
ciency.	-1j	чо	ela		Δr^2	00.	00.	00.	00.	00.	00.	.01
ng profic	odels 1a	noti vati	se mode	-	d	.78	.49	.60	.64	.31	.51	.05
nd readi.	Me	+	pa		χ^2	.08	.47	.27	.22	1.04	.44	3.78
background at	Regression models	Models specifi- cation (additional predictor)	Compared to model	Difference in df.	Model criteria ^b	a. Intrinsic motivation	b. Avoidance	c. Value	d. Devalue	e. Self- efficacy	f. Perceived difficulty	g. Peer value

Table 5.5 Fit indices for regression models predicting expository text comprehension with motivational aspects and their interactions with cognitive skills, language

00.	00.	00	
.49	.34	.23	
.48	06:	1.47	
.01	00.	00.	
.40	.59	.56	
1.83	1.04	1.16	
00.	00.	00.	
.28	.68	.21	
1.17	.17	1.56	
00.	.01	00.	
.18	.21	8.	
1.77	1.54	.04	
00.	.01	.01	
.70	.16	.22	
.15	1.93	1.49	
00.	00.	.01	
.84	.71	.24	
.04	.14	1.41	
.01	8	-00	
.12	.38	T.	
2.43	.78	2.59	
h. Peer de value	i. Preference for challenge	j. Mastery goal	

^a predictors in base model: sentence reading fluency, general vocabulary knowledge, knowledge of connectives and metacognitive knowledge, $\Delta r^2 = .45$. ^b Model criteria: χ^2 = difference in -2 Log Likelihood; *p* = p-value of difference between models; Δr^2 = increase in explained variance. **p* < .05.

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reading proficiency and value was significant, the term explained no unique variance.

5.7.7 Robustness check: models with 191 students

Regression analyses performed with a sample of 191 students revealed that there were no differences between expository text comprehension scores of students who either missed or did not miss a score on sentence reading fluency (t (191) = 1.66, p = .10), general vocabulary knowledge (t (191) = .66, p = .51) and knowledge of connectives (t (191) = -1.16, p = .25). However, students who missed a score on metacognitive knowledge or on the motivation questionnaire performed lower on expository text comprehension than those students with valid scores on metacognitive knowledge (t (191) = -2.87, p = .01) and the motivation questionnaire (t (191) = -2.69, p = .00). Regression models with 191 students led to the same conclusions as models with 152 students: none of the ten motivational aspects accounted for additional variance and none of the ten motivational aspects moderated effects of sentence reading fluency, linguistic knowledge and metacognitive knowledge. The effect of motivational aspects also did not differ for readers who varied in reading proficiency level or language background.

5.8 Discussion

The present study examined whether motivational aspects account for additional variance in eighth graders' expository text comprehension, on top of the variance accounted for by cognitive skills. It was also examined whether these motivational aspects moderate the effect of cognitive skills. These two questions were examined for a total of ten motivational dimensions, drawn from various theoretical perspectives. Furthermore, it was assessed whether the predictive value of these motivational aspects differed between poor and good readers, and between monolingual and bilingual Dutch students.

Our findings revealed that none of the ten reading motivations had unique predictive value for expository text comprehension controlling for cognitive skills; neither did motivations have a moderating impact on the contribution of cognitive skills. Furthermore, there were no significant differences between monolinguals and bilinguals in the contribution of these reading motivations to expository text comprehension. The same holds for poor and good readers, with one exception: value related negatively with text comprehension for the poor but not for the good readers. From a theoretical point of view, it is not likely that poor readers who valued expository texts more, scored lower for text comprehension than poor readers who valued these texts less. Although the interaction term reading proficiency x value was significant, no extra variance was explained by this term. For these two reasons, we do not attach much importance to this result.

Our results are in contrast with four previous studies that did find motivational aspects to have predictive value for text comprehension on top of the effect of cognitive skills (i.e., Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). Although these four studies have not established which cognitive skills were affected by motivational aspects, they did find that motivational factors had an additional contribution to text comprehension, when accounting for cognitive skills, and it was argued that this effect reflected that the more motivated readers in these studies employed their cognitive capacities to a greater extent during reading than their less motivated peers.

Based on the fact that motivational aspects did not have predictive value in our study, one may argue that motivational aspects do not contribute to eighth graders' text comprehension as moderators of cognitive skills, as we hypothesized in the introductory section of this chapter. However, we consider this explanation unlikely in the light of studies which have shown motivational differences to be predictive of text comprehension level controlling for cognitive resources (i.e., Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009).

A mismatch between students' motivational levels assessed in the motivation questionnaire and their actual motivational levels when taking our reading comprehension test, seems a more reasonable explanation for the lack of motivational contributions to expository text comprehension. More specifically, due

to the fact that our participants received education at distinct educational levels, students from different educational levels may have had different reading tasks and texts in mind when filling in the motivation questionnaire, whereas text comprehension was tested with one and the same text comprehension test for all students. Assuming the validity of this explanation, it is unlikely that students' reading motivation levels at their educational level matched their text-specific motivational levels when taking the comprehension test. In future studies, we therefore recommend text specific measurement of motivational aspects, if the sample consists of students who receive education at various educational levels in which reading tasks and tests are tailored to their needs.

When performing additional analyses, we found support for the assumption that there is a discrepancy between students' motivational levels indicated in the questionnaire and their actual motivational levels during testing. These analyses revealed that students from the low educational tracks scored worse than those from the higher tracks on the text comprehension test, whereas there were no differences in motivations to read. Because students from the lower tracks performed worse on the expository text comprehension test, it seems reasonable to assume that they felt less able than their peers from the higher educational tracks to perform the reading tasks in the text comprehension test (self-efficacy), and that they perceived this test as less enjoyable (intrinsic motivation) and more difficult (perceived difficulty). These seemingly contradicting results, then, can be explained by a discrepancy between students' motivational levels assessed in the questionnaire and their test specific motivational levels.

This explanation is also in line with the results of the four studies that did find an additional contribution of motivation (i.e., Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). Although these studies did measure motivation for reading in general or at the genre level (as in our study),¹¹ there was presumably a correspondence between motivational levels as assessed in the questionnaire and during test taking, since participants in these

¹¹ Except for Schaffner and Schiefele (2013), who measured motivational levels text specifically..

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studies received education at the same level. Therefore, participants in these studies had texts from the same level in mind when asked to indicate their motivational levels in the motivation questionnaire, and these motivational levels probably matched their motivational levels during test-taking to a considerable degree. Correlations between motivational aspects and text comprehension found in our study, compared to previous studies, also support the idea that motivational levels while reading a particular text can be measured accurately by genre-specific measurement in a non-stratified school context, but need to be measured text-specific in a stratified school system. That is, Ho and Guthrie (2013) and Wigfield et al. (2012) found self-efficacy and perceived difficulty, assessed for school book expository texts, to be the strongest predictors of expository text comprehension in a non-stratified school context (the United States), whereas in our study self-efficacy and perceived difficulty, assessed in a similar vein for school book expository texts, did not predict expository text comprehension for a sample of students from mixed educational levels.

Apart from the issue of measurement specificity, one may also counter that results in our study are affected by the large number of students excluded due to misbehavior on one or more of the tests. We have shown, however, that results were similar with a slightly larger sample size. More importantly, variance in motivation and text comprehension was not smaller in our study than in other studies: the coefficient of variance for reading motivations ranged from 15.8% to 24.7% in our study, while in other studies it ranged from 17.9% to 32.7% (Anmarkrud & Bråten (2009), 17.9%-26.9%; Ho and Guthrie (2013), 19.9%-32.7%; Logan et al. (2011), 19.8%; Tabadoa et al. (2009), 24.7%; Wigfield et al. (2012), 19.5%-29.4%). For reading comprehension, the coefficient of variation was 21.2% in our study, while in other studies it ranged from 8.8% to 38.4% (Anmarkrud & Bråten (2009), 38.3%; Ho and Guthrie (2013), 23.2%; Logan et al. (2011), 11.36%; Tabadoa et al. (2009), 8.8%-38.4%).

One remarkable finding in the present study is that bilinguals did not differ from their monolingual peers on self-efficacy and perceived difficulty. As bilinguals are characterized by lower expository text comprehension skills, it could be

expected that they perceive expository texts as more difficult and that they have a lower self-efficacy for expository text reading. Reasons for not finding a difference might be that bilinguals may feel overconfident about their text understanding skills (cf., De Milliano, 2013; Salomon, 1984; Sawyer, Graham, & Harris, 1992) or that they hold relatively strong self-efficacy beliefs, as a coping mechanism to persist despite reading difficulties (cf., De Milliano, 2013; Klassen, 2002).

It is important to note that less than half of the total variance in expository text comprehension was explained by the cognitive skills in our sample. These results seem to indicate that, besides fluency, linguistic knowledge and metacognitive knowledge other factors play a key role as well. In this discussion section, we have argued that motivation may account for part of this unexplained variance, but that our measurement of motivation may have hindered us in establishing the impact of motivational processes. Future research with text-specific measurement of motivation in a stratified education context, could clarify whether or not motivational differences play a role in addition to cognitive skills for secondary school readers' expository text understanding.

Chapter 6 Conclusion and discussion

6.1 Four components and two research questions

The present dissertation examined which components of reading predict individual differences in eighth graders' expository text comprehension. It is important to understand the components underlying expository text comprehension better, since about a quarter of secondary school students in several countries demonstrate inadequate expository text comprehension (see, for example, Hacquebord et al., 2004; National Centre for Education Statistics, 2003). In the Netherlands, it seems that for students in schools in Amsterdam-West, where most of the students have a language minority background and a low SES, expository text comprehension levels are markedly below the required level to enable learning from schoolbook texts (see section 1.2). A better understanding of the components related to individual differences in expository text comprehension would help optimize reading comprehension instruction.

Text comprehension is the product of several cognitive subprocesses executed at the word, sentence and text level. Controlling for the components that have been claimed to relate to a successful execution of these subprocesses, the present dissertation examined whether four components have additional predictive value for expository text comprehension. These four components were knowledge of connectives (chapter 2), text reading fluency (chapter 3), text structure inference skill (chapter 4) and reading motivation (chapter 5). Sentence reading fluency, general vocabulary knowledge and metacognitive knowledge served as control variables.

In the preceding chapters, we put forward why these four components might have unique predictive value for expository text comprehension (i.e. above the control variables). In addition, we hypothesized that these components might not be equally predictive for all readers, depending on their language background and

level of cognitive resources. The two research questions representing these hypotheses were:

- Do knowledge of connectives, text reading fluency, text structure inference skill and/or reading motivation predict eighth graders' expository text comprehension, controlling for sentence reading fluency, general vocabulary knowledge and metacognitive knowledge?
- 2) Does the predictive value of knowledge of connectives, text reading fluency, text structure inference skill and/or reading motivation depend on eighth graders' language background and/or on their level of cognitive resources?

As regards research question 1, reading motivation was assumed to contribute to expository text comprehension in an *indirect* way, that is, by moderating the effect of components underlying expository text comprehension. Reading motivation was examined as a moderator of the effect of six cognitive components: the three control variables (sentence reading fluency, general vocabulary knowledge and metacognitive knowledge) and the three other key components central to this dissertation (knowledge of connectives, text reading fluency and text structure inference skill).

The first part of research question 2 pertains to language background as a moderator of the effect of the four components. The predictive value of the four components was compared between Dutch monolingual and Dutch bilingual students (with a language minority background), and between bilingual Dutch dominant and Dutch not dominant students. In addition to language background, several cognitive resources were examined as potential moderators for each key component (the second part of research question 2). We will discuss these potential moderators in section 6.3, which also describes the results pertaining to our second research question. In the next section (6.2), we will answer our first research question. In sections 6.4 and 6.5, we will discuss the theoretical and educational

implications of our findings. Lastly, in section 6.6, we will describe limitations of the present dissertation and we provide suggestions for further research.

6.2 Research question 1: examining unique contributions of four components

Two of the four components we examined had unique predictive value for expository text comprehension, when accounting for sentence reading fluency, general vocabulary knowledge and metacognitive knowledge: knowledge of connectives and text structure inference skill. Knowledge of connectives in particular was a strong predictor; 37.3% of the total explained variance in expository text comprehension (36.5%) was accounted for uniquely by knowledge of connectives. Text structure inference skill shared less unique variance with expository text comprehension, namely 6.7% of the total explained variance (29.9%). Moreover, text structure inference skill did not predict expository text comprehension uniquely, when knowledge of connectives was taken into account as a control variable, along with the control predictors sentence reading fluency, general vocabulary knowledge and metacognitive knowledge. To unravel which control variables were associated with the unique predictive value of text structure inference skill, several regression analyses were performed; we found that metacognitive knowledge and knowledge of connectives were the crucial factors. Only when both types of knowledge were used to predict expository text comprehension, text structure inference skill did not have additional predictive power. Note, however, that analyses with a slightly larger sample size (a robustness check) showed that text structure inference skill contributed to expository text comprehension, even when accounting for metacognitive knowledge and knowledge of connectives. This outcome seems to indicate that, for some readers, having the knowledge required to infer text structure (knowledge of connectives and metacognitive knowledge) does not necessarily mean this knowledge is applied.

The other two components central to this dissertation, text reading fluency and reading motivation, did not have unique predictive value for expository text

comprehension, when accounting for the control variables. Reading motivation was treated as a multidimensional construct: ten motivational goals, beliefs and values were assessed with regards to expository text reading. None of these motivations accounted for unique variance in expository text comprehension, nor did they moderate the effect of cognitive skills on expository text comprehension. The lack of unique predictive value for both text reading fluency and motivational aspects came as no surprise, since correlations between both factors and expository text comprehension were close to zero.

Apparently readers with more text reading fluency and a more positive motivational profile did not score higher at understanding expository texts. On the other hand, readers with more knowledge of connectives and better text structure inference skill were better expository text comprehenders (correlations were moderate). Moreover, knowledge of connectives and text structure inference skill played a role in explaining those individual differences in eighth graders' expository text comprehension that were not accounted for by our control variables.

6.3 Research question 2: interactions with language background and cognitions

Our second research question concerned potential differences in the predictive value of knowledge of connectives, text reading fluency, text structure inference skill and reading motivation for expository text comprehension, depending on readers' language background and their level of cognitive resources.

In the context of limited attentional resources, we put forward the idea that low levels of sentence reading fluency and vocabulary knowledge could prevent readers from fully benefitting from their knowledge of connectives, text reading fluency and text structure inference skill. This idea was not confirmed, since we found that readers with relatively low sentence reading fluency, low vocabulary knowledge, or language backgrounds associated with these characteristics did not show any difference in the predictive value of these three components, when
compared to their peers who were more knowledgeable, fluent or had more favorable language backgrounds.

We also put forward the possibility that bilinguals with a language minority background could benefit more from their text structure inference skills than their monolingual peers do. Bilinguals have been argued to focus more on global text understanding, as a compensating mechanism for lack of local text understanding (Hacquebord, 1989; 1999). Because language background did not interact with text structure inference skill, we found no evidence for this idea. For text structure inference skill, we also hypothesized that poor readers could benefit less from this skill than good readers do, because the former experience more reading difficulties that could hinder them from using this skill. We also expected poor readers to have less motivation to infer text structure, less practice in inferring text structure and less notion of the relevance of text structure inference: for all these additional reasons, we argued that poor readers could have less advantage of their text structure inference skills. However, we found no interaction between reading proficiency level and text structure inference skill. Poor readers were also expected to benefit more from motivational aspects than good readers do, because we argued that motivational aspects work as an energizer to deal with reading difficulties, and we expected poor readers to experience more reading difficulties. However, we did not find the effect of motivational aspects to be larger for poor readers than it was for good readers.

Lastly, we hypothesized that knowledge of connectives might be less beneficial for readers with less metacognitive knowledge, as these readers might be less able to use connectives successfully than their peers with more metacognitive knowledge are. This hypothesis was confirmed, as metacognitive knowledge appeared to reinforce the positive correlation between knowledge of connectives and expository text comprehension: the better the metacognitive knowledge, the higher the predictive value of knowledge of connectives for expository text comprehension. Metacognitive knowledge was also hypothesized to affect knowledge of connectives' contribution to expository text comprehension indirectly (by affecting

sentence reading fluency and vocabulary knowledge' contributions to the effect of knowledge of connectives), but no evidence for this indirect impact was found. In the next two sections, we will elaborate on how our findings may contribute to reading comprehension theory and practice.

6.4 Theoretical implications

6.4.1 Skills associated with expository text comprehension

The present dissertation has revealed that, in addition to sentence reading fluency, general vocabulary knowledge and metacognitive knowledge, the level of two other cognitive skills are indicators of eighth graders' expository text comprehension. Given equal sentence reading fluency, general vocabulary knowledge and metacognitive knowledge, readers with relatively more knowledge of connectives and better text structure inference skills understand expository texts better. Due to our correlational design, we cannot conclude that the additional contribution of knowledge of connectives and text structure inference skill to expository text comprehension implies that a better development of these components *causes* better expository text comprehension. That is, these results could also reflect that a better development of these components is the *result of* better text comprehension. Another possibility is that both skills share another factor responsible for their correlation. This so called 'third variable problem' is partly countered for the control variables sentence reading fluency, general vocabulary knowledge and metacognitive knowledge. In other words, the unique relationship between knowledge of connectives and expository text comprehension is not related to readers' sentence reading fluency, general vocabulary knowledge and metacognitive knowledge levels.

In particular, the present dissertation has shown that knowledge of connectives is not simply an indication of general vocabulary knowledge for eighth graders. Although general vocabulary knowledge and knowledge of connectives are related, the predictive value of knowledge of connectives on top of general vocabulary knowledge indicates that eighth graders score differently for these types of knowledge, and that those differences matter for expository text comprehension. Previously, Crosson and Lesaux (2013) found that knowledge of connectives predicted English text comprehension uniquely for primary school readers (fifth graders), above and beyond word reading fluency and general vocabulary knowledge. The present study adds that the unique predictive value of knowledge of connectives also holds for expository text comprehension of Dutch secondary school readers (eighth graders), even when metacognitive knowledge is taken into account as an additional control variable, along with reading fluency and general vocabulary knowledge.

Furthermore, the finding that text structure inference skill has unique predictive value for expository text comprehension, controlling for general vocabulary knowledge, seems to indicate that general vocabulary knowledge alone is not sufficient to infer text structure while reading. More specifically, metacognitive knowledge and knowledge of connectives seem to be the crucial components that enable text structure inference: when taking these types of knowledge into account, text structure inference skill was not uniquely related to expository text comprehension. This finding concurs with other studies that have advanced knowledge of connectives and metacognitive knowledge as key components to text structure inference skill (e.g., Meyer et al., 1980; Meyer & Rice, 1982). Apparently, eighth graders need these 'specialized' kinds of knowledge, in addition to general vocabulary knowledge, for text structure inference. We must add, however, that additional analyses revealed that the relationship between text structure inference skill and expository text comprehension is not accounted for by metacognitive knowledge and knowledge of connectives for every reader. This outcome supports the idea that the knowledge to infer text structure does not lead to text structure inference for every reader.

Although it cannot be inferred from the present results whether knowledge of connectives and text structure inference skill are a cause or a result of better text comprehension, we consider it likely that more knowledge of connectives and better text structure inference skill lead to better expository text comprehension. Given that

expository texts often describe relationships between text ideas that are unknown to readers, it is not surprising that several studies have shown that readers often need to be informed about the way text ideas are related by means of connectives or other signaling words (which indicate causality, addition, etc.) in order to accurately establish coherence between these text ideas (e.g., Degand et al., 1999; Degand & Sanders, 2002; Singer & O'Connell, 2003; Van Silfhout et al., 2014). Knowing the meaning of connectives is a prerequisite for using these devices and given their high frequency in expository texts (in our expository texts an average of 5.2 connectives per 100 words), it is reasonable to assume that knowing more connectives, and the way in which these words can be used to establish coherence, will allow readers to improve their expository text comprehension.

Better text structure inference skill is also likely to improve expository text comprehension. In many intervention studies, it has been shown that training students to focus on text structure and words that signal text structure has led to better memory and understanding of text ideas (e.g., Cook & Mayer, 1988; Gordon, 1989; Meyer et al., 1989; Meyer & Poon, 2001; Paris et al., 1984; Wijekumar et al., 2013; Williams et al., 2004; Williams, 2005; Williams et al., 2009). Meyer (1985) has shown that expository texts are often structured in a particular top-level structure (e.g., problem-solution, causation, description, etc.), and we expect readers who are trained at inferring this structure to be better at comprehending texts. Instead of building a list-like representation of a text that makes no distinction between important text information and details, the reader capable of inferring text structure will process and store text information according to the inferred structure (cf., Meyer et al., 1980). In other words, better text structure inference skill will result in better understanding of what the text is actually about and of which text parts are important or less important.

Our finding that text reading fluency had no unique predictive value for expository text comprehension also adds to our knowledge about reading comprehension theory. In the context of limited attentional resources, we hypothesized that the fluency of text level processes might have distinctive predictive value for expository text comprehension, separate from sentence reading

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fluency, linguistic knowledge and metacognitive knowledge. Expository texts were hypothesized to require considerable attention and strategic processing, due to their dense and difficult nature, and therefore higher-order fluency can be necessary in the context of competition between reading processes. However, the lack of unique predictive value of text reading fluency rejects a special role of higher-order fluency for secondary school readers' expository text comprehension. More than that, in our study, both sentence and text fluency did not have any predictive value for individual differences in expository text comprehension. Based on our outcomes, we conclude that fluency is no longer a bottleneck for secondary school readers, as it is for beginning readers, who need substantial fluency in word reading processes (lower-order processes) to successfully execute higher order comprehension processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). Although significant correlations between fluency and comprehension have been established for secondary school students in other studies, these correlations were low, and language skills and metacognitive knowledge had better predictive value for text comprehension (e.g., Trapman et al., 2014; Van Gelderen et al., 2003); this was also the case in our study. These results underscore that knowledge factors are crucial for comprehension at the secondary school level, while reading fluency seems to have reached a level beyond which individual differences play a substantial role. Only when time to read is restricted and readers do not have enough opportunity to compensate for relatively inefficient reading processes, fluency could play a role at the secondary school level (e.g., Walczyk & Raska, 1992; Walczyk, 1993; 1995; Walczyk et al., 2007). But even in these kinds of time-constrained situations, we expect fluency to play a minor role, as opposed to knowledge, because the relationship between fluency and comprehension has been shown to decrease with age and reading experience (e.g., Hoover & Gough, 1990; Tilstra et al., 2009; Yovanoff et al., 2005). To put this assumption to the test, future research is necessary that taps into the reading comprehension skill of secondary school students, in situations with limited reading time.

The lack of predictive value of reading motivation in our study does not match earlier studies, which found unique predictive value for motivational aspects on top of cognitive skills (Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). Moreover, in contrast to other studies (e.g., Ho & Guthrie, 2013; Wigfield et al., 2012), none of the ten examined motivations to read expository texts was significantly correlated with expository text comprehension. We hypothesized that motivational aspects moderate the effect of cognitions on expository text comprehension, but we could not establish this effect. In the light of other studies that found correlations between motivational aspects and text comprehension, we assume that the main reason for the lack of predictive value of motivational aspects lies elsewhere: in a mismatch between the motivational levels assessed in our reading motivation questionnaire and the actual motivational levels among students when taking the comprehension test. Assuming this mismatch is present, our study may not contribute to reading theory in the way we initially intended, but, at the same time, does foreground an important methodological issue: in studies on the role of motivation, motivational levels must be assessed in a manner specific to comprehension tests, if the sample consists of students reading expository texts at their own education (and difficulty) level.

6.4.2 Language background as a moderator of the four components

We had hypothesized that there could be differences between Dutch bilinguals with a language minority background and their monolingual peers, in terms of the contribution of the four components to expository text comprehension. It was argued that bilinguals with a language minority background might need more attentional resources for word and sentence level processing than their monolingual peers do (due to lower fluency and linguistic knowledge levels), which could prevent them from taking full advantage of the cognitions responsible for other reading processes. More specifically, bilinguals could be less able i) to use their knowledge of connectives to process connectives (examined in chapter 2), ii) to benefit from fluent text reading (examined in chapter 3) and, iii) to use their text structure inference skill to infer text structure (examined in chapter 4). We found monolinguals to outperform bilinguals in general vocabulary knowledge (not in fluency), but our results do not support the idea that bilinguals' lower general vocabulary knowledge levels have a negative impact on the contribution of other cognitions to expository text comprehension. The absence of a difference between monolinguals and bilinguals, in terms of the predictive value of knowledge of connectives, text reading fluency and text structure inference skill, does not support the idea of bilinguals being hampered by their lower general vocabulary knowledge when executing other reading processes. A lower general vocabulary knowledge is therefore likely to be the direct cause of bilinguals' lower text comprehension levels, but not likely to have an indirect impact on text comprehension, that is, by affecting successful use of other cognitions.

We also hypothesized that bilinguals with and without Dutch as a dominant home language may differ in fluency and knowledge levels and that this could influence the contribution of other cognitions. We found no differences in general vocabulary knowledge between these two bilingual groups, but we did find that bilinguals with Dutch as a dominant language were more fluent readers at the sentence and text level than their Dutch not dominant counterparts. These differences, however, did not lead to differences in the predictive value of knowledge of connectives, text reading fluency and text structure inference skill. Therefore, we did not find support for the view that lower reading fluency levels prevented bilinguals without Dutch as a dominant language from using other cognitions equally well as their more fluent Dutch dominant bilingual peers do.

We also hypothesized that text structure inference skill could be a more important factor for bilinguals than for monolinguals. In line with Hacquebord (1989; 1999), we argued that bilinguals may compensate for lack of understanding at a local level by focusing on overall text understanding, and that they may therefore benefit more from their text structure inference skills. As bilinguals did not differ from monolinguals in the association between text comprehension and text structure inference skill, our results are not in accordance with Hacquebord's compensatory view. Therefore, we consider it more likely that lack of local

understanding leads to the initiation of strategic behavior to deal with local misunderstandings. This assumption is in accordance with think-aloud studies demonstrating that bilinguals focus directly on the word and sentence comprehension problems they encounter (e.g., Davis & Bistodeau, 1993; Horiba, 1990; 1996; 2000; Stevenson et al., 2003). Our assumption that readers focus on language problems directly, rather than employing compensating reading behavior, also holds for the bilingual readers who do not have Dutch as a dominant language. We did not find any differences with regards to the predictive value of text structure inference skill between bilinguals with or without Dutch as a dominant home language either. Therefore, we expect bilingual Dutch non dominant students, who are less fluent readers, to compensate for potential fluency-related reading problems directly rather than increasing their focus on global text comprehension.

In addition to text structure inference skill, reading motivation was considered to have better predictive value for bilinguals than for monolinguals, as we assumed that reading motivation works as an energizer to deal with reading difficulties. Therefore, bilinguals facing more language problems during reading may benefit more from higher motivation levels than their monolingual peers experiencing less language difficulties. Because no difference was found between these groups in terms of the predictive value of motivational aspects, we conclude that motivation does not play a different role for bilinguals than it does for monolinguals. The same holds for a comparison between bilinguals with and without Dutch as a dominant home language. It is possible that we did not find any differences between students from different language backgrounds, with regards to the effects of motivation, because readers varying in language background might not have differed in reading problems to the extent that motivation played a different role for these groups. However, because we did not measure comprehension problems while reading for readers with different language backgrounds, this issue needs further investigation.

To sum up, monolinguals and bilinguals did not demonstrate different benefits from the contributions of the four components central to this dissertation. Therefore, we assume that the lower expository text comprehension level of bilinguals seems to be predominantly caused by their lower linguistic knowledge levels. Apart from the often established lower general vocabulary knowledge levels, the present study also found that bilinguals with a language minority background have less knowledge of connectives. Furthermore, they performed less well on the metacognitive knowledge test. The outcomes of regression analyses (in chapter 3) are in line with the assumption that the difference between monolinguals and bilinguals is exclusively knowledge-related: language background was not a significant predictor of expository text comprehension, when controlling for general vocabulary knowledge, knowledge of connectives and metacognitive knowledge.

6.4.3 Cognitive resources as moderators of the four components

Lower sentence reading fluency and general vocabulary knowledge levels were put forward as potentially preventing readers from taking full advantage of their knowledge of connectives, text reading fluency and text structure inference skill. As both factors did not have a moderating impact, we can conclude that readers with lower levels of sentence reading fluency and general vocabulary knowledge were not hampered more in this than their peers with higher levels of these cognitions. In other words, even the slower readers appear to execute their reading processes fast enough to successfully execute other reading processes without hindrances. In a similar vein, even the readers with lower general vocabulary knowledge levels are not hampered in the use of their knowledge of connectives, text reading fluency and text structure inference skills. Contrary to sentence reading fluency, however, general vocabulary knowledge is - not surprisingly - correlated with expository text comprehension, but our study with eighth graders seems to indicate that, for secondary school readers, general vocabulary knowledge is not likely to be a factor that hinders the use of other cognitions.

For knowledge of connectives, the hypothesized moderating effect of metacognitive knowledge could be confirmed. Our results do support the idea that whether one benefits from knowledge of connectives depends on one's metacognitive knowledge. Simply having knowledge about connectives does not

seem sufficient for actually using connectives to integrate text parts: a reader also needs to have knowledge about text structure and reading strategies (metacognitive knowledge). In other words, having more knowledge of connectives does not seem very helpful when a reader does not understand the importance of connectives as coherence markers and how they can be used for comprehension purposes. As our study is correlational, it was important to find online evidence for individual differences in the use of connectives. To this end, an eye-tracking study by Vlaar, Sanders and Welie (in preparation) was initiated. Vlaar et al. compared two groups of students on their text comprehension performances and their processing of connectives, namely students who varied in metacognitive knowledge but had similar knowledge of connectives. They found that readers with high metacognitive knowledge levels looked back to previous text parts longer, and more often, after fixating on the connective and reaching the end of sentences. This looking-back behavior (i.e., regressions) in readers with high metacognitive knowledge levels seems to indicate a reader's effort to integrate text parts (e.g., Mak & Sanders, 2013; Van Silfhout et al., 2014). Readers with high metacognitive knowledge levels also attained better scores for questions tapping into the relationships expressed by the connectives than readers with limited metacognitive knowledge. Therefore, it seems reasonable to assume that the reading behavior of readers with high metacognitive knowledge levels causes these readers to integrate text parts better. Vlaar et al.'s findings therefore provide additional support for the idea put forward in this dissertation that readers with more metacognitive knowledge use their knowledge of connectives more successfully when reading, compared to their peers with less metacognitive knowledge.

Lastly, we hypothesized that reading proficiency level could moderate the impact of text structure inference skill and reading motivation. We expected that readers with relatively high reading proficiency levels were better able to benefit from text structure inference skills than their less proficient counterparts for two reasons. First, in line with the view that working memory capacity is limited, more proficient readers are assumed to have more capacity available for the execution of strategic behavior (such as inferring text structure) than their less proficient peers

with more fluency and vocabulary problems while reading. Second, it was also hypothesized that poor readers were less likely to meet the requirements put forward as important to the successful execution of reading strategies (such as text structure inference), namely understanding the relevance of reading strategies, having enough experience in employing them and being motivated to employ them (e.g., Baker, 2005; Pintrich & Zusho, 2002; Veenman et al., 2006). The absence of an interaction between reading proficiency and text structure inference skill seems to indicate, however, that poor readers were not hampered more than their proficient peers in their use of text structure inference skills.

Reading motivation was considered more important for poor readers, because we argued that reading motivation may work as an energizer to deal with reading difficulties, which are more common among poor readers. The absence of a significant interaction between motivational aspects and reading proficiency seems to indicate that motivational aspects were in fact not more important within a subgroup of poor comprehenders than within a subgroup of good comprehenders. However, motivational levels may have been measured inaccurately (see discussion in chapter 5), and therefore further investigation on this topic is required before theoretical conclusions can be drawn about the absence or presence of a differential effect of motivation for subgroups of readers.

6.5 Educational implications

6.5.1 Skills required to improve expository text comprehension

The present dissertation has shown that metacognitive knowledge, knowledge of connectives and text structure inference skill are important to expository text comprehension, in addition to general vocabulary knowledge. Our findings showed a unique relationship between these three components and expository text comprehension, which is not necessarily a causal one. Many other studies, however, have shown that training students in one or more of these components improves text comprehension (e.g., Cook & Mayer, 1988; Gordon, 1989; Meyer et al., 1989;

Meyer & Poon, 2001; Moeken, Kuiken, & Welie, 2015b; Paris et al., 1984; Wijekumar et al., 2013; Williams et al., 2004; Williams, 2005; Williams et al., 2009). Therefore, taking for granted the efficacy of instruction in these components, metacognitive knowledge, knowledge of connectives and text structure inference skill should also be part of the reading comprehension instruction at secondary school.

Our study also showed an interaction between knowledge of connectives and metacognitive knowledge, which may have repercussions for educational practices. This interaction supports the idea that knowing the meaning of connectives is not sufficient to use these words successfully, that is, readers also need to have metacognitive knowledge. This assumption is supported by a recent eye-tracking study by Vlaar et al. (in preparation). Therefore, we suggest that teachers couple instruction on the meaning of connectives with instruction that targets metacognitive knowledge. It does not seem to be enough to know the meaning of connectives: in order to benefit from these words, students need to know about text structure in general, and about the relevance of connectives as coherence markers. Moreover, students need to know how connectives can be used strategically during reading.

The CRISS project (Moeken, Kuiken, & Welie, 2015a; 2015b; 2015c; in preparation), initiated as a spin-off of the present research project, also underscores the relevance of knowledge of connectives and metacognitive knowledge for expository text comprehension. In the CRISS project, eighth graders, from the same three secondary schools participating in the present research project, received instruction on text structure and connectives and collaboratively read expository texts from their biology, history and geography school books. When reading together, students practiced reading strategies, one of which was underlining connectives and signaling words in texts. The effect of this reading intervention was measured through comparison with a control group that received regular reading instruction. Before and after the intervention, in addition to expository text comprehension, students were assessed on cognitive and motivational components underlying expository text comprehension, which made it possible to determine which subskills were affected by the intervention in the event of improved expository text comprehension.

Results from the CRISS project showed that readers from the intervention group who improved their expository text comprehension, compared to readers from the control group, also improved their metacognitive knowledge or knowledge of connectives to a larger extent than readers from the control group. Other subcomponents, such as general vocabulary knowledge and reading fluency, were not affected by the intervention. This finding underscores that more metacognitive knowledge and knowledge of connectives *causes* better expository text comprehension for a specific population of eighth graders, namely those who have, on average, a low SES and who speak another language than Dutch at home.

There was an additional finding in the present study that could be of interest to educational practitioners: we did not find support for the idea that eighth graders with less than optimal cognitive resources, benefit less from their knowledge of connectives and text structure inference skill - with the only exception being the interaction between metacognitive knowledge and knowledge of connectives mentioned above. In line with these results, we expect eighth graders with lower reading fluency, general vocabulary knowledge, and reading proficiency levels, to draw similar benefits from instruction on knowledge of connectives and text structure inference skill as their more knowledgeable, fluent or proficient peers do. In other words, based on our results, there is no reason to assume that reading fluency, general vocabulary knowledge or reading proficiency levels need to be better developed in eighth graders, in order for them to benefit from instruction on knowledge of connectives and text structure. Teachers may start to train these latter components for the entire group of secondary school readers.

Lastly, we do not advise secondary school teachers to initiate reading practices aimed at increasing reading fluency. In our study, the more fluent readers were not better comprehenders, nor was fluency a moderator of other cognitive components; therefore, we do not think normally developing secondary school readers improve their expository text comprehension by enhancing their reading

fluency. This view is supported for word level fluency by Fukkink, Hulstijn and Simis (2005), who showed that improving the speed of eighth graders' lexical access did not result in better reading comprehension.

6.5.2 Teaching bilinguals with a language minority background

The present investigation has shown that differences between monolinguals and bilinguals in expository text comprehension are knowledge-related. The bilinguals in our study did not have lower expository text comprehension than their monolingual peers, once knowledge of connectives, metacognitive knowledge and general vocabulary knowledge were accounted for. The present study has found that, in addition to the often established lower general vocabulary knowledge levels of bilinguals, they are also characterized by more limited knowledge of connectives and metacognitive knowledge. Given the importance of the latter two factors for expository text comprehension, we advise teachers to focus on these knowledge domains in their reading comprehension instruction of bilinguals. More specifically, we recommend teachers to not only focus on the meaning of content words (general vocabulary knowledge), but also on words that signal the relationships between these contents words (connectives and other signaling words). Moreover, given the finding that knowledge of connectives is not sufficient in itself for the use of connectives during reading, it is important that bilinguals increase their metacognitive knowledge in parallel.

6.6 Limitations and suggestions for future research

Despite a strict testing procedure, and careful selection of teachers to manage classrooms during test administrations, classroom management difficulties during test administrations did arise, which resulted in a large number of test results being rendered invalid. We doubt whether this attrition of test scores affected the representativeness of our sample for the population we are interested in, but the possibility cannot be ruled out. Replication of our study could clarify to what extent the results in the present study are generalizable.

Apart from the issue of the representativeness of our sample, another issue is the amount of unexplained variance in expository text comprehension. Our predictors of expository text comprehension accounted for less than half of the total variance in expository text comprehension, ranging between 36.5% and 45% for differing sample sizes, which leaves more than 50% of the variance unexplained. The large amount of unexplained variance may be due to the fact that our predictors and expository text comprehension are measured with an error margin. It is possible to account for the measurement error in structural equation modeling with latent variables (see, for example, Hancock & Schoonen, 2015; Schoonen, 2015). However, this technique requires multiple tests or scores for each variable involved.

Besides a statistical method that enables error-free measurement of components, it is also worth the effort of investigating which other components are key to expository text comprehension. In addition to language skills, non-linguistic cognitive abilities are important to understand dense expository texts, such as reasoning skill or the ability to concentrate for longer periods of time. One direction for further research is to examine whether these non-linguistic skills are important for relatively experienced readers. One might argue that, once vocabulary knowledge and fluency skills are developed to a considerable degree, non-linguistic skills will become a better predictor to account for individual differences in text comprehension. In line with this idea, Tighe and Schatschneider (2014) found, in a cross-sectional study investigating reading comprehension of third, seventh and tenth graders, that reasoning skill became more associated with text comprehension as reading experience increased.

The absence of online reading data is another issue that was mentioned several times in this dissertation. In order to get a better grasp of what good readers do differently from poor readers, it is necessary to examine online reading behavior and mental processes during reading of readers with varying cognitive and motivational make-up. Moreover, to be able to draw conclusions about the effect of reading behavior and mental processes on comprehension performance, it is necessary to tap into the level of text understanding in readers whose reading

behavior and mental processes are examined (see Van Silfhout et al., 2014 for a similar argument). This type of research that combining online (reading behavior) and offline (comprehension) measurements can advance theoretical understanding, and findings from these studies can direct the design of intervention studies. Consequently, the efficacy of these interventions can be measured in terms of reading behavior and comprehension.

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Appendices

Appendix I. Educational tracks in Dutch secondary schools

In the Netherlands, students receive secondary education in a track that prepares them for vocational education, higher vocational education or education at university level.

Tracks that prepare for vocational education (in Dutch "voorbereidend middelbaar beroepsonderwijs (vmbo)") consist of four school years and are further differentiated into four subtracks. These four subtracks differ in their focus on practical or theoretical education and prepare for different levels of vocational education. At the lowest level, 'vmbo-basisberoepsgerichte leerweg' (vmbo-b), students receive less theoretical types of education. This track prepares students for vocational education at the basic level (mbo-2 in Dutch) at Dutch institutes for vocational education (i.e., mbo: "middelbaar beroepsonderwijs"). Vocational education at the basic level trains students for executive professions, such as garage mechanic or hairdresser. The second and third lowest prevocational tracks, 'vmbokaderberoepsgerichte leerweg' (vmbo-k), and 'vmbo-gemengde leerweg' (vmbo-gl), provide access to vocational education at a lower and intermediate level. The lower and intermediate vocational tracks (mbo-3 and mbo-4 in Dutch) differ in the amount of independence that is expected from students in their later professions. The lower track trains students for professions such as nurse or beautician, the intermediate track for jobs such as branch manager or assistant accountant. Students who finalize a program at the intermediate vocational level (mbo-4) successfully can enroll for a study at Dutch institutes that offer higher vocational studies (i.e., hbo: "hoger beroepsonderwijs"). The most theoretical prevocational track is 'vmbo-theoretische leerweg' (vmbo-tl), which also gives access to the lower and intermediate vocational programs. Graduation from the 'vmbo-gemengde leerweg' also provides access to the 'general secondary education' track at Dutch secondary schools.

The general secondary education track (Dutch: "hoger algemeen vormend onderwijs (*havo*)") lasts five years and prepares students for education at Dutch institutes that offer higher vocational programs. Students who finalize this track may

also attend the pre-university track at Dutch secondary schools. The pre-university track (Dutch: "voorbereidend wetenschappelijk onderwijs (*vwo*)") lasts six years and prepares students for education at university level.

The figure below summarizes the school system in the Netherlands. Arrows indicate which educational programs students are allowed to attend in succession. Note that, for the sake of simplicity, we have not always indicated that secondary school students also have the possibility of enrolling for a postsecondary educational program lower than the one they are prepared for (for example, starting *hbo* after the *vwo* track).



Connective in	Semantic	Difficulty	Difficulty	Difficulty
Dutch	class	level	level	level
(English		connective	distractor 1	distractor 2
translation)				
ZO				
(for example)	clarification	low	medium	low
echter				

Appendix II. Dutch connectives from the knowledge of connective test (in order of the

	Duten	ciuss	10 001	10 001	10 001
	(English		connective	distractor 1	distractor 2
	translation)				
1.	ZO				
	(for example)	clarification	low	medium	low
2.	echter				
	(however)	contrastive	medium	medium	low
3.	in tegenstelling tot				
	(in contrast to, as				
	opposed to)	contrastive	low	low	medium
4.	daarentegen				
	(however)	contrastive	high	low	medium
5.	overigens				
	(otherwise)	additive	medium	medium	medium
6.	maar (but)	contrastive	low	low	low
7.	het gevolg van				
	(the consequence				
	of)*	causal	low	low	medium
8.	zoals (like)	clarification	low	low	low
9.	maatregelen				
	(measures)*	causal	low	medium	medium
10.	ondanks (despite)	adversative	medium	medium	medium
11.	eveneens (also,				
	likewise)	additive	medium	high	high
12.	denk hierbij aan				
	(take for example)	clarification	medium	low	medium
13.	kortom				
	(in short, in sum)	clarification	medium	medium	low
14.	indien	temporal(or	medium	medium	medium
	(in the event of)	conditional)			

15.	niettemin				
	(nevertheless)	contrastive	high	high	high
16.	namelijk (namely)	clarification	low	low	medium
17.	oftewel (that is)	clarification	high	high	medium
18.	uiteindelijk				
	(in the end,				
	finally)	temporal	low	high	medium
19.	als (when)	temporal	low	medium	low
		(or			
		conditional)			
20.	immers				
	(namely, since)	clarification	low	medium	medium
21.	tenslotte (after all)	temporal	low	medium	medium
22.	daarom				
	(that is why)	causal	low	medium	low
23.	hoewel				
	(though, although)	adversative	medium	low	low
24.	al				
	(though, although)	adversative	medium	low	medium
25.	vanwege				
	(because of)	causal	low	low	low
26.	behalve				
	(except for)	contrastive	low	medium	low
27.	door				
	(by means of)	causal	low	medium	medium
28.	hiernaast (besides)	additive	low	medium	low
29.	waardoor				
	(through which)	causal	low	low	medium
30.	gedurende				
	(during)	temporal	medium	medium	medium
31.	evenals				
	((just) like)	additive	low	low	medium
32.	destijds				
	(in those days)*	temporal	high	high	medium
33.	ondanks (despite)	adversative	medium	low	medium

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34.	omdat (because)	causal	low	low	low
35.	tevens				
	(besides, also)	additive	medium	medium	medium
36.	onder andere				
	(among other				
	things)	clarification	low	medium	medium
37.	bovendien				
	(moreover)	additive	low	low	low
38.	gezien (given)	causal	medium	medium	low
39.	met behulp van				
	(with the aid of)	causal	medium	medium	low
40.	zodra (as soon as)	temporal	medium	low	medium
41.	daarnaast				
	(besides)	additive	medium	low	low
42.	daardoor				
	(therefore)	causal	medium	low	low
43.	nadat (after)	temporal	low	low	low

*= item 7, 9 and 32 are signaling words.

Summary

Individual differences in reading comprehension. A componential approach to eighth graders' expository text comprehension

Adequate text understanding is a prerequisite to learn from texts. In secondary school, textbooks play an important role in information exchange. However, secondary school students need to be able to understand their textbooks to a certain degree, to be able to absorb the information provided in these books. Unfortunately, about a quarter of secondary school students fails to achieve the text comprehension level necessary to understand their school book texts (Hacquebord et al., 2004; National Centre for Education Statistics, 2003). The results of the OTAW project ("Opbrengst Taalonderwijs Amsterdam-West", which translates into 'Results of Language Education Amsterdam-West') have demonstrated that expository text comprehension skills seem especially inadequate for readers with a language minority background and a low SES.

In this context, we consider it important to improve our understanding of the components underlying expository text comprehension, especially for readers with a language minority background and a low SES. To this end, the present study investigated predictors of expository text comprehension in a sample of eighth graders who had, on average, low SES, and of whom the majority spoke another language than Dutch at home. In our samples, varying between 151 and 171 eighth graders, between 65 and 68 percent of the students had a language minority background. Most of these students spoke Turkish or Arabic at home. In our samples, students were more or less evenly distributed across the educational levels in Dutch secondary schools: the study had students from prevocational (*vmbo-t*), general secondary education (*havo*) and pre-university tracks (*vwo*) participating.

Based on the literature, the present study investigated whether four components in reading comprehension have unique predictive value for individual differences in the expository text comprehension of these eighth graders. These components were knowledge of connectives, text reading fluency, text structure

inference skill and reading motivation. Sentence reading fluency, general vocabulary knowledge and metacognitive knowledge served as control variables. Thus, in this study, unique predictive value means predictive beyond the three control variables.

Unique predictive value of four components

Knowledge of connectives is assumed to be especially important for expository texts, because connectives signal the nature of relationships between information elements, and expository texts aim to convey new information and relationships to readers. Connectives indicate, for example, whether the relationship between text parts is additive, causal or contrastive. Although earlier research has shown convincingly that inserting connectives in expository texts leads to better expository text comprehension (cf., Degand et al., 1999; Degand & Sanders, 2002; Singer & O'Connell, 2003; Van Silfhout et al., 2014), it was not clear yet what the role of knowledge of connectives was. It was not clear yet whether knowledge of connectives is simply an indication of secondary school readers' general vocabulary knowledge or a separate component. Neither was it clear whether knowledge of connectives has a unique association with expository text comprehension, controlling for other predictors, such as general vocabulary knowledge.

We investigated the unique predictive value of text reading fluency in the context of fluent word and sentence reading as a prerequisite for executing higher order comprehension processes (e.g., Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). We hypothesized that, together with fluency at the word and sentence level, fluency in text level processes (text reading fluency) could be an important requirement for expository text comprehension. A reader's working memory capacity is limited and therefore text reading fluency may be essential, especially for expository texts, which are challenging in terms of attention, effort and strategic processing.

We considered text structure inference skill, that is, the ability to infer overall text structure, important to expository text comprehension. Text structure inference skill enables readers to distinguish between more and less important text information and to store information accordingly (i.e., hierarchically) in their mental representations of texts. The existence of a link between expository text comprehension and text structure inference skill has been established (Meyer et al., 1980), but its unique role in an individual differences approach to expository text comprehension, separate from other components, was not yet studied. Therefore, we considered it important to investigate the role of text structure inference skill in combination with other predictors of text comprehension.

Lastly, we hypothesized that reading motivation moderates the contribution of the aforementioned cognitive components to expository text comprehension. We expected that less motivated readers would benefit less from their cognitive resources than their more motivated peers. For example, an unmotivated reader might read sloppily, and therefore will have a smaller advantage from his vocabulary knowledge, in terms of text understanding, than a more motivated peer would. We examined the moderating role of ten motivational aspects drawn from various theoretical perspectives.

We found knowledge of connectives and text structure inference skill to have unique predictive value for expository text comprehension, taking into account sentence reading fluency, general vocabulary knowledge and metacognitive knowledge as control variables. Knowledge of connectives had strong unique predictive value: this single component accounted for more than one third of the total variance accounted for in expository text comprehension by all predictors together (37.5% total variance). Imagine two eighth graders with equal sentence reading fluency, general vocabulary knowledge and metacognitive knowledge levels; our results show that the student with more knowledge of connectives will have a higher expository text comprehension level. The unique contribution of knowledge of connectives also indicates that knowledge of connectives and general vocabulary knowledge are separate constructs.

The unique contribution of text structure inference skill was lower than that of knowledge of connectives, namely 6.7% unique variance of the total variance explained by text structure inference skill and our control variables (29.9% total

variance). Interestingly enough, text structure inference skill did not relate to expository text comprehension uniquely if knowledge of connectives was included as an additional control variable. Moreover, separate regression analyses with subsets of the control variables indicated that text structure inference skill did not predict expository text comprehension, when controlling for metacognitive knowledge and knowledge of connectives. This outcome stresses the importance of metacognitive knowledge and knowledge of connectives for text structure inference skill. A robustness check of the latter findings, showed that metacognitive knowledge and knowledge of connectives are not able to account for the predictive value of text structure inference skill for every reader. This finding seems to indicate that having the knowledge to infer text structure (knowledge of connectives and metacognitive knowledge) does not necessarily lead to active text structure inference for every eighth grader.

The lack of unique predictive value for text reading fluency was expected, considering the correlations we found, because fluency, whether at sentence level or text level, did not correlate with expository text comprehension for our eighth graders. Based on our results, we conclude that fluency at the sentence and text level does not play a role in limiting readers in the execution of higher order comprehension processes or in making use of their cognitive resources. We argued that, for eighth graders, individual differences in reading fluency are beyond the point where they play a role in expository text comprehension levels.

The absence of an effect for reading motivation does not correspond with earlier studies that found motivational aspects to contribute to expository text comprehension, controlling for cognitive skills (Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). In the present study, the lack of correlations between motivational aspects and expository text comprehension was also remarkable in light of studies that have shown that better expository text readers are more motivated to read these texts (Ho & Guthrie, 2013; Wigfield et al., 2012). As most studies have found an effect of motivational aspects on text comprehension, we considered it unlikely that motivational levels did not influence expository text comprehension differences in our study. Therefore, we argued that inaccurate measurement of actual motivational levels during reading was the most plausible explanation for the lack of effect of motivational aspects. Additional research seems necessary to examine motivational aspects as potential moderators of cognitive resources underlying expository text comprehension.

Language background and cognitive resources as possible moderators of the four components

In addition to the hypothesized unique predictive value of the four core components (research question 1), we also hypothesized that the effect of these four components on expository text comprehension might depend on readers' cognitive resources and on their language backgrounds (research question 2). With regards to language background, we argued that bilinguals with a language minority background, compared to their monolingual peers, might not benefit fully from their knowledge of connectives, text reading fluency, and text structure inference skill, due to their lower word and sentence reading fluency, and their lower general vocabulary knowledge levels (e.g., Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004; Páez et al., 2007; Swanson et al., 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000). Because of reading relatively slow and having less vocabulary knowledge, bilinguals may require substantial attentional resources for word and sentence processing. As a result, bilinguals might be unable to employ the attentional resources required to benefit from their knowledge of connectives, text reading fluency and text structure inference skill. In line with this view, we also examined whether the effect of knowledge of connectives, text reading fluency and text structure inference skill depended on sentence reading fluency and vocabulary knowledge levels.

We did not find evidence for the assumption that readers with lower sentence reading fluency or general vocabulary knowledge levels (or a language background that is associated with these characteristics), have smaller advantages from their knowledge of connectives, text reading fluency and text structure inference skill. Interactions of sentence reading fluency or vocabulary knowledge

with these three components were absent. In line with these results, although we found bilinguals to have lower general vocabulary knowledge than their monolingual peers (we found no difference on sentence and text reading fluency), these groups did not differ with regard to the effect these three components have on expository text comprehension. In a similar vein, we found no difference in the contribution of the three components between bilinguals with and without Dutch as a dominant home language, despite more fluent sentence reading of the former group. Taken together, these findings do not support the idea that lower sentence reading fluency or general vocabulary knowledge levels prevents readers from using other cognitive resources to the same extent as than their more knowledgeable and fluent peers.

More specifically, based on these results, we argued that lower vocabulary knowledge is merely a direct cause of bilinguals' lower expository text comprehension and not likely to be a factor that hampers bilinguals in their use of other cognitive components. In addition to a smaller amount of general vocabulary knowledge, we found bilinguals to have less metacognitive knowledge and knowledge of connectives too. Our results also revealed that bilinguals did not score lower than monolinguals on expository text comprehension when general vocabulary knowledge, metacognitive knowledge and knowledge of connectives were taken into account.

We have also put forward perspectives from which text structure inference skill and reading motivation are components that have a larger effect on text comprehension for bilinguals. Text structure inference skill could be more important for bilinguals according to Hacquebord's view, which assumes that bilinguals direct their attention to global understanding as a compensating mechanism for the word and sentence level problems they encounter during reading (Hacquebord, 1989; 1999). From the perspective that reading motivation helps to compensate for vocabulary knowledge or fluency problems (cf., Walczyk, 1995; 2000; Walczyk et al., 2007), we argued that motivational aspects may have more predictive value for bilingual readers, who are hypothesized to experience more of these reading problems than their monolingual counterparts.

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We found no interaction between language background and text structure inference skill, which is not in line with Hacquebord's compensatory view, which would suggest an interaction. Therefore, we considered it likely that bilinguals focus directly on the language problems they encounter, instead of compensating by focusing on higher textual levels. Other studies based on think-aloud data have argued likewise (e.g., Davis & Bistodeau, 1993; Horiba, 1990; 1996; 2000; Stevenson et al., 2003). Our assumption of a direct focus on problems at the local text level seems to hold for both bilingual groups, since no differences between these groups were found in terms of the predictive value of text structure inference skill.

We found no interaction between reading motivation and language background either. We hypothesized that this effect could indicate that the degree to which readers with different language backgrounds experience reading difficulties, does not vary enough for motivational aspects to play a different role for these subgroups. This hypothesis requires further examination, as we did not measure comprehension problems during reading of readers with different motivational levels and language backgrounds.

For text structure inference skill, in addition to sentence reading fluency and general vocabulary knowledge, we examined reading proficiency level as a possible moderator. We argued that poor readers may not be able to exploit their text structure inference skills to the same extent as their better comprehending peers, as poor readers may need their attention for word and sentence level processing, thereby preventing them from inferring text structure more strategically. Moreover, we expected that poor readers were less likely to meet the requirements suggested as important for the successful execution of reading strategies, such as text structure inference. These requirements are: i) being aware of the relevance of strategies, ii) being motivated to employ them and iii) having had enough practice in using them (e.g., Baker, 2005; Pintrich & Zusho, 2002; Veenman et al., 2006).

We also examined reading proficiency level as a moderator of the effects of reading motivation. Although we hypothesized that poor readers have lower reading

motivation in general (e.g., Ho & Guthrie, 2013; Wigfield et al., 2012), we argued that motivation may play a more crucial role within a subgroup of poor readers than within a subgroup of proficient readers. We expected poor readers to experience more reading difficulties, hence requiring more effort to achieve a high level of text understanding than their better comprehending peers, and we considered motivation crucial for surmounting reading difficulties, and for putting effort into reading.

Similar to language background, a moderating effect of reading proficiency level could not be established either. This finding seems to indicate that poor readers do not profit less from their text structure inference skills than their more proficient counterparts. Reading proficiency level did not moderate the effect of motivational aspects either. However, our study may not be the best test of the hypothesized idea that poor readers benefit more from motivational aspects than good readers. Further investigation into this topic is needed.

Lastly, we also investigated the interaction between metacognitive knowledge and knowledge of connectives, as we hypothesized that readers with limited knowledge about text structure and reading and writing strategies (i.e., metacognitive knowledge as operationalized in the present study) could benefit less from knowing connectives. Readers with limited metacognitive knowledge may have a more limited understanding of the importance of connectives, and may not use them as well to establish coherence as their peers with more metacognitive knowledge.

This hypothesis was confirmed. We found a significant interaction between knowledge of connectives and metacognitive knowledge: the contribution of knowledge of connectives to expository text comprehension was larger when metacognitive knowledge increased. This significant interaction shows that cognitive resources can act as moderators for other components. More specifically, this finding supports the idea that having knowledge of connectives is not sufficient to be able to use them successfully: readers need to have sufficient metacognitive knowledge as well. Due to our correlational design, we did not have online evidence for the idea that metacognitive knowledge had an impact on the use of connectives during reading. Findings from a recent eye-tracking study by Vlaar, Sanders and Welie (in preparation), however, support our assumption that readers with more metacognitive knowledge use connectives more successfully, compared to their peers with less metacognitive knowledge.

Educational implications

The findings from the present study add to our knowledge about expository text comprehension at secondary school and they also are of interest for educational practitioners. We underscored that metacognitive knowledge, knowledge of connectives and text structure inference skill should be addressed in reading comprehension instruction, in addition to general vocabulary knowledge. Our advice is in line with other studies that showed that training students on these components results in better expository text comprehension (e.g., Cook & Mayer, 1988; Meyer et al., 1989; Meyer & Poon, 2001; Moeken et al., 2015b; Wijekumar et al., 2013; Williams et al., 2004; Williams et al., 2009).

What our study adds, is that instruction in knowledge of connectives and text structure inference skill seems to be beneficial for eighth graders irrespective of their language background and their levels of reading fluency, general vocabulary knowledge, and reading proficiency¹². In other words, as we found no evidence that readers with less than optimal cognitive resources are restricted from using their knowledge of connectives and text structure inference skill, we assumed that eighth graders do not require their cognitive resources to be better developed first, that is, as a prerequisite, before they are able to benefit from instruction in knowledge of connectives and text structure inference skill.

There is, however, one exception to this assumption. Our results seem to indicate that having knowledge of connectives does not seem very helpful in improving expository text comprehension if the reader's metacognitive knowledge is insufficient; therefore we advise teachers to combine instruction in knowledge of connectives and metacognitive knowledge. Furthermore, because our study found that bilinguals with a language minority background not only have less general

¹² Reading proficiency level was examined only as a moderator for text structure inference skill.

vocabulary knowledge, but less knowledge of connectives and metacognitive knowledge than their monolingual peers too, we propose that these components get special attention in reading instruction for bilinguals. Finally, we do not advise secondary school teachers to initiate reading practices aimed at increasing reading fluency. Given the absence of predictive value of reading fluency in the present study, we do not expect fluency training to lead to an increase in secondary school readers' expository text comprehension.

Concluding remarks

Our study has broadened our understanding of the individual differences related to eighth graders' expository text comprehension. We suggested that research designs that combine online and offline data will help in gaining a better understanding of the reading processes of readers with different cognitive and motivational make up, as well as of how these processes affect text comprehension.

Finally, we do want to stress the social importance of long-lasting reading comprehension interventions for bilingual readers with a language minority background. Both the present study and the preceding OTAW project have shown that bilinguals with a language minority background lag behind their peers in linguistic knowledge, metacognitive knowledge and expository text comprehension. Closing these gaps between monolingual and bilingual students is not expected to be an easy task. Extra effort and interventions are required to promote knowledge and text comprehension, both at school and outside of school situations, in order to reduce the differences between monolingual and bilingual students. In the present dissertation, we underscored the importance of tailored remedial activities at schools and we also proposed educational practices in Dutch language arts classes that could improve students' language proficiency. However, more research is required to examine what the most efficient and effective ways are for schools to help in closing the gaps between monolingual and bilingual students. Outcomes from this research, and language policy based on these outcomes, will bring us closer to an ambitious goal: creating equal opportunities for students to finish their school careers successfully.

Samenvatting

Individuele verschillen in begrijpend lezen. Een componentiële benadering van het begrijpen van informatieve teksten door tweedeklassers in het voortgezet onderwijs

Om te kunnen leren van een tekst moet je hem eerst kunnen begrijpen. Op de middelbare school spelen zaakvakteksten in schoolboeken een belangrijke rol bij het uitwisselen van informatie. De vraag is of scholieren over de juiste vaardigheden beschikken om die informatie tot zich te kunnen nemen. Helaas blijkt ongeveer een kwart van de middelbare scholieren niet het gewenste tekstbegripsniveau te bereiken dat noodzakelijk is om hun schoolboekteksten te begrijpen (Hacquebord et al., 2004; National Centre for Education Statistics, 2003). De resultaten van het OTAW-project (Opbrengst Taalonderwijs Amsterdam-West) toonden aan dat het begrip van informatieve teksten in het bijzonder onder de maat is voor lezers met een andere thuistaal dan het Nederlands met bovendien een lage sociaaleconomische status (SES).

Gegeven deze context vinden we dat het belangrijk is om ons inzicht te vergroten in de onderliggende componenten van het begrijpen van informatieve teksten, in het bijzonder voor lezers met een andere thuistaal dan het Nederlands en een lage SES. Hiertoe onderzocht de huidige studie voorspellers van het begrijpen van informatieve teksten in een steekproef van tweedeklassers met over het algemeen een lage SES en van wie de meerderheid thuis een andere taal dan het Nederlands sprak. In onze steekproeven, waarin 151 tot 171 tweedeklassers waren opgenomen, had 65 tot 68 procent van de leerlingen een thuistaal anders dan het Nederlands. De meeste leerlingen spraken thuis Turks of Arabisch. In onze steekproeven was de spreiding over onderwijsniveaus ongeveer gelijk; zowel vmbot-, havo- als vwo-leerlingen namen deel aan de studie.

Op basis van onderzoeksliteratuur heeft de huidige studie onderzocht of vier componenten in begrijpend lezen een unieke voorspellende waarde hebben voor individuele verschillen bij tweedeklassers in het begrijpen van informatieve teksten.

Deze componenten zijn kennis van connectieven, tekstvloeiendheid, vaardigheid in het infereren van tekststructuur en leesmotivatie. Zinsvloeiendheid, algemene woordenschat en metacognitieve kennis fungeerden als controlevariabelen. In deze studie wordt met de notie unieke voorspellende waarde dan ook de voorspellende waarde bovenop de drie controlevariabelen bedoeld.

Unieke voorspellende waarde van de vier componenten

Kennis van connectieven wordt met name belangrijk beschouwd voor het begrijpen van informatieve teksten, omdat connectieven de aard van de relatie tussen tekstdelen aangeven, en informatieve teksten als doel hebben om lezers nieuwe informatie en relaties bij te brengen. Connectieven geven bijvoorbeeld aan of de relatie tussen tekstdelen additief, causaal of contrastief is. Hoewel eerder onderzoek overtuigend heeft aangetoond dat het inserteren van connectieven in informatieve teksten leidt tot beter begrip van deze teksten (zie bijvoorbeeld Degand et al., 1999; Degand & Sanders, 2002; Singer & O'Connell, 2003; Van Silfhout et al., 2014), was het nog onduidelijk welke rol kennis van connectieven precies speelt. Het was nog niet opgehelderd of kennis van connectieven simpelweg een indicatie van algemene woordenschat is, of een afzonderlijke component in tekstbegrip. Noch was het duidelijk of kennis van connectieven een unieke relatie heeft met het begrijpen van informatieve teksten wanneer wordt gecontroleerd voor andere voorspellers, zoals algemene woordenschat.

We onderzochten de unieke voorspellende waarde van tekstvloeiendheid in de context van woord- en zinsvloeiendheid als een vereiste voor het uitvoeren van hogere-orde begripsprocessen (zie bijvoorbeeld Just & Carpenter, 1992; LaBerge & Samuels, 1974; Perfetti, 1985; Perfetti & Lesgold, 1977; Perfetti & Hart, 2001). We veronderstelden dat bovenop woord- en zinsvloeiendheid, vloeiendheid in leesprocessen op tekstniveau (tekstvloeiendheid) een belangrijke voorwaarde kan zijn voor het begrijpen van informatieve teksten. De werkgeheugencapaciteit van een lezer is beperkt en daarom zou tekstvloeiendheid essentieel kunnen zijn, voornamelijk voor het begrijpen van informatieve teksten, die uitdagend zijn in termen van aandacht, moeite en strategisch lezen.

We veronderstelden ook dat vaardigheid in het infereren van de (overkoepelende) tekststructuur belangrijk is voor het begrijpen van informatieve teksten. Vaardigheid in het infereren van tekststructuur maakt het voor lezers mogelijk om onderscheid te maken tussen belangrijke en minder belangrijke informatie in teksten en om informatie dienovereenkomstig (d.w.z. hiërarchisch) op te slaan in de mentale representaties van teksten. Een relatie tussen het begrip van informatieve teksten en vaardigheid in het infereren van tekststructuur was in eerder onderzoek al vastgesteld (Meyer et al., 1980), maar de unieke rol van deze factor was nog niet onderzocht vanuit een benadering gericht op individuele verschillen. Daarom vonden we het belangrijk om de voorspellende waarde van vaardigheid in het infereren van tekststructuur te onderzoeken in combinatie met andere voorspellers van tekstbegrip.

Ten slotte veronderstelden we dat leesmotivatie als moderatorvariabele optreedt voor de hiervoor genoemde cognitieve componenten. We verwachtten dat minder gemotiveerde lezers minder profijt zouden hebben van hun cognitieve middelen dan hun beter gemotiveerde leeftijdsgenoten. Een ongemotiveerde lezer kan bijvoorbeeld slordig lezen en heeft daardoor minder voordeel van zijn woordenschat voor tekstbegrip dan een beter gemotiveerde leeftijdsgenoot. We onderzochten de modererende rol van tien motivationele aspecten afkomstig van verschillende theoretische perspectieven.

Onze resultaten lieten zien dat kennis van connectieven en vaardigheid in het infereren van tekststructuur een unieke voorspellende waarde hadden voor het begrip van informatieve teksten bovenop de controlevariabelen zinsvloeiendheid, algemene woordenschat en metacognitieve kennis. Kennis van connectieven had een sterke unieke voorspellende waarde: deze component verklaarde zelfstandig meer dan een derde van de 37.5% totaal verklaarde variantie in het begrip van informatieve teksten. Van twee tweedeklassers met een identieke zinsvloeiendheid, algemene woordenschat en metacognitieve kennis zal diegene met meer kennis van

connectieven het best informatieve teksten begrijpen. De unieke bijdrage van kennis van connectieven toont ook aan dat kennis van connectieven en algemene woordenschat te onderscheiden componenten zijn.

De unieke bijdrage van vaardigheid in het infereren van tekststructuur was kleiner dan die van kennis van connectieven, namelijk 6.7% unieke variantie van de 29.9% totale variantie die werd verklaard door vaardigheid in het infereren van tekststructuur en de controlevariabelen. Een interessante bevinding was dat vaardigheid in het infereren van tekststructuur niet uniek gerelateerd was aan het begrip van informatieve teksten als ook kennis van connectieven als controlevariabele werd meegenomen in de analyses. Bovendien toonden regressieanalyses met subsets van de controlevariabelen aan dat vaardigheid in het infereren van tekststructuur het begrip van informatieve teksten niet voorspelde als werd gecontroleerd voor metacognitieve kennis en kennis van connectieven. Deze bevinding benadrukt het belang van metacognitieve kennis en kennis van connectieven voor de contributie van vaardigheid in het infereren van tekststructuur. Uit een controle voor de robuustheid van deze resultaten bleek echter dat metacognitieve kennis en kennis van connectieven de voorspellende waarde van vaardigheid in het infereren van tekststructuur niet altijd wegnamen voor iedere lezer. Deze uitkomst geeft wellicht aan dat het hebben van de kennis om tekststructuur te infereren (kennis van connectieven en metacognitieve kennis) niet voor alle tweedeklassers noodzakelijkerwijs leidt tot actieve inferentie van tekststructuur.

Het ontbreken van een unieke voorspellende waarde van tekstvloeiendheid was verwacht gezien de in ons onderzoek vastgestelde correlaties. Leessnelheid, zowel op zins- als tekstniveau, correleerde namelijk niet met het begrijpen van informatieve teksten. Op basis van deze resultaten concludeerden we dat een lagere vloeiendheid op zins- en tekstniveau lezers niet beperkt in de uitvoering van hogereorde begripsprocessen of in het benutten van hun cognitieve middelen. We beargumenteerden dat individuele verschillen in leessnelheid voor tweedeklassers voorbij een punt zijn gekomen waarbij ze het begrijpen van informatieve teksten beïnvloeden.
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De afwezigheid van een effect van leesmotivatie komt niet overeen met eerdere studies die vonden dat motivationele aspecten bijdroegen aan het begrijpen van informatieve teksten wanneer werd gecontroleerd voor cognitieve vaardigheden (Anmarkrud & Bråten, 2009; Logan et al., 2011; Schaffner & Schiefele, 2013; Taboada et al., 2009). In de huidige studie was het ontbreken van correlaties tussen motivationele aspecten en het begrijpen van informatieve teksten opvallend, in het licht van studies die aantoonden dat betere lezers van informatieve teksten ook meer gemotiveerd zijn om deze teksten te lezen (Ho & Guthrie, 2013; Wigfield et al., 2012). Omdat de meeste studies een effect van motivationele aspecten op tekstbegrip hadden vastgesteld, is het onwaarschijnlijk dat in onze studie leesmotivatieniveaus geen invloed hadden op verschillen in tekstbegrip. Daarom brachten we als verklaring voor het ontbreken van een effect van motivationele aspecten naar voren dat daadwerkelijke motivatieniveaus tijdens het lezen niet waren gemeten. Aanvullend onderzoek is nodig om te ontdekken of motivationele aspecten als moderatoren kunnen dienen voor de inzet van de cognitieve middelen die ten grondslag liggen aan tekstbegrip.

Taalachtergrond en cognitieve middelen als mogelijke moderatoren van de vier componenten

In aanvulling op de veronderstelde unieke voorspellende waarde van de vier centrale componenten (onderzoeksvraag 1) veronderstelden we ook dat het effect van de vier componenten op het begrip van informatieve teksten mogelijk zou afhangen van de cognitieve middelen en taalachtergrond van lezers (onderzoeksvraag 2). Met betrekking tot taalachtergrond gingen we ervan uit dat tweetaligen die thuis een andere taal dan het Nederlands spreken, vergeleken met hun eentalige leeftijdsgenoten, mogelijk niet in staat zijn om optimaal gebruik te maken van hun kennis van connectieven, tekstvloeiendheid en vaardigheid in het infereren van tekststructuur, vanwege hun lagere woord- en zinsvloeiendheid en hun lagere algemene woordenschatniveau (zie bijvoorbeeld Aarts & Verhoeven, 1999; Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004; Páez et al., 2007; Swanson

et al., 2006; Trapman et al., 2014; Van Gelderen et al., 2003; Verhoeven, 2000). Vanwege het relatief langzaam lezen en het hebben van een kleinere algemene woordenschat kunnen tweetaligen mogelijk een substantieel deel van hun aandacht nodig hebben voor tekstverwerking op het woord- en zinsniveau. Als gevolg hiervan zijn tweetaligen wellicht niet in staat om de aandachtsbronnen aan te spreken die nodig zijn om voordeel te genieten van hun kennis van connectieven, tekstvloeiendheid, en vaardigheid in het infereren van tekststructuur. Vanuit dit perspectief onderzochten we ook of het effect van kennis van connectieven, tekstvloeiendheid en vaardigheid in het infereren van tekststructuur afhing van het niveau van zinsvloeiendheid en algemene woordenschat.

We vonden geen bewijs voor de aanname dat lezers met een lagere zinsvloeiendheid of kleinere algemene woordenschat (of een taalachtergrond gerelateerd aan deze kenmerken) minder profiteren van hun kennis van connectieven, tekstvloeiendheid of vaardigheid in het infereren van tekststructuur. Interacties tussen zinsvloeiendheid of algemene woordenschat met deze drie componenten waren afwezig. In overeenstemming met deze resultaten vonden we geen verschil tussen eentaligen en tweetaligen met betrekking tot het effect van deze drie componenten op tekstbegrip, alhoewel de tweetaligen een kleinere algemene woordenschat dan de eentaligen bleken te hebben (we vonden geen verschillen op zinsvloeiendheid). In overeenstemming met deze resultaten vonden we ook geen verschil tussen tweetaligen met of zonder het Nederlands als dominante thuistaal in de contributie van deze drie componenten, ondanks een hogere zinsvloeiendheid van de tweetaligen met het Nederlands als dominante taal. Al met al ondersteunen deze bevindingen niet het idee dat een lagere zinsvloeiendheid of kleinere algemene woordenschat lezers ervan weerhoudt om gebruik te maken van andere cognitieve middelen in dezelfde mate als hun leeftijdsgenoten met een hogere zinsvloeiendheid en een grotere algemene woordenschat.

Gebaseerd op deze resultaten beargumenteerden we dat een kleinere algemene woordenschat in onze ogen slechts een directe oorzaak is van het lager tekstbegrip van informatieve teksten van tweetalige leerlingen en dat het niet waarschijnlijk is dat een kleinere algemene woordenschat een factor is die tweetaligen blokkeert in het gebruiken van andere cognitieve componenten. We vonden dat tweetaligen naast een kleinere algemene woordenschat, ook minder metacognitieve kennis en kennis van connectieven hebben. Onze resultaten lieten ook zien dat tweetaligen niet minder begrip van informatieve teksten hebben dan eentaligen als algemene woordenschat, metacognitieve kennis en kennis van connectieven in de analyses als controlevariabelen werden meegenomen.

We introduceerden ook perspectieven die voor tweetaligen een groter effect op tekstbegrip veronderstellen van de factoren vaardigheid in het infereren van tekststructuur en leesmotivatie. Vaardigheid in het infereren van tekststructuur kan belangrijker zijn voor tweetaligen volgens Hacquebords compensatiehypothese die veronderstelt dat tweetaligen hun aandacht op globaal tekstbegrip richten als een compensatiemechanisme voor de woord- en zinsproblemen die ze tijdens het lezen tegenkomen (Hacquebord, 1989; 1999). Vanuit de gedachte dat leesmotivatie helpt om te compenseren voor woord- en vloeiendheidsproblemen (vgl., Walczyk, 1995; 2000; Walczyk et al., 2007) beargumenteerden we dat motivationele aspecten een grotere voorspellende waarde kunnen hebben voor tweetalige lezers van wie verondersteld wordt dat ze meer van deze leesproblemen ervaren dan hun eentalige klasgenoten.

We vonden geen interactie tussen taalachtergrond en vaardigheid in het infereren van tekststructuur en dit is niet in overeenstemming met Hacquebords compensatiehypothese die wel een interactie veronderstelt. Om die reden vonden we het waarschijnlijk dat tweetaligen hun aandacht direct richten op de taalproblemen die ze tegenkomen in plaats van dat ze compenseren door hun aandacht te richten op hogere tekstniveaus. Andere studies die een hardopdenkmethode gebruikten, hebben dezelfde conclusie getrokken (zie bijvoorbeeld, Davis & Bistodeau, 1993; Horiba, 1990; 1996; 2000; Stevenson et al., 2003). Onze aanname van een directe focus op problemen op lokaal niveau lijkt van toepassing op beide groepen tweetaligen; we vonden namelijk geen verschil tussen deze groepen met betrekking tot de voorspellende waarde van vaardigheid in het infereren van tekststructuur.

We konden ook geen interactie vaststellen tussen leesmotivatie en taalachtergrond. We veronderstelden dat dit effect mogelijk aangeeft dat de mate waarin lezers met verschillende taalachtergrond leesproblemen ervaren niet genoeg varieert om verschillen te laten optreden in de rol van motivationele aspecten. Deze hypothese verdient nadere aandacht, omdat we geen begripsproblemen tijdens het lezen hebben gemeten van lezers die verschillen in leesmotivatie en taalachtergrond.

Voor vaardigheid in het infereren van tekststructuur werd naast zinsvloeiendheid en algemene woordenschat ook leesvaardigheidsniveau als potentiële moderator onderzocht. We beargumenteerden dat zwakke lezers mogelijk niet in dezelfde mate hun vaardigheid in het infereren van tekststructuur kunnen benutten als hun leesvaardigere leeftijdsgenoten, omdat zwakke lezers hun volledige aandacht nodig hebben voor woord- en zinsverwerking en er daardoor van kunnen worden weerhouden om strategisch tekststructuur te infereren. Bovendien namen we aan dat zwakke lezers waarschijnlijk minder goed voldeden aan de belangrijk veronderstelde voorwaarden voor de uitvoering van leesstrategieën zoals tekststructuurinferentie. Deze voorwaarden zijn: i) bewust zijn van de relevantie van strategieën, ii) gemotiveerd zijn om strategieën te benutten, en iii) genoeg oefening hebben gehad in de toepassing van strategieën (zie bijvoorbeeld Baker, 2005; Pintrich & Zusho, 2002; Veenman et al., 2006).

We onderzochten leesvaardigheidsniveau ook als moderator van de effecten van leesmotivatie. Hoewel we veronderstelden dat zwakke lezers over het algemeen een lagere leesmotivatie hebben (zie bijvoorbeeld Ho & Guthrie, 2013; Wigfield et al., 2012), beargumenteerden we dat motivatie een crucialere rol zou kunnen spelen binnen een subgroep van zwakke lezers dan binnen een subgroep van vaardige lezers. We verwachtten dat zwakke lezers meer leesproblemen ervaren dan hun leesvaardigere leeftijdsgenoten, dat het ze daardoor meer moeite kost om een hoger niveau van tekstbegrip te bereiken, en dat motivatie cruciaal is voor zowel het oplossen van leesproblemen als het zich inspannen voor tekstbegrip.

Net als bij taalachtergrond konden we geen modererend effect van leesvaardigheidsniveau vaststellen. Deze bevinding lijkt aan te geven dat zwakke lezers niet minder voordeel genieten van hun vaardigheid in het infereren van tekststructuur dan hun leesvaardigere klasgenoten. Leesvaardigheidsniveau modereerde ook niet het effect van motivationele aspecten. Onze studie is echter mogelijk niet de beste test voor het veronderstelde idee dat zwakke lezers meer voordeel hebben van motivationele aspecten dan goede lezers. Verder onderzoek naar dit onderwerp is nodig.

Ten slotte onderzochten we ook de interactie tussen metacognitieve kennis en kennis van connectieven, aangezien we veronderstelden dat lezers met een beperkte kennis van tekststructuur en lees- en schrijfstrategieën (d.i. metacognitieve kennis zoals geoperationaliseerd in de huidige studie) minder kunnen profiteren van hun kennis van connectieven. Lezers met een beperkte metacognitieve kennis hebben wellicht een beperkter begrip van het belang van connectieven, en gebruiken deze woorden misschien niet zo goed om coherentie te bewerkstelligen als hun leeftijdsgenoten met meer metacognitieve kennis.

Deze hypothese werd bevestigd. We vonden een significante interactie tussen kennis van connectieven en metacognitieve kennis: de bijdrage van kennis van connectieven aan het begrip van informatieve teksten was groter wanneer de metacognitieve kennis toenam. Deze significante interactie laat zien dat cognitieve capaciteiten als moderatoren kunnen optreden voor andere componenten. Met andere woorden, deze bevinding ondersteunt het idee dat het hebben van kennis van connectieven niet voldoende is om connectieven succesvol te gebruiken: lezers moeten ook voldoende metacognitieve kennis hebben. We hadden echter geen bewijs voor het idee dat metacognitieve kennis het gebruik van connectieven tijdens het lezen beïnvloedt. Bevindingen van een recente eye-tracking studie van Vlaar, Sanders en Welie (in voorbereiding) ondersteunen echter de aanname dat lezers met meer metacognitieve kennis hun connectieven succesvoller gebruiken vergeleken met hun leeftijdsgenoten met minder metacognitieve kennis.

Implicaties voor het onderwijs

De resultaten van de voorliggende studie vergroten onze kennis over het begrijpen van informatieve teksten op de middelbare school en zijn ook interessant voor de

onderwijspraktijk. We hebben benadrukt dat metacognitieve kennis, kennis van connectieven en vaardigheid in het infereren van tekststructuur aandacht zouden moeten krijgen in het begrijpend leesonderwijs. Dit advies is in overeenstemming met andere studies die aantoonden dat het trainen van leerlingen op deze componenten leidde tot beter begrip van informatieve teksten (zie bijvoorbeeld Cook & Mayer, 1988; Meyer et al., 1989; Meyer & Poon, 2001; Moeken et al., 2015b; Wijekumar et al., 2013; Williams et al., 2004; Williams et al., 2009).

Wat onze studie toevoegt is dat instructie op het gebied van kennis van connectieven en vaardigheid in het infereren van tekststructuur voordelig lijkt te zijn voor tweedeklassers ongeacht hun taalachtergrond of hun niveaus van leesvloeiendheid, algemene woordenschat en leesvaardigheid.¹³ Met andere woorden, omdat we geen bewijs vonden dat lezers met minder dan optimale cognitieve middelen worden beperkt in het gebruiken van hun kennis van connectieven en vaardigheid in het infereren van tekststructuur, nemen we aan dat tweedeklassers niet eerst beter ontwikkelde cognitieve middelen moeten hebben voordat ze kunnen profiteren van instructie op het gebied van kennis van connectieven en vaardigheid in het infereren van tekststructuur.

Er is echter één uitzondering op deze aanname. Onze resultaten lijken aan te geven dat kennis van connectieven niet erg behulpzaam is om het begrip van informatieve teksten te verbeteren als de metacognitieve kennis van lezers onvoldoende is. Om die reden adviseren we docenten om de instructie van kennis van connectieven en metacognitieve kennis te combineren. Omdat onze studie vond dat tweetaligen die thuis een andere taal dan het Nederlands spreken niet alleen een kleinere algemene woordenschat hebben, maar ook minder kennis van connectieven en metacognitieve kennis dan hun eentalige leeftijdsgenoten, stellen we voor dat deze componenten bijzondere aandacht verdienen in leesinstructie aan tweetaligen. Ten slotte adviseren we docenten op de middelbare school niet om leesonderwijs te initiëren met als doel de leesvloeiendheid te bevorderen. Gegeven de afwezigheid van de voorspellende waarde van leesvloeiendheid in de huidige studie verwachten

¹³ Leesvaardigheidsniveau is alleen onderzocht als moderator van vaardigheid in het infereren van tekststructuur.

we niet dat vloeiendheidstraining leidt tot een beter begrip van informatieve teksten voor tweedeklassers.

Concluderende opmerkingen

Onze studie heeft ons meer inzicht gegeven in de individuele verschillen die gerelateerd zijn aan het begrijpen van informatieve teksten door tweedeklassers in het voortgezet onderwijs. We veronderstelden dat onderzoeksmethodes die online en offline data combineren zouden helpen om een nog beter begrip te krijgen van de leesprocessen van lezers die verschillen op het gebied van cognities en motivaties, alsmede hoe deze leesprocessen tekstbegrip beïnvloeden.

Tot slot willen we het maatschappelijk belang benadrukken van langdurige interventies op het gebied van begrijpend lezen voor tweetalige leerlingen met een andere thuistaal dan het Nederlands. Zowel de huidige studie als het hieraan voorafgaande OTAW-project hebben aangetoond dat tweetaligen die thuis een andere taal dan Nederlands spreken achterblijven bij hun leeftijdsgenoten in linguïstische kennis, metacognitieve kennis en begrip van informatieve teksten. Het wegnemen van verschillen tussen eentaligen en tweetaligen op deze gebieden is geen eenvoudige taak. Extra inspanning, op school en daarbuiten, is nodig om de verschillen tussen eentalige en tweetalige leerlingen kleiner te maken. In de voorliggende dissertatie hebben we in de introductiesectie het belang onderstreept van maatwerk bij remediërende activiteiten op scholen en tevens hebben we onderwijspraktijken in de lessen Nederlands naar voren gebracht die de taalvaardigheid van leerlingen kunnen verbeteren. Er is echter meer onderzoek nodig om te ontdekken wat de meest effectieve en efficiënte manieren zijn voor scholen om verschillen tussen eentalige en tweetalige leerlingen te helpen overbruggen. Uitkomsten van dit type onderzoek en taalbeleid gebaseerd op deze uitkomsten kunnen ons dichter bij een ambitieus doel brengen: gelijke kansen creëren voor leerlingen om hun schoolcarrière succesvol te beëindigen.

Curriculum Vitae

Camille Welie was born on 15 November 1984 in Maastricht, the Netherlands. In 2003, after graduating from high school, he moved to Amsterdam to study psychology at VU University. In 2006 he graduated for his bachelor psychology (cum laude) and in 2007 for his master in social psychology (cum laude). When Camille Welie stayed in Italy for a while to learn Italian, he discovered his interest in language learning, especially second language learning. For this reason, after some work experience, he decided in 2008 to enroll for the bachelor Dutch language and culture at the University of Amsterdam, and because of his interest in second language learning, he chose the master Dutch as a second language as a specialization at the same university; he finalized his bachelor (cum laude) in 2011 and his master (cum laude) in 2011 to 2013, in his role of project coordinator elearning, he was responsible for coordinating the development of didactical approaches to learn Dutch as a second language.

In 2012, Camille Welie started the OTAW-project ("Opbrengst Taalachterstand Amsterdam-West") at the University of Amsterdam which led to the start of his PhD-project *Individual differences in reading comprehension* at the same university in 2013. He presented findings from both projects at local events and at international conferences in Toronto (2015, *Annual Conference of the American Association for Applied Linguistics*), New Brunswick (2015, *International Symposium on Bilingualism*), Hawaii (2015, *Annual Conference of the Society of Scientific Studies in Reading*), and Washington D.C. (2016, *Annual Conference of the American Educational Research Association*). During his PhD-project, he supervised, in collaboration with Folkert Kuiken, the CRISS project (Collaborative Reading in Secondary School), and he also co-lectured several bachelor courses at the Dutch Linguistics' Department of the University of Amsterdam (Sentence and Language Analysis (2012-2016), Dutch Language Arts at Secondary Schools (2013) and Urban Multilingualism (2013-2016)).