Downloaded from UvA-DARE, the institutional repository of the University of Amsterdam (UvA)
http://hdl.handle.net/11245/2.33245

File ID	uvapub:33245
Filename	prefinal version.pdf
Version	postprint

SOURCE (OR PART OF THE FOLLOWING SOURCE):

Type	article
Title	First language and second language writing: the role of linguistic knowledge, speed of processing, and metacognitive knowledge
Author(s)	R. Schoonen, A. van Gelderen, K. de Glopper, J. Hulstijn, A. Simis, P. Snellings, M. Stevenson
Faculty	FMG: Research Institute Child Development and Education (CDE), FGw: Amsterdam Center for Language and Communication (ACLC)
Year	2003

FULL BIBLIOGRAPHIC DETAILS:
http://hdl.handle.net/11245/1.217166

Copyright

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content licence (like Creative Commons).

UvA-DARE is a service provided by the library of the University of Amsterdam (http://dare.uva.nl)
(pagedate: 2015-02-27)

First language and second language writing: the role of linguistic knowledge, speed of processing and metacognitive knowledge

Rob Schoonen, Amos van Gelderen, Kees de Glopper, Jan Hulstijn, Annegien Simis, Patrick Snellings & Marie Stevenson

University of Amsterdam

Address for correspondence

Rob Schoonen

~~SCO-Kohnstamm Institute~~

~~Faculty of Social and Behavioural Sciences~~

~~University of Amsterdam~~

~~Wibautstraat 4~~

~~NL-1091 GM Amsterdam~~

~~tel.~~ ~~+31.20.5251352/-1226~~

~~fax.~~ ~~+31.20.5251200~~

e-mail: rob.schoonen@~~hum.~~uva.nl

First language and second language writing: the role of linguistic knowledge, speed of processing and metacognitive knowledge

ABSTRACT

In this study the relative importance of linguistic knowledge, metacognitive knowledge and fluency or accessibility of this linguistic knowledge in both L1 (Dutch) and L2 (English) writing was explored. Data were collected from 281 grade 8 students. Using structural equation modeling the relative importance of the three components was studied and compared across L1 and L2 writing.

The results showed that the fluency measures were correlated with overall writing performance in both L1 and L2. However, when compared to linguistic knowledge resources, these fluency measures turned out to have no additional value in predicting L1 or L2 writing performance. L2 writing proficiency turned out to be highly correlated with L1 writing proficiency, more than with either L2 linguistic knowledge or the accessibility of this knowledge.

INTRODUCTION

Writing in one's mother tongue is a demanding task, which calls upon several language abilities, as well as upon more general (meta)cognitive abilities. These constituent abilities are in a constant interplay. Writing in a second language (L2) is even more demanding because several of these constituent abilities may be less well developed than in one's first language (L1). For example, linguistic knowledge of the L2 may be limited, and the accessibility of this knowledge may be less rapid or automatic. The question is to what extent the decomposition of L1 writing in terms of linguistic knowledge, metacognitive knowledge and accessibility of linguistic knowledge is comparable to the decomposition of L2 writing, and to what extent L1 and L2 writing are interrelated.

Because of the complexity of the writing process it is difficult to envisage a model for writing in terms of its 'subskills' (see Abbott & Berninger, 1993; Grabe & Kaplan, 1996 for an attempt to arrive at such a model). Most existing writing models focus on the writing process (Chenoweth & Hayes, 2001; Flower & Hayes, 1980; Flower & Hayes, 1983; Hayes, 1996; Kellogg, 1996) or on the development of writing proficiency (Bereiter & Scardamalia, 1994) more than on the characteristics of the cognitive and linguistic resources needed for writing. Process models do, however, acknowledge that writers need to have certain resources available. Chenoweth and Hayes (2001) distinguish three levels in their description of the writing process: a resource level, a process level and a control level. The *resource* level consists of linguistic knowledge and general knowledge and is called upon by the processes at the *process* level, such as translating and revising. The *control* level includes a task schema consisting of the task goal and a set of productions "that govern the

interactions among the processes" (o.c.,: 84). At this control level, other kinds of knowledge resources might be called upon, such as knowledge of writing strategies. The question is which knowledge resources or component skills are of value to a successful writing performance, that is, to effective writing and control processes, and make up the cognitively complex construct of writing ability.

First of all, writers, who have the intention of expressing an idea or message to a reader, need to have some vocabulary knowledge of the language in which they are writing (cf. Grabe & Kaplan, 1996). Writers' lexical knowledge or vocabulary size is likely to influence the quality of their texts. Measures of lexical richness of texts correlate substantially with holistic ratings of these texts (Engber, 1995). Also, in a study by Laufer and Nation (1995), it was shown that vocabulary size, use of words of different frequency bands (Lexical Frequency Profile) and composition rating are highly intercorrelated. Limited lexical resources seem to reduce writers' possibilities for expressing their ideas. However, writers' ideas are not just expressed in single words, but need to be cast in grammatical structures that indicate the relationships between the constituents in the clause. Consequently, writers need to have some grammatical knowledge at their disposal to be able to connect the words into proper clauses and sentences (cf. Grabe & Kaplan, 1996).

In contrast to speaking, writing also requires knowledge of the orthography of the language, i.e., spelling (Abbott & Berninger, 1993). Depending on the language involved, the 'match' between spelling and the spoken language varies in terms of transparency. The degree of transparency in a particular language will effect the amount of difficulty that writers experience in encoding their ideas in written form.

In producing longer stretches of text, that is, beyond clause or sentence level, writers should be aware of the organization of their texts at discourse level. They

should also be aware of how their communicative intentions can best be expressed. In a broader, more pragmalinguistic and sociolinguistic perspective, writers need to have knowledge of the addressed readership and of ways texts function in their community in order to be able to write effective texts (cf. Cumming, 2001; Grabe & Kaplan, 1996).

In addition to all this language-related knowledge, writers need to have (metacognitive) knowledge of what constitutes a good text and which writing strategies are likely to be successful in dealing simultaneously with all the constraints writing a text poses (cf. Flower & Hayes' (1980) ‘juggling with constraints’). Schoonen and De Glopper (1996) showed that proficient writers have more declarative knowledge about writing than less proficient writers and that they have a different perception of what is important for a text to be adequate: proficient writers focused more on text organization compared to poor writers who focused on mechanics and layout. In the same vein, Victori (1999) showed that successful and unsuccessful foreign language writers could be distinguished by their metacognitive knowledge in each of three domains: the knowledge one holds about oneself as cognitive processor, task knowledge and strategy knowledge. This kind of metacognitive knowledge, which is stored at the *resource* level in the Chenoweth-Hayes model, may be considered an important knowledge source for the task schema at the *control* level that orchestrates the writing process.

The presence of linguistic and metacognitive knowledge resources in long term memory is just one facet of the writing process. At the *process* level writers have to access these knowledge resources when they translate their ideas into written language. At this level writers are restricted by the limitations of their working memory capacity in the cognitive processes and rhetorical constraints they can handle

simultaneously. Fluent or automatic accessing of lower-level (linguistic) knowledge resources may take up little of writers' attention and therefore may leave sufficient cognitive capacity for other attention consuming, higher level processes of writing, such as text structuring. Writers must have enough cognitive capacity in working memory at their disposal to be able to deal with all the writing constraints of lexical, grammatical, orthographical and discourse decisions simultaneously. Automatic or fluent retrieval of lexical or grammatical chunks may contribute to an efficient use of the available working memory capacity. Recently developed models of writing include working memory as a critical component mediating the successful coordination of writing subprocesses (cf. Hayes, 1996; Kellogg, 1996) and research has demonstrated a significant relationship between the availability and efficient use of working memory capacity on the one hand, and writing fluency and -to a lesser extent- writing quality on the other hand (cf. Benton, Kraft, Glover, & Plake, 1984; Bereiter & Scardamalia, 1994; Chenoweth & Hayes, 2001; Fayol, 1999; Kellogg, 1999; Lea & Levy, 1999; Levy & Marek, 1999; McCutchen, 2000; McCutchen, Covill, Hoyne, & Mildes, 1994; Ransdell & Levy, 1999; Torrance & Jeffery, 1999). From this research it can indeed be inferred that it is not enough to have linguistic and metacognitive knowledge available while writing; writers must also be able to apply this knowledge efficiently and fluently. Fluent access to words and phrases or grammatical structures in memory may lower the cognitive processing load for a writer and may thus enhance the writing process and possibly the quality of written text (cf. Chenoweth & Hayes, 2001; Cumming, 2001; Grabe & Kaplan, 1996; McCutchen, 1996; Penningroth & Rosenberg, 1995). See McCutchen (1996; 2000) for an extensive discussion of working memory and writing.

However, although one may assume that fluency in lexical retrieval and in sentence building are constituent subskills of writing at the process level –besides the linguistic and metacognitive knowledge at the resource and control level–,in (large scale) correlational research such measurements have been largely ignored.

Although the above sketch of writing proficiency is a simplification of a very complex construct (See for more extensive analyses of writing and theories about writing: Grabe (2001) and Grabe & Kaplan (1996)), it addresses three different components of knowledge and skills of fundamental relevance for writing proficiency: linguistic knowledge, metacognitive knowledge and fluent access of linguistic knowledge.

Knowledge versus accessibility; writing in first and second language

When writing in a first language (L1), words and grammatical structures may be readily available in an automatised way, as they are in speaking. Consequently, speed of lexical and grammatical retrieval may not discriminate well between writers at higher levels of language proficiency. This expectation is in line with reading research findings that showed low correlations between reading proficiency and word recognition speed at higher levels of reading proficiency (Stanovich, 1991). However, Benton *et al.* (1984) showed that proficient and less proficient (L1) writers differ in their 'elementary information processing programs'. Proficient writers can keep information in working memory while manipulating the content of text (e.g. reordering) far better than weak writers. Benton *et al*. suggest that proficient writers have automated certain components of the writing process which less proficient writers have not. More recent research has also demonstrated a relationship between the efficient use of working memory resources (reading and writing span) and writing

fluency. The relationship between working memory resources and writing *quality*, however, was less easy to establish (Ransdell & Levy, 1999). In sum, proficient and less proficient L1 writers may not only differ in their linguistic and metacognitive knowledge, but also in their efficient use of working memory.

In second language[1] (L2) writing, the situation is likely to be different. Compared to L1 writers, L2 writers will not only differ in their linguistic knowledge of the (second) language, but – due to differences in exposure to the L2 – they most likely will also differ in their 'fluency', i.e. the ease with which words and grammatical structures can be accessed during writing. Differences in degree of fluency among L2 writers can also be expected to be larger than the differences among L1 writers, due to differences in L2 exposure, L2 instruction and language learning aptitude. Chenoweth and Hayes (2001) were able to demonstrate that even two to three semesters of L2 instruction made a difference in L2 writing fluency. Our assumption is that difficulties in fluent retrieval of words or grammatical structures in L2 writing will burden the working memory and thus hinder the writing process as such, not just with respect to writing *fluency*, but also with consequences for the *quality* of the text. Therefore, we expect that the contribution of these kind of fluency variables to the overall writing proficiency will be larger for L2 writing than for L1 writing. The L2 writer may be so much involved in these kind of 'lower order' problems of word finding and grammatical structures that it may require too much conscious attention, leaving little or no working memory capacity free to attend to higher level or strategic aspects of writing, such as organizing the text properly or trying to convince the reader of the validity of a certain view. The discourse and metacognitive knowledge that L2 writers are able to exploit in their L1 writing may remain unused, or underused, in their L2 writing[2]. Whalen and Ménard (1995) reached similar conclusions based on their

think-aloud study with Canadian students learning French as a second language. They found that, in comparison to their L1 writing, in their L2 writing the students planned and evaluated relatively more frequently at the linguistic level compared to the textual and pragmatic level. Revisions were made most frequently at the linguistic level, both in L1 and in L2, but these linguistic revisions were at a deeper level (phrase and sentence) in L1 than in L2, where most revisions concerned morphemes and orthography.

Little research has been done on the role of lower-level L2 processing skills or speed of processing and L2 writing performance. The relevance of lower-level processing skills as predictors of L2-proficiency (including writing) was demonstrated by Sparks *et al.* (1997). This study showed that a measure of phonological-orthographical decoding (i.e., foreign language word decoding) is highly relevant in the prediction of L2 proficiency.

In a think-aloud study, Jones and Tetroe (1987) studied the interaction between composing skills and (second) language competence in six native Spanish adult ESL writers who wrote essays in both L1 and ESL. The researchers studied -- among other things-- to what extent the writers kept to their plans and the constraints of the tasks, and it turned out that in ESL writing the 'success rate' was much lower than in L1 writing, which made the researchers conclude that not only were these (elicited) plans in ESL not as fully developed as in L1, but writers also had more difficulty in keeping track of their plan. Jones and Tetroe conclude from their think aloud protocols:

> *(...) that there is some decrease in performance simply due to the fact that it is in a second language, that working in an unfamiliar*

> *language does take up cognitive capacity that would be used for other tasks, such as monitoring and revising the plan, in first-language composing.* (o.c.: 53)

Sasaki and Hirose (1996) studied L1 and EFL writing performance of Japanese students and tried to model the interplay between EFL proficiency, L1 writing ability and strategic knowledge and writing experience/education. It turned out that the students' foreign language proficiency was the major predictor of their EFL writing performance (i.e., the score on a single writing assignment), with minor roles for 'metaknowledge' and L1 writing performance. These predictors of EFL writing explained 54.5% of the total amount of variance in EFL writing performance; *unique* contributions of EFL proficiency, metaknowledge and L1 writing performance were 32.6, 0.3 and 1.5%, respectively. Furthermore, Sasaki and Hirose foundthat good (EFL) writers paid more attention to the overall organization of the text. They also seemed to be more fluent, that is, they wrote longer texts, but there were no differences in reported pausing. As an explanation for the relatively small contribution of L1 writing, Sasaki and Hirose suggested that weak writers may be:

> *tied up with word- or sentence-level processing (in other words, the "what next strategy" cited in Bereiter & Scardamalia, 1987), and could not afford to think about overall organization much*. (o.c.:158).

Difficulties with the lower order processing of text may account for the low correlation between students' EFL and L1 writing scores in the Sasaki and Hirose study, as

lower order skills are more language specific, in contrast to metacognitive knowledge of texts and writing strategies which may be applicable across languages. If metacognitive knowledge was a major discriminating factor in EFL writing, as it often seems to be in L1 writing, then higher correlations between L1 and EFL writing could be expected. Consequently, it is of interest to further study with new data the interrelations between L1 and EFL writing proficiency with the effects of lower order EFL linguistic knowledge and skills partialled out.

The suggestions about the interrelations between lower-order linguistic knowledge and fluency, and higher-order textual and pragmatic skills in L2 writing (Jones & Tetroe, 1987; Sasaki & Hirose, 1996; Whalen & Ménard, 1995) are in accordance with recent findings of Chenoweth and Hayes (2001). Chenoweth and Hayes showed in a timed think-aloud study that writing performance in L1 and FL not only differ remarkably in fluency (i.e., in words per minute), but also in the length of bursts of text production (i.e., in the number of proposed new words between two pauses) and in the number of acceptable word retrievals (i.e., in the percentage of proposed new words that eventually show up in the written text). These L1-FL differences seem to be mediated by amount of experience in the FL, as students with three semesters of FL instruction turned out to be less fluent than students with five or six semesters of FL instruction. According to the authors, the “increase in burst size reflects an increase in the capacity of the translator to handle complex language structures” (o.c.: 94).

Research questions

Within the context of possible differences in the roles of different knowledge and processing resources in L1 and L2 writing, the present study aims to unravel to some

extent the contribution of the different component skills to the overall quality of the written text, be it in L1 or L2. The primary focus is on the hypothesized importance of fluency in L1 and L2 writing (questions 1, 2 and 3 below). Furthermore, the relationship between L1 and L2 writing proficiency (question 4) will be explored. The following questions guided our analyses:

1. What is the relationship between speed of language processing (i.e. lexical retrieval and sentence building), and writing proficiency in Dutch as a first language (L1) and in English as a foreign language (L2)?
2. Is this relation between speed of language processing skills and writing proficiency the same for L1 and L2?
3. How does the contribution of speed of language processing to L1 and L2 writing proficiency compare to the contribution made by L1 and L2 linguistic knowledge and metacognitive knowledge of writing and written texts?
4. Does L1 writing proficiency contribute to L2 writing proficiency beyond the contribution of L2 linguistic knowledge, processing speed and metacognitive knowledge of writing and written texts?

We expect that, in L2 writing, writers will experience problems with both linguistic knowledge (vocabulary, grammar and orthography) and fluency or accessibility of linguistic knowledge (lexical retrieval and sentence building). Individual differences in these component skills should show up in individual differences in the L2 writing performance. Differences in metacognitive knowledge are expected to be less important for L2 writing performance than for L1 writing performance. In L1 writing, we expect a somewhat different picture: differences in metacognitive and linguistic

knowledge are expected to constitute the main determinants of L1 writing performance, whereas the role of accessibility of linguistic knowledge will be less decisive.

METHOD

Participants

The data from this study has been collected from 281 grade 8 students (i.e. second year of secondary education) in the Netherlands. These students are a subsample from the 397 students participating in a longitudinal study into the development of reading and writing proficiency in Dutch as an L1 or L2 and in English as an FL (project NELSON[3]).

We have confined ourselves to students who participated in all tests relevant for the following analyses and who identified themselves as speakers of Dutch as a first language (N=281), i.e. students who reported both speaking Dutch with their parents, and having acquired Dutch as their first language. The students were sampled from both higher and lower streams of education, ranging from vocational to pre-academic, in eight secondary schools in urban areas. These students had received on average 3.5 years of education in English as a foreign language: 1.5 years at the level of secondary education and two years at the level of primary education. In these latter years, attention is only paid to basic oral communication skills (about 1 hour per week).

Instruments

The testing instruments will be described briefly. Appendix 1 provides sample items.

Writing Proficiency. Students wrote three texts in each language. As far as possible, writing prompts were matched across the two languages. The prompts specified the rhetorical situation and intended audience. Texts were rated by six raters working in panels of two. Every panel rated a Dutch and the 'matched' English assignment. The raters rated according to a primary trait instruction and used benchmark texts as a reference. The five benchmarks represented a very weak (10th percentile), a weak (25th), an average (50th), a good (75th) and a very good (90th) text. The benchmarks were selected and scaled in a separate analysis, according to a procedure described by Blok (1986). Panel reliability (k=2, Cronbach's alpha) ranged from .76-.82 for Dutch, and from .87 to .90 for English compositions.

The following (abbreviated) prompts were given for the Dutch compositions:

D1 Write to an emigrated friend what you plan to do when he visits you and stays at your place.

D2 Write to a television network to complain about their pulling the plug on your favorite soap.

D3 Describe your Dutch language lessons for a school magazine.

The following (abbreviated) prompts were given for the English compositions:

E1 Write to an English pen pal who is moving to your hometown.

E2 Write to an English music magazine to complain about their ignoring your favorite group.

E3 Describe your English language lessons for an English school magazine.

Vocabulary Knowledge. Vocabulary tests comprised 75 (Dutch) or 65 (English) multiple choice items. Only nouns, verbs, adjectives and adverbs were included in the tests. In the Dutch test we followed the format of Hazenberg and Hulstijn (1996): each item consists of a neutral carrier sentence with a target word in bold print and the students had to choose between four synonyms or paraphrases of the stimulus word. In the English test there were four Dutch translations of the stimulus word (see Appendix 1).

The Dutch word selection was based on Hazenberg and Hulstijn (1996), which spans the 20,000 most frequent words of Dutch. The English word selection was based on four frequency bands of the COBUILD corpus: the first 2000 words, 2000-3000, 3000-4000, and 4000-5000. Since our students, unlike native speakers, are primarily exposed to English is a classroom setting, we also based our target-word selection on an analysis of EFL textbooks. We avoided Dutch-English cognates as target words. The words were not specifically related to the topics of the writing assignments.

Orthographic Knowledge. In the Orthographic Knowledge tests, students had to choose between two or three concurrent options for the spelling of the missing part of a word. The target words were presented in a sentence that provided a strong cue to the intended word. The Dutch test consisted of 100 items covering well known spelling problems (single or double consonants, homophones, etc.) including the spelling of conjugated verbs, which is notoriously problematic for students. The English test consisted of 89 items covering typical spelling problems in English (Castley, 1998). Some items had a multiple choice format, requiring students to choose either of two options (e.g., single or double consonant), while other items

were of the fill-in-the-blank type, requiring students to decide which consonant(s) or vowel(s) had to be inserted. To ensure that students knew which word they needed to spell in the English items of the latter type, the Dutch translation of the intended words was also provided. For example: *I__e is very cold. ("IJs")*.

Grammatical Knowledge. Students had to fill in the correct form of verbs, adjectives, anaphora, comparatives, pronouns and articles or had to put randomly presented words or phrases into the right order. For example, students had to choose between contrasted elements like *any(thing)* and *some(thing)*, *many* and *much,* or *little* and *few*. The word order items required students to take grammatical number, time, aspect, position of adverbs and agreement into account, as in, for example, [*He*]$_1$ [*take*] $_2$ [*the bus*] $_3$ [*not*] $_4$ [*does*] $_5$; "The best order is: 1, ...".

The Dutch test consisted of 69 items. The English test consisted of 80 items.

Metacognitive Knowledge. For the measurement of Metacognitive Knowledge a questionnaire consisting of 80 statements about text characteristics, reading and writing strategies was used. Students had to tick whether they agreed or disagreed with the statements. All statements were in Dutch. Statements concerned knowledge of texts and knowledge of reading and writing strategies. Some of the statements were general and some applied specifically to reading and writing in EFL. Note that, whereas all other constructs were measured for Dutch and English separately, Metacognitive Knowledge was assessed with a single test.

Speed of Lexical Retrieval. Students were presented with pictures on a laptop screen and were requested to type the first letter of the noun referring to the person or object

depicted. Responses were coded for accuracy and reaction times (RT). RTs faster than 550 milliseconds or slower than three standard deviations of the mean RT on that stimulus were considered invalid and were replaced (see Scoring). RTs were corrected for 'typing fluency', i.e., the speed with which a student is able to find a certain letter on the keyboard. This typing fluency was assessed separately and students' scores for typing fluency, i.e., mean RTs, were partialled out of their mean RTs in Lexical Retrieval. The testing format was the same for Dutch and English. Each test started with 10 trial items. Only items with high hit rates (see Scoring) were used to compute a test score (i.e., mean RT). For Dutch, 38 out of 39 items met this criterion, for English, this was the case for 18 out of 38 items.

Speed of Sentence Building. Students were presented with the beginning of a sentence on a laptop screen. Then they had to choose as quickly as possible which of two constituents should continue the sentence by pressing a corresponding key. Each test started with 10 trial items. RTs faster than 650 milliseconds or slower than three standard deviations of their corresponding item mean were considered invalid and were replaced (see Scoring). Only items with high hit rates (see Scoring) were used to compute a test score (i.e., mean RT). For Dutch, 32 out of 43 items met this criterion, for English, this was the case for 24 out of 44 items.

Procedure

Data were collected in 1999, as the first phase of a longitudinal study. The tests were administered in a classroom setting by trained test-assistants during school hours. All the tests were administered within a period of about 10 weeks, ranging from 8.5 weeks to 11.3 weeks between the first and the last test. Tests were assigned in a

quasi-random order, taking into account the availability of the laptop computers needed for the speed tests and the timetable of the schools.

Scoring

Skipped items from the knowledge tests were scored ‘incorrect’. Missing more than half of the number of items of a test led to a missing value on the test as a whole.

In speed tests, two scores are usually relevant: accuracy and RT. Since we were solely interested in the speed of processing and wanted to avoid the interference of linguistic knowledge, we only used RTs of responses to items with sufficiently high hit rates. This allowed us to assume that the right answers were known to (almost) all students. For Lexical Retrieval items, for which there is only a negligible chance of guessing the right answer, the hit rate had be higher than .75, that is, 75% or more students had to have recognized the word as a word. For Sentence Building items (with a 50% chance level for guessing), the hit rate had to be higher than .875 (=.75 + (.25*.50)). Responses to all other items were removed. RTs of (incidental) wrong answers and missing RTs were replaced by estimates according to the EM-algorithm of SPSS (cf. Acock, 1997; Hox, 1999). The EM estimates involved 9.4% (Dutch) and 17.0% (English) of the Lexical Retrieval scores, and 6.7% (Dutch) and 7.5% (English) of the Sentence Building scores.

Missing *test* scores, for example, due to absence of students on one of the testing days, were also estimated according to the EM procedure. In our dataset[4] about 12.1% of test scores were missing. Estimating these test scores had hardly any effect on the test means or standard deviations. In terms of Cohen's (1988) effect size for means, the largest difference (.06) is still small according to Cohen's rule of thumb that effects of .10 are considered to be small effects.

Analyses

Means and standard deviations were computed for all tests. All tests, except for Writing Proficiency, were split into two parallel parts according to the Gulliksen (1950) procedure. For Writing Proficiency, the three scores (one for each assignment) were kept separate. Using the 'observed' scores per variable, latent variables were estimated in order to perform structural equation modeling (SEM) in LISREL (Jöreskog & Sörbom, 1996a; Raykov & Marcoulides, 2000). According to the procedure described in Fleishman & Benson (1987), reliabilities of the sums of the two test halves and the three writing assignments were estimated within the SEM analyses. Variables were normalized in PRELIS (Jöreskog & Sörbom, 1996b) and the covariance matrix of the observed (parts of the) tests was computed as input for SEM.

We will report on the bivariate correlations between the latent component variables and the corresponding dependent (latent) variables Writing Proficiency in L1 and L2. These correlations are often referred to as 'true' correlations, because measurement error is partialled out. These correlations indicate the relationship between individual component variables and Writing Proficiency. Furthermore, we will fit a model in which all component variables are simultaneously related to Writing Proficiency. Such a ''regression analysis' will show the relative importance of component variables in the context of the other component variables. Regression weights of the component variables will be compared across L1 and L2 writing.

RESULTS

Descriptive and psychometric statistics

Table 1 contains the descriptive and psychometric statistics per test, for Dutch L1 and L2.

INSERT TABLE 1 ABOUT HERE

Table 1 shows that the language proficiency tests are of average difficulty and show a fair amount of variance of scores. On the basis of the difference in performance on the speed measures in L1 and L2, one might be inclined to conclude that students are less 'fluent' in L2 than in L1. However, one should bear in mind that no attempt was made to equate the Dutch and English stimuli in terms of difficulty or accessibility. In general, it seems that students differ more in their L2 skills and proficiencies than in their L1 skills and proficiencies, as can be inferred from the standard deviation(-mean ratio')s.

The right panel of the table shows that all tests have a satisfactory reliability. Both measures of Speed of Lexical Retrieval are just below .80, which might be due to the fact that these measures are residuals, i.e., RTs with the RTs for Typing Fluency partialled out. Dutch Writing Proficiency is clearly below .80, which is not that surprising given the known effects of topic and assignment in writing assessment (Cooper, 1984; Schoonen & De Glopper, 1999). These effects make it difficult to reach a satisfactory level of score reliability. However, in the subsequent SEM analyses we will be dealing with the latent variables from which measurement error is

partialled out and, in that sense, measurement error should not influence the size of correlations or regression weights. Nevertheless, one should be a bit cautious in interpreting the dependent variable Dutch Writing Proficiency.

A basic model of L1 and L2 writing

In this section we describe the selection of a satisfactory model of L1 and L2 writing. Model fit is evaluated by chi-square (χ^2) and the corresponding degrees of freedom (*df*). However, it is well-known that this statistical measure is very sensitive to sample size (Raykov & Marcoulides, 2000), in the sense that minor deviations from the model lead to a significant chi-square and thus to rejection of the model. Therefore, more descriptive measures of fit should be reported as well, for example the chi-square/df ratio, which preferably is lower than 2, the root mean square error of approximation (*RMSEA*), which preferably is lower than .05, and the non-normed fit index (*NNFI*), which should be in the upper .90's (Raykov & Marcoulides, 2000). For the expected cross-validation index (*ECVI*), there is no absolute criterion, but it can be used to compare different models for the same data; the lower the *ECVI* the better.

Our point of departure is a basic model in which Writing Proficiency in each language is regressed on the corresponding component variables. Since Metacognitive Knowledge is considered to be non-language-specific, this variable appears in both regressions. The component variables of the two languages are allowed to correlate among each other, but the regressions are language specific. Writing Proficiency in Dutch and English are considered to be correlated as well (see Figure 1). The two 'observed' parts per tests were assumed to be parallel, except for

Speed of Lexical Retrieval which are residual scores (see note in Table 1). However, since this parallelism was established post-hoc, we did not include this feature of the test parts in our model, that is, we did not constrain the measurement model by setting the parameters to be pair wise equal.

Figure 1. Basic model for Dutch L1 and English L2 Writing Proficiency; ovals refer to latent variables, squares are observed variables.

INSERT FIGURE 1 ABOUT HERE

Although this basic model should be rejected, statistically speaking (χ^2=525.76 with *df*=282) it fits the data reasonably well: the χ^2/df ratio is lower than 2, *RMSEA* comes close to .05 and the *NNFI* is (almost) in the upper .90's. The *ECVI* will be used to compare this model with other models. Part of the misfit is caused by the fact that some of the *Dutch* component variables are more strongly related to *English* Writing Proficiency and vice versa than can be explained by the intercorrelations among the component variables of the two languages (cf. Schoonen, Hulstijn, & Bossers (1998) for similar findings with respect to L1 and L2 reading proficiency).

INSERT TABLE 2 ABOUT HERE

Considering the basic model (Model 1) is a fair description of our data, we now can return to our research questions. The other models described in Table 2 will be discussed below. First, we will present the bivariate correlations between the predictor variables and the dependent variable Writing Proficiency in L1 and L2, respectively. Table 3 shows these correlations.

INSERT TABLE 3 ABOUT HERE

It turns out that all component variables, except for Lexical Retrieval in Dutch, correlate substantially with Writing Proficiency in the same language. Correlations are at least of medium size (>.30) or even large (>.50) according to Cohen's rules of thumb for effect sizes. In general, the L2 tests show higher correlations with English Writing Proficiency than the Dutch tests with Dutch Writing Proficiency. The speed tests correlate negatively with Writing Proficiency, as expected, since faster times (low RTs) go with higher writing scores. The correlations of the speed tests are somewhat less strong than those of the knowledge test scores. The correlation between Writing Proficiency and Lexical Retrieval in the L1 (Dutch) is rather low (-.10), but Lexical Retrieval in L1 may be fully automated for all students and therefore cause no problems in their writing. Speed of Lexical Retrieval in L1 is not likely to contribute much to the prediction of Writing Proficiency.

Furthermore, it turns out that the two writing proficiencies are very highly intercorrelated (r=.93), which implies that the two variables have a lot in common.

This commonality could be the metacognitive knowledge component or other aspects of writing proficiency that are not language specific.

To get more insight into the relevance of the different component variables in the context of the other variables, we report the unstandardized and standardized regression weights in Table 4. The results of the regression analyses (Table 4, left panel) show that the component variables taken together explain substantial percentages of the variance of the Writing Proficiency scores in Dutch and English, 56% (multiple R=.75) and 80% (multiple R=.89) respectively. For English, the amount of explained variance is larger. Remarkable is the negative regression weight for Vocabulary Knowledge in Dutch. This might be an artifact, because of a so-called suppressor effect (Tabachnick & Fidell, 1996: 165) caused by the high intercorrelation between Metacognitive Knowledge and Vocabulary Knowledge and the relatively lower correlation between Vocabulary Knowledge and Writing Proficiency. L2 Vocabulary Knowledge also plays a minor role in the regression of L2 Writing Proficiency.

It seems as if L2 Writing Proficiency is more dependent on L2 language knowledge and processing skills than is L1 Writing Proficiency. To test this supposition, we fitted a more restrictive model to our data, that is, a model with equal regression weights across the two languages. Indeed, it turns out that assuming equal regression weights decreases the fit of the model (see model 2 in Table 2). The difference in fit between model 1 and 2 is statistically significant (χ^2=36.13 with df=6, p=.000). Subsequent analyses in which the equality of corresponding regression weights in L1 and L2 was tested per variable showed that the regression weights for

Vocabulary Knowledge and Orthographic Knowledge should be considered different across the two languages.

INSERT TABLE 4 ABOUT HERE

A comparison of the contributions of the knowledge tests with those of the speed measures shows that the largest contributions come from the knowledge tests. Although the speed measures are certainly correlated to Writing Proficiency, as we saw in Table 3, they have almost no *unique* contribution to the prediction of Writing Proficiency. A model with regression weights for the speed measures fixed at zero (model 3, Table 2) does not fit the data less well than a model with these regression weights free; there is no statistically significant difference between these two models (see Table 2: χ^2=1.49, *df*=4, *p*=.828). Moreover, the knowledge measures still explain 56% and 80% of the Writing Proficiency in Dutch and English, respectively.

A regression model with only speed measures (model 4, Table 2) would mean a serious (and statistically significant) deterioration of the model compared to our basic model (see Table 2: χ^2=159.02, *df*=8, *p*=.000). However, the two speed measures still explain a fair amount of variance in the Writing Proficiency scores when they are on their own in the regression model, i.e. 31% and 69% in Dutch and English, respectively.

To test whether L1 Writing Proficiency contributes to the L2 Writing Proficiency, beyond the contribution of the aforementioned L2 linguistic and metacognitive knowledge, we postulated a regression of English Writing Proficiency on Dutch Writing Proficiency (model 5, Table 2). Table 2 shows that the fit (slightly) improves compared to the basic model (χ^2=519.40, *df*=281; *RMSEA*=.051, *NNFI*=.95 and *ECVI*=2.64). The difference in fit between the two models is statistically significant (χ^2=6.36, *df*=1, *p*=.012). In this fifth model Dutch Writing Proficiency is 'explained' to an extent of 57% (which equals an multiple *R* of .75) and English Writing Proficiency to an extent of 100%[5] (multiple *R*=1.00). Furthermore, Table 4 (right panel) shows that L1 Writing Proficiency is an important 'predictor' of L2 Writing Proficiency (mainly at the cost of the predictive value of Metacognitive Knowledge).

DISCUSSION

To summarize our findings we return to our four research questions. The first question concerned the relationship between speed of language processing, i.e., lexical retrieval and sentence building, and writing proficiency in Dutch as L1 and English as L2. Table 3 shows that the speed measures are correlated with Writing Proficiency: -.10 and -.48 respectively in Dutch, and -.38 and -.60 respectively in English. These correlations (except for Dutch Lexical Retrieval) can be considered substantial, but we should also bear in mind that these are 'true' correlations, which are not attenuated by measurement error The correlations between the speed

measures and Writing Proficiency are generally lower than the correlations between the knowledge measures and Writing Proficiency.

The correlations between the speed measures and Writing Proficiency are higher in English than they are in Dutch (research question 2). Thus speed of access to linguistic knowledge may be more important in the L2 than in the L1. In subsequent analyses we showed that the regression of L2 Writing Proficiency on the component skill differs statistically from the corresponding regression of Dutch Writing Proficiency on its component skills. However, the major differences in the regression equations pertain to the knowledge tests. This finding need not surprise us if we consider the third question, that is, the unique contribution of the speed measures in the context of the linguistic and metacognitive knowledge tests. It turned out that the speed measures had virtually no *unique* contribution in the 'prediction' of Writing Proficiency, neither in L2 nor in L1, and in this respect the findings for L2 and L1 are similar.

Finally, we improved our basic model by regressing L2 Writing Proficiency not only on its language specific component skills and the general Metacognitive Knowledge, but also on L1 Writing Proficiency. Students acquired their L1 Writing Proficiency prior to their L2 Writing Proficiency, and therefore, it may predict L2 Writing Proficiency. It turned out that the model improved and that L1 Writing Proficiency indeed contributes to the prediction of L2 Writing Proficiency, as could be expected given the high correlation between the two variables. The additional value of L1 Writing Proficiency also implies that the correlation between the writing measures is not fully captured by the Metacognitive Knowledge measure (cf. Schoonen et al. (1998) for a similar pattern of results in the case of L2 Reading). Apparently there are typical aspects of writing proficiency that are captured in both

writing assessments (L1 and L2), but not in our component variables. This finding underscores that our models for writing --despite the number of variables involved-- are not all-encompassing (as this was not our primary goal). More general variables might account for the high correlation between L1 and L2 writing (see also below), such as general 'world knowledge', certain writing strategies or general cognitive fluency as indicated by, for example, working memory span (see **Introduction**). However, we do not have separate measures for such variables and thus can only speculate about the nature of these other variables that are common to L1 and L2 writing. It would also be interesting to further explore the relation between metacognitive knowledge and writing proficiency. Our operationalization of metacognitive knowledge, though based on earlier research, was --for practical reasons-- rather straightforward knowledge. However, the construct of metacognitive knowledge could be extended to the actual writing strategies the writers use (cf. Whalen & Ménard, 1995) or consider to be most important in writing (cf. Schoonen & De Glopper, 1996), in either L1 or L2 writing.

Surprisingly, Vocabulary Knowledge makes little contribution in L2 and an unexpected negative contribution in L1. This latter regression weight must be an artifact of the procedure; we are dealing with a so-called suppressor variable (Tabachnick & Fidell, 1996: 165). This suppressor effect is likely to be due to the high intercorrelation between Metacognitive Knowledge and Vocabulary Knowledge and the lower correlation between Vocabulary Knowledge and Writing Proficiency.

Although it may not be readily clear from the regression weights, it seems as if L2 writing is more dependent on L2 linguistic knowledge and processing speed than is L1 writing. L1 writing is harder to explain in terms of linguistic variables and this may imply that in L1 writing other factors (which we did not measure) such as topic

knowledge may play a role. In contrast, in L2 writing, linguistic variables seem to play a major role in writing, suggesting that students are more concerned with tackling language problems when writing in L2 than when writing in L1. In L1 writing the metacognitive knowledge plays a more important role.

When we consider possible transfer from L1 (higher order) writing skills to L2 writing or the existence of a threshold either in terms of linguistic knowledge or speed of language processing, as posited by Sasaki and Hirose (1996), which inhibits the transfer of higher order skills, our correlational data can give only 'circumstantial evidence'. As mentioned above, project NELSON is part of a longitudinal study, and so far we have data from just a single round of measurements. The important question of how in each language (i.e. L1 and L2) the relationship develops between, on the one hand, language proficiency and language processing skills, and, on the other, writing proficiency remains unanswered until the longitudinal data has been analysed. The same applies to the development of the relationship between L1 and L2 Writing proficiency. At this stage, our conclusions can be no more than preliminary.

Bearing these limitations in mind, we see that lexical retrieval correlates far lower with writing proficiency in L1 than in L2, which is reconcilable with the notion of a linguistic (speed) threshold. It seems plausible that 14 year-old students writing in their mother tongue have already surpassed the level beyond which differences in speed matter in writing. It may also be the case that students have reached a ceiling in Dutch (L1) lexical retrieval. Whether this is actually the case should become clear when we have analyzed more longitudinal data in the coming years.

With respect to the relation between L1 and L2 writing proficiency, our results differ remarkably from those reported by Sasaki and Hirose (1996). In our case,

metacognitive knowledge and L1 writing do make a (unique) contribution to the prediction of the L2 writing scores in model 1 and model 5, respectively (see Table 4; in model 5, the contribution of metacognitive knowledge to L2 writing proficiency is completely suppresses by L1 writing proficiency). At least three explanations come to mind for these differences in outcomes. First of all, this difference may be explained by differences between the two studies in assessment and analyses. Sasaki and Hirose used one writing assignment per language. Scores on single writing assignments usually show low intercorrelations, and are therefore considered of low reliability. In our approach we used three writing assignments per language and in our analyses the common variance of those three assignments is considered the 'true score' variance. This means that task specific variance, such as topic-related variance, is 'filtered out'. Estimates of correlations are not attenuated by error (or task specific) variance. Furthermore, we tried to match writing tasks in L1 and L2 as well as possible, because it is common knowledge that writing performance is very much dependent on the features of the writing assignment. Another (methodological) difference is that our sample of participants is relatively heterogenous. We did not aim at a nationally representative sample, but tried to cover the range of language proficiency found in grade 8 of Dutch secondary education. Consequently, we can expect a lot of variance in L1 and L2 writing proficiency, and in such a context correlations are more likely to show up than in contexts with a restriction of range. To what extent prior (L1 and L2) language instruction influenced the writing proficiencies of our students we do not know, but this information may not be very relevant in the view of our goals. Our primary goal is to find out what constitutes proficient L1 and/or L2 writing, rather than to determine what kind of language instruction most enhances writing proficiency. The second, more theory-based explanation for the differences

between the findings of Sasaki and Hirose and our findings would be that most students in our sample already have surpassed the threshold level (both in linguistic knowledge and fluency) that inhibits a substantial correlation between L1 and L2 writing, whereas Sasaki and Hirose's students may have not surpassed this level. It is well known that Japanese learners of English continue for a long time during their L2 learning careers to process written English words primarily as pictures, because of the fundamental difference between the non-phonological nature of their L1 writing system in comparison to the phonological nature of the alphabetic system of English (Koda, 1999). This means that Japanese students may profit much less from phonological cues which facilitate access to written word forms in the mental lexicon, than do L2 learners with an alphabetical L1. If this is the case, the students in our study may be less occupied with the spelling of the English words than the Japanese students, thus saving more cognitive capacity to use their metacognitive knowledge in L2 writing. Nonetheless, it seems very unlikely that English word production and sentence construction processes are already fully automated in the Dutch students after such a relatively short period of not very intensive instruction. An indication of the Dutch students not being fully automated in English lexical retrieval and sentence building is that they were less successful and slower in retrieval of English lexical items and English sentence building than in similar tasks in Dutch.

The third possible explanation is that the threshold hypothesis may be invalid, or applies to L2 writing to a far lesser extent than to L2 reading. Although reading and writing may partly use the same knowledge resources, the nature of the cognitive processes involved and the flow of information may be quite different. Readers have little control over the linguistic and cognitive difficulty of the texts to which they are exposed, whereas writers are likely to avoid writing texts of linguistic and cognitive

complexity beyond their knowledge and skills. Lack of (some) language knowledge and slow processing in L2 then does not necessarily prevent successful application of higher order strategies in L2 writing. It is conceivable that students profit from their metacognitive knowledge in spite of very limited linguistic resources, thereby even compensating for some of these limitations.

Which one of these (latter two) explanations is the most acceptable, will be one of the main focuses of our research project in the near future. In order to be able to choose the most acceptable explanation, we will need to gather more evidence on the role of linguistic and metacognitive knowledge in L1 and L2 composition.

As our data are correlational, strictly speaking, causal interpretations are not warranted. We cannot infer, for example, that increased speed of L2 sentence building for our students would actually *help* them to become better L2 writers. The same holds, of course, for the role of metacognitive knowledge. It cannot be concluded from the above results that improving metacognitive knowledge about texts and writing strategies *helps* students to become better writers. Our longitudinal study may show that when students acquire more speed in language processing the importance of this variable in explaining L2 writing proficiency will diminish. The pattern of regression weights of L2 writing proficiency and its constituent variables may then become more similar to that of L1 writing proficiency with a bigger role for metacognitive knowledge. Such findings would point at a kind of (fluency) threshold. Students might have experienced problems in applying their metacognitive knowledge in L2 writing due to (amongst other things) slow language processing. Additional data might corroborate this hypothesis. Another way to get more insight in this important issue is to take a closer look at cognitive processes in L1 and L2 writing. Stevenson (in prep.) is conducting a qualitative study in which think aloud

data is combined with RT-data. Of course, to conduct an experimental intervention study to test the effect of increased speed of lexical and grammatical fluency on L2 writing is yet another way to approach this issue. Such a study has been conducted by Snellings and preliminary findings show that lexical retrieval in writing can be improved by training (Snellings, Van Gelderen & De Glopper, 2002). Whether this will improve the quality of the written texts has yet to be established.

NOTES

[1] We use the term L2 in a general sense, referring to both situations in which the second language is the language of the majority or of the community the language user lives in, and to situations in which the second language is not the community language, but is a so-called foreign language (FL). In the present article, our participants' L2 is English which is a foreign language in their linguistic context (EFL).

[2] A similar line of reasoning is used in the Threshold hypothesis, in which it is stated that lack of linguistic *knowledge* of the second or foreign language (instead of lack of *fluency*) hinders application of strategic knowledge in FL reading:

> *Poor foreign language reading is due to reading strategies in the first language not being employed in the foreign language, due to inadequate knowledge of the foreign language. Good first-language readers will read well in the foreign language once they have passed a threshold of foreign language ability* (Alderson, 1984).

However, one could also argue that L2 readers, experiencing language difficulties, try to compensate for this lack of language comprehension by using certain content oriented reading strategies. See for an extensive discussion Stevenson, Schoonen & De Glopper (submitted).

[3] General information about the NELSON project is available at http://www.sco-kohnstamminstituut.uva.nl/nelson/index.htm.

[4] Our dataset also included reading scores. These reading data were included in the missing data estimation procedure in order to optimize the accuracy of the estimates.

[5] The amount of unexplained variance is estimated to be –5%; however zero was in its 68% confidence interval, and therefore the amount of *un*explained variance was considered to be zero, which is the theoretical minimum.

REFERENCES

Abbott, R. D., & Berninger, V. W. (1993). Structural equation modeling of relationships among developmental skills and writing skills in primary- and intermediate-grade writers. *Journal of Educational Psychology, 85*(3), 478-508.

Acock, A. C. (1997). Working with missing values. *Family Science Review, 10*(1), 76-102.

Alderson, J. C. (1984). Reading in a foreign language: A reading or a language problem? In J. C. Alderson & A. H. Urquhart (Eds.), *Reading in a foreign language* (pp. 1-24). London: Longman.

Benton, S. L., Kraft, R. G., Glover, J. A., & Plake, B. S. (1984). Cognitive capacity differences among writers. *Journal of Educational Psychology, 76*(5), 820-834.

Bereiter, C., & Scardamalia, M. (1994). *The psychology of written composition*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Blok, H. (1986). Essay rating by the comparison method. *Tijdschrift voor Onderwijsresearch, 11*, 168-176. [*Journal for Educational Research*]

Castley, A. (1998). *Practical Spelling*. New York: Learning Express.

Chenoweth, N. A., & Hayes, J. R. (2001). Fluency in writing. Generating text in L1 and L2. *Written Communication, 18*(1), 80-98.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cumming, A. (2001). Learning to write in a second language: two decades of research. In R. Manchon (Ed.), *Writing in the L2 classroom: Issues in research and pedagogy* (to appear).

Engber, C. A. (1995). The relationship of lexical proficiency to the quality of ESL compositions. *Journal of Second Language Writing, 4*(2), 139-155.

Fayol, M. (1999). From on-line management problems to strategies in written composition. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing. Processing capacity and working memory in text production* (pp. 13-23). Amsterdam: Amsterdam University Press.

Flower, L. S., & Hayes, J. R. (1980). The dynamics of composing: Making plans and juggling constraints. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 31-50). Hillsdale, NJ: Lawrence Erlbaum Associates.

Flower, L. S., & Hayes, J. R. (1983). *A cognitive model of the writing process in adults*.: ERIC Document Reproduction Service No. ED 240608.

Grabe, W. (2001). Notes towards a theory of second language writing. In T. Silva & P. K. Matsuda (Eds.), *On second language writing* (pp. 39-57). Mahwah, NJ: Lawrence Erlbaum Associates.

Grabe, W., & Kaplan, R. B. (1996). *Theory & practice of writing. An applied linguistic perspective*. London and New York: Longman.

Gulliksen, H. (1950). *Theory of mental tests*. New York: Wiley.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories,*

methods, individual differences and applications (pp. 1-27). Mahwah, NJ: Lawrence Erlbaum Associates.

Hazenberg, S., & Hulstijn, J. H. (1996). Defining a minimal receptive second-language vocabulary for non-native university students: An empirical investigation. *Applied Linguistics, 17*(2), 145-163.

Hox, J. J. (1999). A review of current software for handling missing data. *Kwantitatieve Methoden, 62*, 123-138. [*Quantative Methods*]

Jones, S., & Tetroe, J. (1987). Composing in a second language. In A. Matsuhashi (Ed.), *Writing in real time. Modelling production processes* (pp. 34-57). Norwood, NJ: Ablex Publishing Corporation.

Jöreskog, K., & Sörbom, D. (1996a). *LISREL 8: User's reference guide.* Chicago, IL: Scientific Software International, Inc.

Jöreskog, K., & Sörbom, D. (1996b). *PRELIS 2: User's reference guide. A program for multivariate data screening and data summarization; a preprocessor for LISREL*. Chicago, IL: Scientific Software International, Inc.

Kellogg, R. T. (1996). A model of working memory in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 57-71). Mahwah, NJ: Lawrence Erlbaum Associates.

Kellogg, R. T. (1999). Components of working memory in text production. In M. Torrance & G. C. Jeffery (Eds.), *The cognitive demands of writing. Processing capacity and working memory in text production* (pp. 43-61). Amsterdam: Amsterdam University Press.

Koda, K. (1999). Development of L2 intraword orthographic sensitivity and decoding skills. *Modern Language Journal, 83*(1), 51-64.

Laufer, B., & Nation, P. (1995). Vocabulary size and use: Lexical richness in L2 written production. *Applied Linguistics, 16*(3), 307-322.

Lea, J., & Levy, C. M. (1999). Working memory as a resource in the writing process. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing. Processing capacity and working memory in text production* (pp. 63-82). Amsterdam: Amsterdam University Press.

Levy, C. M., & Marek, P. (1999). Testing components of Kellogg's multicomponent model of working memory in writing: The role of the phonological loop. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing. Processing capacity and working memory in text production* (pp. 25-41). Amsterdam: Amsterdam University Press.

McCutchen, D. (1996). A capacity theory of writing: Working memory in composition. *Educational Psychology Review, 8*(3), 299-325.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*(1), 13-23.

McCutchen, D., Covill, A., Hoyne, S. H., & Mildes, K. (1994). Individual differences in writing: Implications of translating fluency. *Journal of Educational Psychology, 86*(2), 256-266.

Penningroth, S. L., & Rosenberg, S. (1995). Effects of a high information processing load on the writing process and the story written. *Applied Psycholinguistics, 16*, 189-210.

Ransdell, S., & Levy, C. M. (1999). Writing, reading, and speaking memory spans and the importance of resource flexibility. In M. Torrance & G. C. Jefferey (Eds.), *The cognitive demands of writing. Processing capacity and working*

memory in text production (Vol. 3, pp. 99-113). Amsterdam: Amsterdam University Press.

Raykov, T., & Marcoulides, G. A. (2000). *A first course in structural equation modeling*. Mahwah, NJ & London: Lawrence Erlbaum Associates.

Sasaki, M., & Hirose, K. (1996). Explanatory variables for EFL students' expository writing. *Language Learning, 46*(1), 137-174.

Schoonen, R., & Glopper, K. d. (1996). Writing performance and knowledge about writing. In G. Rijlaarsdam & H. v. d. Bergh & M. Couzijn (Eds.), *Theories, models and methodology in writing research* (pp. 87-107). Amsterdam: Amsterdam University Press.

Schoonen, R., Hulstijn, J., & Bossers, B. (1998). Language-dependent and language-independent knowledge in native and foreign language reading comprehension. An empirical study among Dutch students in grades 6, 8 and 10. *Language Learning, 48*(1), 71-106.

Schoonen, R., Van Gelderen, A., De Glopper, K., Hulstijn, J., Snellings, P., Simis, A., & Stevenson, M. (2002). Linguistic knowledge, metacognitive knowledge and retrieval speed in L1, L2 and EFL writing. A structural equation modelling approach. In S. Ransdell & M.-L. Barbier (Eds.), New directions for research in L2 writing (pp. 101-122). Dordrecht, etc.: Kluwer Academic Publishers.

Snellings, P., Van Gelderen, A. & De Glopper, K. (2002, in press). Lexical retrieval: an aspect of fluent second language production that can be enhanced. *Language Learning*

Sparks, R. L., Ganschow, L., Patton, J., Artzer, M., Siebenhar, D., & Plageman, M. (1997). Prediction of foreign language proficiency. *Journal of Educational Psychology, 89*(3), 549-561.

Stanovich, K. E. (1991). Word recognition: Changing perspectives. In R. Barr & M. L. Kamil & P. B. Mosenthal & P. D. Pearson (Eds.), *Handbook of reading research* (Vol. II, pp. 418-452). New York/London: Longman.

Stevenson, M., Schoonen, R., & De Glopper, K. (submitted) Inhibition or compensation? A multi-dimensional comparison of reading processes in Dutch and English.

Tabachnick, B. G. & Fidell, L.S. (1996). *Using multivariate statistics* (3rd ed.). New York: HarperCollins College Publishers.

Torrance, M., & Jeffery, G. (1999). Writing processes and cognitive demands. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing. Processing capacity and working memory in text production* (pp. 1-11). Amsterdam: Amsterdam University Press.

Victori, M. (1999). An analysis of writing knowledge in EFL composing: a case study of two effective and two less effective writers. *System, 27*, 537-555.

Whalen, K., & Ménard, N. (1995). L1 and L2 writers' strategic and linguistic knowledge: a model of multiple-level discourse processing. *Language Learning, 44*(3), 381-418.

AUTHORS' NOTE

Rob Schoonen and Jan Hulstijn, Department of Second Language Acquisition, Faculty of Humanities of the University of Amsterdam; Amos van Gelderen, Annegien Simis, Patrick Snellings, Marie Stevenson, SCO-Kohnstamm Institute for Educational Research, Faculty of Social and Behavioural Sciences of the University of Amsterdam; Kees de Glopper, Department of Language and Communication, Faculty of Letters of the University of Groningen.

The Netherlands Organization for Scientific Research (NWO) is gratefully acknowledged for funding this research project. The authors also wish to thank the schools and students that participated in this study as well as the test assistants who collected the data. We would like to thank Fred Marschall who provided us with some of the drawings for the lexical retrieval tests. Finally, we would like to thank the three anonymous reviewers for their comments on an earlier draft of this article.

Correspondence concerning this article may be addressed to Rob Schoonen, Dept. of Second Language Acquisition, Faculty of Humanities, University of Amsterdam, Spuistraat 210, 1012 VT Amsterdam, the Netherlands. E-mail: rob.schoonen@hum.uva.nl

Table 1. Descriptives for the L1 Dutch and L2 English tests: Mean, standard deviation, reliability and number of items (*N*=281).

	Means (standard deviation)		Reliability (number of items)	
	Dutch	English	Dutch	English
Writing Proficiency	298.8	295.7	.65	.80
(Scale mean is 300)	(19.5)	(24.7)	(3 assign.)	(3 assign.)
Vocabulary Knowledge	51.0	51.8	.89	.90
	(9.7)	(9.8)	(75)	(65)
Grammatical Knowledge	49.6	43.7	.88	.95
	(8.7)	(16.2)	(69)	(80)
Orthographic knowledge	70.8	48.8	.89	.93
	(11.2)	(13.1)	(100)	(89)
Metacognitive knowledge	61.6		.81	
(not language specific)	(7.3)		(80)	
Speed of Lexical Retrieval[a]	1826	2205	.77	.74
(RTs in ms)	(287)	(425)	(38)	(18)
Speed of Sentence Building	1938	2344	.95	.93
(RTs in ms)	(318)	(464)	(32)	(24)

Note. Maximum possible score equals the number of items, except for Writing Proficiency and the speed measures. Different scales prevents comparison of the means across the languages. Reliabilities are estimated under model 1 (see Table 2 and text)[6].

[a] In the subsequent SEM analyses, the Lexical Retrieval response times were corrected for Typing Fluency; Typing Fluency was partialled and the residuals were used as indicators of Lexical Retrieval speed. The mean residual is (by definition) 0.

[6] Some of the reliabilities are slightly different from the ones reported in (Schoonen et al., 2002), because those reliabilities were estimated under a different model. But generally speaking, the estimates are quite stable.

Table 2. Model fit indices for modeling Writing Proficiency: Chi-square (χ^2) and the degrees of freedom (*df*), Root Mean Square Error of Approximation (*RMSEA*), Non-Normed Fit Index (*NNFI*) and the Expected Cross-Validation Index (*ECVI*); *N*=281.

	Model fit indices				
Models	χ^2	*df*	*RMSEA*	*NNFI*	*ECVI*
1. Basic model (cf. Figure1)	525.76*	282	.052	.95	2.66
2. Basic model with equal regressions in L1 and L2	561.89*	288	.054	.94	2.72
difference between model 2 and 1	36.13*	6			
3. Basic model without regressions on Speed variables	527.25*	286	.052	.95	2.64
difference between model 3 and 1	1.49	4			
4. Basic model without regressions on Knowledge variables	684.78*	290	.068	.92	3.22
difference between model 4 and 1	159.02*	8			
5. Basic model with additional regression of L2 on L1	519.40*	281	.051	.95	2.64
difference between model 1 and 5	6.36*	1			

** Statistically significant at p=.05*

Table 3 Correlations between (latent) Writing Proficiency in L1 and L2, respectively, and the corresponding component variables under the Basic model (Figure 1).

	Metacognitive Knowledge	Vocabulary Knowledge	Grammatical Knowledge	Orthographic Knowledge	Lexical Retrieval	Sentence Building	L1 Writing Proficiency
Dutch L1 Writing Proficiency	.67	.47	.63	.58	-.10	-.48	-
English L2 Writing Proficiency	.73	.63	.84	.85	-.38	-.60	.93

Note. Only within language correlations are reported, for example, Dutch Vocabulary with Dutch Writing Proficiency (*r*=.47) and English Vocabulary with English Writing Proficiency (*r*=.63); Metacognitive Knowledge is one and the same general test. The final column provides the correlation between the two dependent variables: Dutch and English Writing Proficiency.

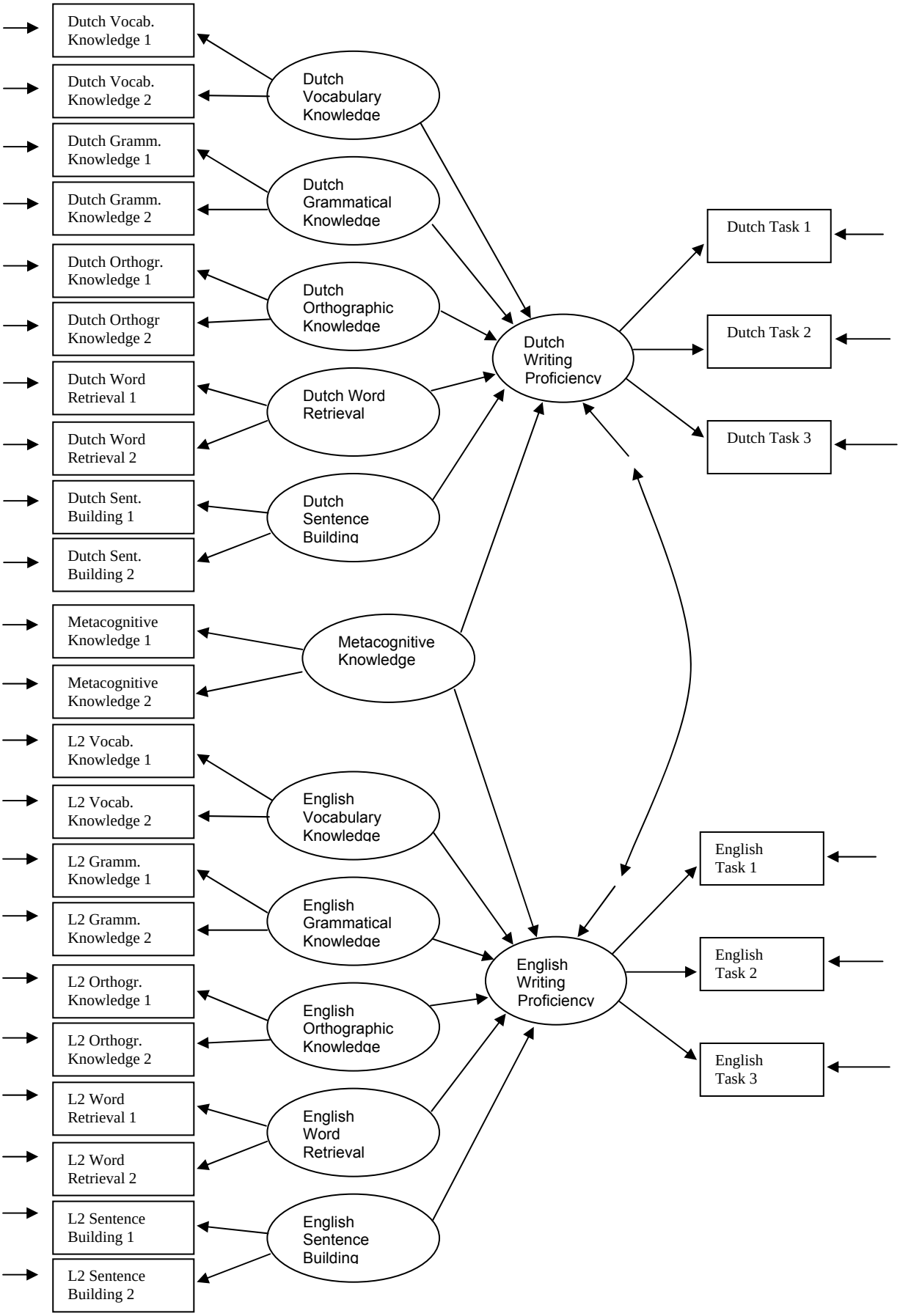
Correlations can be considered 'true' correlations (i.e., not attenuated by measurement error).

Table 4 Unstandardized (B) and standardized (β) regression weights for (latent) Writing Proficiency in L1 and L2, on the corresponding component variables, for two different models. Standard errors for the unstandardized regression weights between brackets.

	Basic model 1				Model 5			
	Dutch L1 Writing Proficiency		English L2 Writing Proficiency		Dutch L1 Writing Proficiency		English L2 Writing Proficiency	
	B	β	B	β	B	β	B	β
Metacognitive	.93*	.61*	.49*	.22*	.75*	.44*	.01	.00
Knowledge	(.25)		(.16)		(.25)		(.19)	
Vocabulary	-.53*	-.35*	.13	.06	-.38*	-.29*	.23	.15
Knowledge	(.22)		(.17)		(.19)		(.12)	
Grammatical	.32	.21	.60*	.27*	.59*	.43*	.21*	.22*
Knowledge	(.18)		(.27)		(.18)		(.10)	
Orthographic	.38*	.25*	.90*	.40*	.13	.13	.28*	.25*
Knowledge	(.16)		(.23)		(.12)		(.11)	
Lexical	-.06	-.04	-.06	-.02	.05	.01	-.11	-.05
Retrieval	(.12)		(.11)		(.28)		(.11)	
Sentence	-.09	-.06	-.11	-.05	-.20	-.11	-.03	-.02
Building	(.11)		(.12)		(.15)		(.08)	
L1 Writing	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.66*	.49*
Proficiency							(.20)	
% variance explained	56%		80%		57%		100%	

* Statistically significant contribution (p<.05), i.e. unstandardized regression weight is larger than 1.96 times its standard error. If the unstandardized regression weight is statistically significant this also goes with the standardized regression weight.

Figure 1. Basic model for Dutch L1 and English L2 Writing Proficiency; ovals refer to latent variables, squares are observed variables.



Appendix 1: Sample test items

- VOCABULARY (English test)

1. That's important news.

	important is:	[literal translation of the Dutch alternatives]
⇒	a. belangrijk	[significant]
	b. interessant	[interesting)
	c. opwindend	[exciting]
	d. saai	[boring]

- ORTHOGRAPHIC KNOWLEDGE (English test)

He likes e___s. (g) ⇒ gg

- GRAMMATICAL KNOWLEDGE (English test)

She never ____ (listen) to me. ⇒listens

- METACOGNITIVE KNOWLEDGE [literal translation from Dutch]

28. The order in which you present the information in your text is usually not relevant.

agree

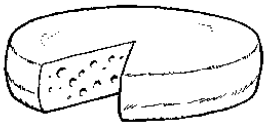
⇒ don't agree

55. It is wise to keep the organization of the text in mind while writing.

⇒ agree

don't agree

SPEED OF LEXICAL RETRIEVAL (RT)



⇒C [cheese]

SPEED OF SENTENCE BUILDING (RT)

We think that….

1. is alright ⇒2. it