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Schoonen, R.; Hulstijn, J.; Bossers, B.

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**Metacognitive and Language-specific Knowledge in Native and Foreign Language
Reading Comprehension
An Empirical Study among Dutch Students in Grades 6, 8 and 10**

Rob Schoonen

*SCO-Kohnstamm Institute for Educational Research and
Dept. of General Linguistics, University of Amsterdam*

Jan Hulstijn

Free University, Amsterdam

Bart Bossers

*Free University, Amsterdam and
National Institute for Educational Measurement (Cito), Arnhem*

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~~Correspondence concerning this article may be addressed to Rob Schoonen, SCO-Kohnstamm Institute for Educational Research, Faculty of Educational Sciences, University of Amsterdam, Wibautstraat 4, 1091 GM Amsterdam, the Netherlands. Telephone: +31.20.5251352. Fax: +31.20.5251300. E-mail: rob@educ.uva.nl.~~

Metacognitive and Language-specific knowledge in native and foreign language reading comprehension. An empirical study among Dutch students in grades 6, 8 and 10

ABSTRACT

This paper gives the results of a study among a large number of students in grades 6, 8 and 10 in the Netherlands who were administered grade-appropriate measures of reading comprehension and vocabulary knowledge in their native language (NL) as well as, in grades 8 and 10, in English as a foreign language (FL). Furthermore, all students were administered the same questionnaire of (four components of) metacognitive knowledge of reading. The aim of the study was to explore the relative contributions to NL and FL reading comprehension of a more language-specific predictor (vocabulary knowledge) and of general metacognitive knowledge.

Results of analyses of covariance structure show that metacognitive knowledge was not entirely implicated in vocabulary knowledge, demonstrating that, for older students (grades 8 and 10) metacognitive knowledge appears to play a significant role in both NL and FL reading comprehension. These findings suggest that, in the educational setting investigated in this study, poorer students in grade 6 to 8, not having spontaneously acquired metacognitive knowledge of reading stand a good chance of profiting from instruction of this type of knowledge.

Furthermore, evidence was found of the so-called threshold hypothesis according to which (metacognitive) knowledge of reading strategies, reading goals and text characteristics cannot compensate for a lack of language-specific knowledge if the latter remains below a certain threshold level. The limited FL knowledge is said to 'short-circuit' the transfer of reading skills to the FL.

Introduction

The issue of the relation between NL (native or first language) and FL (foreign or second language)¹ reading comprehension has been a matter of theoretical debate in many recent publications, for instance Coady (1979), Alderson (1984), or Carrell (1988). Empirical studies, such as Bernhardt and Kamil (1995), Clarke (1979), Carrell (1991), Hacquebord (1989), Bossers (1991, 1992) and Taillefer (1996), sought to identify the principal sources of FL reading comprehension problems. These studies distinguished two major factors responsible for differences in comprehension: a *language-specific* factor, namely FL knowledge (generally indicated by some kind of FL vocabulary or FL grammar test), and a factor that is presumed to represent some sort of *common* underlying ability of reading in general, usually called 'reading ability'. In the studies mentioned above, NL reading comprehension was used as a measure of this ability. The outcomes of those empirical studies provided an indication of how FL knowledge and NL reading ability contribute to FL reading comprehension at one particular stage of the FL acquisition process. The present study adds supplementary results to these studies by revealing developmental patterns in FL reading ability, and by specifying some skills and knowledge that may be important components of this unspecified factor 'NL reading ability'.

Why should one in fact claim a positive relation between NL and FL reading ability? The reason for this claim is that *general* reading skills are assumed to constitute an important part of one's reading ability. Such skills are general in the sense that they underly both NL and FL reading. Goodman (1971, p.140), for instance, claimed that reading is "much the same for all languages with minor variations to accommodate the specific characteristics of the orthography used and the grammatical structure of the language" (Goodman, 1971, p. 140). This means that readers, once they have acquired such skills (usually in the NL), merely have to transfer them to similar tasks in the foreign or second language(s). Transfer of such skills cannot but result in a firm, positive

correlation between NL and FL reading comprehension; obviously, good NL readers would then be good FL readers as well.

However, the relation between NL and FL reading performance revealed by a number of studies is only modest. The following correlation coefficients (r) are reported: Bernhardt and Kamil (1995) r between .20 and .53; Bossers (1991, 1992) $r = .59$; Clarke (1979) $r = .53$; and Hacquebord (1989) $r = .40$ (see also Carrell, 1991).² Additional data reported by Taillefer (1996) show that the relation between NL and FL reading performance varies according to the complexity of the reading task: The correlation is modest between NL and FL *scanning*, but very low between NL and FL *receptive* reading, the latter being a more demanding task. Generally, the impact of FL proficiency far outweighed that of NL reading. Such results seem to warrant the conclusion that transfer of reading skills is hindered by a limited knowledge of the foreign (or second) language.

A serious problem concerning the interpretation of studies which entered NL reading into a prediction model for FL reading performance is, that the factor 'NL reading' is a complex predictor in itself. It is important to realize that NL reading is not just a synonym for the 'general reading skills' mentioned above, as NL-specific knowledge (NL vocabulary knowledge in particular) appears to be an important predictor of NL reading comprehension (e.g. Anderson & Freebody, 1985). Thus, NL reading too is underpinned by both language-specific knowledge and more language-independent or general reading skills.

Hence, we need to unravel the variable 'NL reading' into more language-specific knowledge on the one hand, and more general reading skills on the other. The latter skills are potential candidates for transfer, the former are not or only to a limited extent.

The present study used a NL vocabulary test to tap this language-specific knowledge, and a metacognitive knowledge test (divided into four subcomponents) to tap more general, transferable reading ability. Since the metacognitive knowledge test was assumed to tap a general reading ability, it could be used to tap the same ability in FL-reading. It thus permits a determination of how

various general reading skills and strategies are related to NL *and* FL reading performance. A point of interest here is the *difference* in importance of (various components of) metacognitive knowledge of reading to NL and FL reading performance. For instance, if a particular aspect of metacognition - say 'strategic knowledge' - is responsible for differences in NL reading performance but not for differences in FL reading performance, we would have an indication of which aspect of metacognitive knowledge did not transfer from NL to FL reading. This may provide important information with regard to FL reading instruction in the classroom.³

Following Alexander, Schallert & Hare (1991), we define metacognition as knowledge about one's cognition (*knowing that*) and about the regulation of that cognition (*knowing how*). Alexander et al. subdivide metacognitive knowledge into four dimensions:

1. *Self knowledge*: perceptions or understandings of one self as learner or thinker.
2. *Task knowledge*: analyses of the cognitive demands of a task.
3. *Strategic knowledge*: knowledge of processes that are effortful, planful, and consciously invoked to facilitate the acquisition and utilization of knowledge. This component includes both cognitive and metacognitive strategies, the former referring to strategies that contribute directly to the solution of a problem, and the latter to the evaluation and monitoring how well the selected cognitive strategy was working.
4. *Plans and goals*: knowledge of the goals that may be established and the general plans that may be invoked. The first three dimensions "are directly aligned to the goals learners establish or the general plans that they have internalized for themselves" (p. 329).

In the context of reading, metacognitive knowledge should be understood as readers' assessment of themselves as readers and their knowledge and control of strategies for the processing of, and the learning from text, both in relation to the complexity of the task at hand and the goals and plans that guide the reading process. Baker and Brown (1984), among others, have

pointed out that readers who have enhanced their awareness of the nature of reading, and of their own reading strategies, are better readers than those who have not. That is why readers should be made aware of "the importance of employing problem-solving, trouble shooting routines to enhance understanding", which include basic strategies for reading and remembering (Baker & Brown, 1984, p. 376). In order to find out at which age or grade level students would be most amenable to the instruction of reading strategies, one would like to know to what extent students at different grade levels do already possess which components of metacognitive knowledge of reading.

The Study

The present study was part of a larger project, conducted in the Netherlands, on transfer of language skills. Two other studies in this project, Oostdam and Rijlaarsdam (1995) and De Glopper, Schouten-van Parreren and Van Daalen-Kapteijns (1993) focused on, respectively, instruction of metacognitive reading skills in the mother-tongue curriculum and instruction of vocabulary learning skills. The aim of the present study was to find out at which grade and academic level it would be most appropriate to implement a reading strategies instructional program. This was done by exploring how the still obscure relation between NL and FL reading proficiency is mediated by more language-specific knowledge (as indicated by NL and FL vocabulary knowledge) and by more general reading skills (as indicated by four components of metacognitive knowledge) at various grades, as displayed in Figure 1. Data collection took place in the 1992/1993 school year.

Insert FIGURE 1 here

Figure 1. Relationships between reading comprehension and vocabulary knowledge and four components of metacognitive knowledge.

This study focused on the following research questions:

- Question 1: What are the relative contributions to NL reading comprehension of NL vocabulary knowledge and metacognition⁴ in grades 6, 8 and 10? Is the contribution of metacognition to NL reading comprehension liable to change across grades (6, 8 and 10)?
- Question 2: What are the relative contributions to FL reading comprehension of FL vocabulary knowledge and metacognition in grades 8 and 10? Is the contribution of metacognition to FL reading comprehension liable to change across grades (8 and 10)?

Answering research questions 1 and 2 constituted the main goals of our study, as these questions pertained to the project's main issue of when, i.e. in which grade, instruction of metacognitive knowledge and strategies might be most effective. In addition, however, we aimed to explore the nature of the relation between NL and FL reading, by investigating the mediating role vocabulary knowledge (NL and FL) and metacognition play. The following research questions pertain to this issue:

- Question 3: Are the contributions of more language specific and more general reading skills the same for FL reading as they are for NL reading?
- Question 4: To what extent is the correlation between NL and FL reading mediated by metacognitive knowledge?

Method

Students

Students were sampled from three age groups: the final year of primary education, i.e. grade 6 (students of about 12 years old) and the second and fourth year of secondary education, i.e. grades 8 and 10 (students of about 14 and 16 years old, respectively). In grades 8 and 10 (secondary education), students were sampled from the four major streams in the Dutch educational system: lower vocational education through pre-academic education. Students of grade 6, 8 and 10 are in their first, third and fifth year of EFL instruction, respectively.

A total of 685 students participated in our study, one way or another. A substantial number of them missed one or more tests due to absence during testing days, and a number of students had to be excluded from data-analysis because their tests or questionnaires were incomplete. Only 416 students had completed all (items of) tests and questionnaires.⁵ Some students occasionally skipped individual items in questionnaires or tests, these items were scored as 'wrong answer'. Including this latter group of students enables us to report on 488 students of grades 6, 8 and 10 who performed the NL reading comprehension, NL vocabulary and the metacognition tasks; 274 students in grades 8 and 10 also performed the FL (English) reading and vocabulary tasks. Table 1 shows the number of students with respect to their age and the foreign language tests they completed.⁶

Insert TABLE 1 here

Materials and procedures

In this section we describe the measures used in the study. Since the test of metacognition was especially designed for this project, we describe this measure in some detail. The tests for reading comprehension and vocabulary knowledge are described only briefly, as they were rather conventional tests. All measures were pretested and modified on the basis of the pretest results. Testing took place in several sessions during two (grade 6) or three (grades 8 and 10) nonconsecutive school days.

Metacognition

Metacognitive knowledge in all three grades was measured by means of a questionnaire. Its design was not modeled after any particular example found in the literature, but aimed to use the ideas found in the literature deemed most appropriate for our purposes (Alexander et al., 1991; Baker & Brown, 1984; Fischer & Mandl, 1984; Garner, 1987; Paris and Jacobs, 1984). Four domains of metacognitive knowledge were covered. The items of these four parts together were distributed over two test booklets⁷. This enabled the administration of half of the test on the first testing day and the other on the second.

1. Assessment of oneself as a reader.

This part of the test consisted of three clusters of questions. Cluster 1 concerned the question 'How well do you understand school texts related to the content area X, if there is no time limit?', where X stands for Dutch, geography, history, and biology. The questions in cluster 2 had a somewhat different phrasing: 'If you don't understand a text on/in X at first reading, are you still able to overcome this difficulty if you take some extra time?' Thirteen questions in cluster 3 were not related to content areas but to reading activities, e.g. 'How well can you infer the meaning of an unknown word?' The reading activities questioned were related to lexical, syntactic and discourse

levels; memorizing and monitoring were also questioned. Questions had to be answered on four-point scales, such as: very good, reasonably well, not so well, I don't know (clusters 1 and 3); or: very often, sometimes, seldom, I don't know (cluster 2). The maximum score for this part of the metacognition measure was 63.

2. Knowledge of reading goals and comprehension criteria.

This part consisted of three open-ended questions: (1) What are the most important things (parts or characteristics) of a text you need to know in order to be able to say that you have understood it well? List the five most important things. (2) When do you understand a paragraph well? Which things (parts or characteristics) of a paragraph do you need to know for that purpose? Write down the four most important things. (3) When you begin to read a text, you would normally want to understand it well. During reading, you will therefore monitor your text comprehension. Write down the four most important activities you would perform in order to check for text comprehension.

Students' responses pertained to punctuation, words, sentences, paragraphs, chapters, the text as a whole, reading speed, and relationship with the reader's knowledge. One point was given for an adequate answer. In scoring the responses a lenient criterion was applied, i.e. every response that to our judgment showed knowledge of reading goals and comprehension criteria was rewarded with one point. The maximum score for this part of the metacognition measure was 13.

3. Knowledge of text characteristics.

This part of the questionnaire contained six questions probing students' knowledge of the function of paragraphs and introductions (three questions each). Item 7 was a request to write down five helpful indicators to understand text structure and organization. Item 8 offered 30 stimulus sentences, for each of which students had to establish whether it contained a structural marker (e.g. 'for example' or 'in sum'), and if so which one. In item 9, students had to underline text

structure markers in a two-page text, containing 32 markers. The maximum score for this part of the metacognition measure was 74 points.

4. Knowledge of reading strategies.

This part of the questionnaire consisted of 24 items. The first 15 of these were open-ended questions, asking students how a reading problem could best be solved. The problems pertained to word, sentence and discourse levels. For example at the sentence level: 'A text contains long complex sentences which you don't understand after one reading. You are familiar with all the words from the sentences. What is the best thing you as a reader can do to understand those sentences?'. Seven reading experts judged the adequacy of the strategies mentioned by the students, on a three-point scale. A student's response was credited with zero points when at least four experts deemed it inadequate, with two points when at least four experts deemed it adequate, and with one point for a judgment in between. The experts' judgments were used to scale the responses on a three-point scale and therefore no interrater reliability estimates were made.

The nine remaining items had a multiple choice format. They questioned the adequacy of various reading strategies to solve particular reading problems. Students had to choose between an adequate strategy (1 point), a less adequate strategy (.5 point) and an inadequate strategy (0 points).

The maximum score for this part of the metacognition measure was 39 points.

Table 2 provides descriptive statistics for each part of the metacognition measure and for each grade level. Reliability estimates are made using the covariance structure analyses to be described in the next section (cf. Fleishman & Benson, 1987).

Since all students responded to the same questionnaire the scores in Table 2 can be compared across grade levels. It shows that for three of the four parts there seems to be a (cross-sectional) development: older students gain higher scores than younger ones. This development can

be taken as an indication of the questionnaire's validity. The exception to the developmental trends is the *assessment of oneself as a reader*. This exception makes sense in that students probably assess themselves as readers by taking their age group as a point of reference. So, it may not be surprising that the averages of the three age groups do not show a developmental trend.

Insert TABLE 2 here

Generally speaking, all four measures of metacognitive knowledge (including *assessment of oneself as a reader*) are also susceptible to differences in educational level (streams) within grade (Neuvel, Bossers, Schoonen & Hulstijn, 1993), which further supports the measures' known-group validity (Kerlinger, 1973). An exception in this respect was *knowledge of reading goals and comprehension criteria* at grade 6; in this case all students show very little knowledge.

Most measures show satisfactory reliabilities at all grade levels. The measurement of *knowledge of reading goals and comprehension criteria* was less satisfactory, especially at grade 6 due to a floor effect.

Reading comprehension

Reading comprehension in Dutch and English was measured using standardized multiple-choice testing materials developed by the Dutch National Institute for Educational Measurement (Cito) and from an international research project, the so-called International Educational Assessment (IEA) Reading Literacy Study (Elley, 1992), in which the SCO-Kohnstamm Institute participated. Each reading test involved a number of narrative as well as expository texts of different lengths. To allow for grade appropriate and reliable testing, different testing materials were used for the three grades, so in contrast to the measurement of metacognitive knowledge,

scores cannot be compared across grade levels. Table 3 provides descriptive statistics of the reading comprehension measures. The reliability estimates proved to be satisfactory.

Insert TABLE 3 here

Vocabulary Knowledge

All NL and FL vocabulary tests were developed by De Glopper et al. (1993 and 1997). Vocabulary knowledge in NL (Dutch) was measured in a multiple-choice format. Target words were presented in short carrier sentences. Four alternative words were given, one of which provided a correct synonym of the target word. To allow for grade appropriate and reliable testing, different testing materials were used for the three grade levels impeding comparisons across age.

Insert TABLE 4 here

Vocabulary knowledge of English was measured in a translation format. A target word (underlined) was presented in a short carrier sentence. Beneath it, the Dutch translation of the sentence was then given with an open space where students had to fill in the translation of the target word. Responses were credited with 0, 0.5 or 1 point per item. The scoring guide was developed and tested by two researchers till they reached a high level of agreement. Then, the scoring was done by one of them. Again, to allow for grade appropriate and reliable testing, different items were used in the English vocabulary tests of grades 8 and 10.

Table 4 provides descriptive statistics of the vocabulary measures. The reliability estimates show that the vocabulary tests were highly reliable ($r_{xx} > .90$).

Analysis

Our research questions concern the (cor)relations between dependent (NL and FL reading) and independent variables (metacognitive knowledge and NL and FL vocabulary knowledge). These relations can be studied using covariance structure analyses with latent variables (Bollen, 1989; Jöreskog & Sörbom, 1993). In such analyses the differences in reliability of measures are taken into account by partialling out the error variance, before performing the correlational analyses. The variables with the error variance partialled out are referred to as 'latent variables'. The correlations or regressions of interest are postulated between these (hypothesized) latent variables. Each latent variable should at least have two indicators (i.e. observed variables). To this end, all (observed) measures were split up into two parallel parts, providing two indicators for each latent variable⁸. The loadings of the observed variables on the latent variable can be used to estimate the reliability of the measurement (Fleishman & Benson, 1987). These estimates are reported in Tables 2, 3 and 4.

The statistical significance of relations between the latent variables (correlations or regressions) can be tested by comparing the fit of two competing models, one postulating a regression and one postulating zero-regression. In the same vein, the equality of regression weights, either within one sample for different predictors or between samples for the same predictor, can also be tested statistically by comparing the fit of two models, one postulating equal regressions and one without such a restriction.

Since the students of the three grade levels did not perform the same reading and vocabulary tests, separate regression models should be tested. However, in LISREL covariance structures can be analyzed simultaneously in multiple samples with some or all parameters constrained to be equal across samples (Jöreskog & Sörbom, 1993).

The theoretical model (Figure 1) can now be extended to describe the structure of our data (see Figure 2). The results presented here pertain to the latent variables in the (theoretical) model.

Relations between these latent variables should be understood as 'true' correlations or regressions, i.e. not attenuated by measurement error (cf. Jöreskog & Sörbom, 1993).

Insert FIGURE 2 here

Figure 2. Relationships between reading comprehension and vocabulary knowledge and four components of metacognitive knowledge: the latent variables represented by circles and the observed variables (split parts of the tests) represented by boxes.

Note. Predictors can be correlated which is not shown in the figure.

Results

In this section we will present the estimated regressions (β) that go with the arrows between the latent variables in the general model (Figure 2), first for NL reading comprehension and then for FL reading comprehension (cf. Questions 1 and 2).

NL Reading Comprehension

Our first research question pertained to the relative contributions to NL reading comprehension of NL vocabulary knowledge and metacognition in grades 6, 8 and 10. In Table 5, we report on the regression of NL reading comprehension on vocabulary and metacognitive knowledge, respectively. The fit of the models is also reported in Table 5.

The regression weights are estimated simultaneously, and should be interpreted as the regression of the dependent variable on the independent one, with the other independent variables partialled out. Thus, a low regression weight not necessarily means a low correlation between reading comprehension and the predictor.

 Insert TABLE 5 here

Almost two thirds of the (true score) variance in the NL reading comprehension can be explained by vocabulary and metacognitive knowledge: at grade 6 64%, at grade 8 62% and at grade 10 65%. Although this seems a fair amount, it still leaves one third unexplained.

The contribution of metacognitive knowledge to the prediction of NL reading comprehension is modest, especially at grade 6, and different for the four components of metacognitive knowledge. One may even raise the question whether metacognitive knowledge as a whole *really* contributes to reading comprehension, beyond vocabulary knowledge. We tested the contribution of metacognitive knowledge multivariately by postulating an alternative model to the one shown in Figure 2. In the alternative model, the weights for the regression of NL reading comprehension on the four aspects of metacognitive knowledge are all set to be zero. Comparison of the fit of this latter model and the former one shows that, at grade 6, the fit hardly deteriorates, implying that the regression weights for metacognitive knowledge cannot be discerned from zero ($\chi^2(3)=4.86$, $p=.182$).⁹ In this analysis with vocabulary knowledge as the only predictor, vocabulary explains 60% of the variance in reading comprehension. At grades 8 and 10, fixing the regression weights at zero significantly diminishes the fit of the model ($\chi^2(4)=48.65$, $p=.000$ and $\chi^2(4)=36.49$, $p=.000$, respectively). In these analyses the amount of explained variance in reading comprehension drops with 17% at both grades: from 62% to 45% at grade 8 and from 65% to 48% at grade 10.

Another research question was whether the effects of the predictors indicating knowledge of the language on the one hand and general reading skills on the other changes with age. The data reported in Table 5 suggest an increasing influence of metacognitive knowledge with increasing age. To further test this suggestion, we performed a three-group-analysis in which the corresponding regression weights were assumed to be equal across the different age groups. The results of this analysis show that this assumption is not tenable. A model with the restriction of equal (corresponding) regression weights across the three groups fits the data significantly less well than a model without such a restriction ($\chi^2(10)=22.91$, $p=.011$).

In conclusion, predictors tend to differ across the age groups, but we consider the small impact of metacognitive knowledge on reading comprehension at grade 6 compared to the substantial impact it has at 8 and 10, most remarkable.

FL Reading Comprehension

Our second research question pertained to the relative contributions to FL reading comprehension of FL vocabulary knowledge and metacognition in grades 8 and 10. To explore this issue, we conducted again regression analyses with latent variables, analogous to the analyses for NL reading. The regression weights and the fit of the models can be found in Table 6.

Insert TABLE 6 here

Table 6 shows that FL vocabulary is the best predictor of FL reading comprehension in both grades, although at grade 10, where students have reached a relatively high level of English reading proficiency, the importance of vocabulary seems to decrease and the importance of

metacognitive knowledge seems to increase.

Again we tested whether the contribution of metacognitive knowledge (as a whole) was significant. Statistical tests for both grades showed that metacognitive knowledge contributes to FL reading comprehension: Fixing the regressions weights for the four metacognitive predictors at zero made the fit of models drop significantly ($\chi^2(4)=19.95$, $p=.001$ at grade 8, and $\chi^2(4)=29.50$, $p=.000$ at grade 10). The explained variance without metacognitive knowledge drops from 76% to 71% at grade 8 and from 60% to 35% at grade 10.

In the case of the FL, we only have the possibility to evaluate the (cross-sectional) development of the contributions of vocabulary and metacognitive knowledge to reading comprehension by comparing grades 8 and 10. Equating the corresponding regression weights to each other in a two-group-analysis of grades 8 and 10 diminishes the fit of the model ($\chi^2(5)=16.77$, $p=.005$). Thus, the contributions of the predictors indicating knowledge of the language on the one hand and general reading ability on the other, change from grade 8 to grade 10: the contribution of vocabulary decreases and that of knowledge of text characteristics and of reading strategies increases.

Relationship between NL and FL Reading Comprehension

In order to answer research question 3 and 4 about the relationship between NL and FL reading, we conducted analyses for which we combined the data of NL and FL reading comprehension. Both variables are assumed to be dependent on both more general (metacognitive) knowledge and more language-specific (vocabulary) knowledge. Two covariance matrixes were computed, one for grade 8 and one for grade 10, each matrix comprising the variables for NL- and FL-reading, NL- and FL-vocabulary, and the four components of metacognitive knowledge. The model under consideration is depicted in Figure 3. Reading comprehension is again regressed on

metacognitive knowledge and vocabulary knowledge.

 Insert FIGURE 3 here

Figure 3. Relationships between reading comprehension and vocabulary knowledge in NL and FL and four components of metacognitive knowledge.

Note. Predictors can be correlated which is not shown in the figure. For clarity's sake, the observed variables are also left out.

Comparison of contributions of predictors to NL and FL reading

The analyses conducted are similar to the analyses performed for the above research questions. The measurement model, i.e. the regression of the observed variables on the latent variables, was fixed to the parameters found in the former analyses. As not all students made both the NL and the FL tests, sample sizes slightly drop in the combined analyses (cf. Table 1). To answer research question 3, four models per grade level are fitted. The first one does not impose any equality constraint on the regressions for NL and FL reading on their predictors (β_1 thru β_5 and β_6 thru β_{10} , respectively), the second and third model (2a and 2b) assume equal regressions of NL and FL reading on metacognition (model 2a: $\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$) and on vocabulary (model 2b: $\beta_1=\beta_6$) respectively. The fourth model assumes equal regressions on all predictors ($\beta_1=\beta_6$, $\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$). The results of these analyses at grade 8 and 10 are shown in Table 7.

In general, the models seem to fit the data quite well statistically (χ^2 , df and p), although a substantial amount of (co)variance is left unaccounted for (see gfi and agfi).¹⁰ However, our main interest is the comparison between these different models.

At grade 8, it appears that constraining the regressions on metacognition of NL and FL reading to be equal does not significantly decrease the fit of the model (difference in fit between model 1 and 2a: $\chi^2(4)=5.13$, $p=.274$). However, constraining the regressions on vocabulary knowledge to be equal does significantly decrease the fit of the model (difference in fit between model 1 and 2b: $\chi^2(1)=27.91$, $p=.000$). This leads to the conclusion that the influence of vocabulary knowledge differs between NL and FL reading, whereas the influence of metacognitive knowledge does not.

Insert TABLE 7 here

At grade 10, the models explain a little less of (co)variance than at grade 8 (see $gfi/agfi$). However, the smaller sample size at grade 10 makes it harder to reject models statistically (see χ^2 , df and p).

Assuming different regressions on vocabulary knowledge of NL and FL reading hardly improves the model (model 1 vs model 2b, $\chi^2(1)=3.48$, $p=.062$). Constraining the regressions on metacognitive knowledge does slightly improve the fit (model 1 vs model 2a, $\chi^2(4)=10.48$, $p=.033$).

A comparison between the results of grade 8 and grade 10 shows that at grade 8 the role of vocabulary is clearly different in NL and FL reading: in FL reading at grade 8 vocabulary plays a major role, whereas in NL reading at grade 8 it plays a more modest role. The importance of metacognitive knowledge to reading is the same in both languages at this grade. At grade 10 the roles of both metacognitive and vocabulary knowledge in NL and FL reading seem to be more alike. At this grade level the component parts of FL reading are more or less the same as those of NL reading. The difference found with respect to metacognitive knowledge in NL and FL reading is rather small and balances on the edge of statistical significance. Another way to estimate differential effects of metacognitive and vocabulary knowledge in NL and FL reading is by

comparing model 2b versus model 3 and model 2a versus model 3, respectively. These comparisons show that the regression weights of vocabulary knowledge (at grade 10) can be considered to be the same ($\chi^2(1)=0.31$, $p=.578$); the regression weights of metacognitive knowledge are no more very different between NL and FL reading ($\chi^2(4)=7.41$, $p=.116$).

The Mediating Role of Metacognitive Knowledge

As was mentioned in the introduction, NL and FL reading are expected to correlate substantially, assuming that reading is "much the same for all languages" and, thus, involves general, relatively language-independent skills, at least according to one of the theoretical views on FL reading. In our design and analysis, we estimated the 'true' correlation between NL and FL reading comprehension, i.e. the correlation with measurement error partialled out. These 'true' correlations are generally higher than correlations estimated with observed variables.

To answer our fourth research question with respect to the correlation between NL and FL reading comprehension, we performed three analyses. First, we estimated the 'true' correlation between NL and FL reading comprehension within a model without any predictors of NL and FL reading comprehension. This correlation can be considered the aforementioned 'true' correlation between NL and FL reading comprehension as such. Secondly, we estimated the correlation between NL and FL reading comprehension after partialling out vocabulary knowledge in each language. This second estimate represents the 'overlap' in variance of NL and FL reading comprehension that cannot be explained by overlap of vocabulary knowledge of the respective languages. Thirdly, we performed the same analysis, but now metacognitive knowledge was partialled out of both NL and FL reading comprehension, thus revealing the correlation between NL and FL reading comprehension that cannot be explained by metacognitive knowledge. Vocabulary knowledge being the language-specific predictor, we do not expect the correlation to

drop between analysis 1 and 2. Metacognitive knowledge, on the other hand, is expected to be a common factor in NL and FL reading comprehension. Partialling out this factor should lower the correlation between NL and FL reading comprehension substantially (analysis 1 versus 3). Thus, the differences between the estimated correlations in analysis 1 on the one hand, and analyses 2 and 3 on the other hand, show the contribution of the respective predictors to the correlation between NL and FL reading comprehension.

The estimated correlations are shown in Table 8. The reader should be aware of the fact that only in the first analysis, when no predictors are involved, variances of NL and FL reading are standardized (at 1.0), and thus the estimate can be considered a 'correlation'. In analyses 2 and 3 the remaining variance of NL and of FL reading are both less than 1.0, due to the partialling out of the variance of the predictors. In these two latter analyses the estimates are estimates of covariance between (the remaining 'parts' of) FL and NL reading.

 Insert TABLE 8 here

As can be seen from Table 8, NL and FL reading comprehension correlate substantially, but not very highly; about 38% ($.61^2$ and $.62^2$) of the variance is common. Most remarkably, the introduction of the two language *specific* predictors (NL and FL vocabulary) makes the correlation drop substantially, implying that these two predictors are (strongly) correlated and/or explain variance *across* language. The 'remaining parts' of NL and FL reading comprehension (with vocabulary knowledge partialled out) covary hardly at grade 8 (.07) and somewhat more at grade 10 (.21). At grade 8, the common variance of NL and FL reading can to a large extent also be explained by metacognitive knowledge, as we hypothesized. At grade 10, metacognitive knowledge can even better 'explain' the correlation between FL and NL reading, partialling out this

knowledge makes the amount of common covariance drop from .62 to .07.

Vocabulary knowledge and metacognitive knowledge at grade 8 can both explain the correlation between NL and FL reading comprehension to a large extent. Partialling out either of these two factors makes the covariance between NL and FL reading almost disappear. In other words, NL and FL reading and NL and FL vocabulary knowledge and metacognitive knowledge all have the same overlap. At grade 10, NL and FL reading comprehension have variance in common that cannot be attributed to vocabulary knowledge, but can be attributed to metacognitive knowledge.

Summary of the Results

The Relative Contributions of Vocabulary and Metacognition to NL Reading

Our first research question was: What are the relative contributions to NL reading comprehension of NL vocabulary knowledge (as indicator of more language-specific knowledge) and metacognition (as indicator of more general reading ability) in grades 6, 8 and 10? Is the contribution of metacognition to NL reading comprehension liable to change as a function of age (grades)?

Taken together, the analyses (as shown in Table 5) give the following results:

- (1) NL vocabulary knowledge is an important predictor of NL reading comprehension and remains so at all three grades.
- (2) Of the four components of metacognitive knowledge, one component clearly showed increase across grades ('knowledge of text characteristics'). The other components seem to interchange in their roles of relevant predictors.
- (3) In secondary education (grades 8 and 10), metacognitive knowledge becomes more

important as an additional factor, explaining additional variance in NL reading comprehension, beyond vocabulary knowledge.

- (4) Of the four components of metacognition, knowledge of text characteristics and knowledge of reading strategies appear to be the more important ones.

The Relative Contributions of Vocabulary and Metacognition to FL Reading

Our second research question was: What are the relative contributions to FL reading comprehension of FL vocabulary knowledge (as indicator of more language-specific knowledge) and metacognition (as indicator of more general reading ability) in grades 8 and 10? The results of the analyses can be summarized as follows (cf. Table 6).

- (1) FL vocabulary knowledge again is an important predictor of FL reading comprehension, although its importance diminishes at grade 10 compared to grade 8.
- (2) Metacognitive knowledge is not entirely implicated in vocabulary knowledge, since it is capable of explaining additional variance in FL reading comprehension, beyond FL vocabulary knowledge.
- (3) Of the four components of metacognitive knowledge, knowledge of text characteristics, knowledge of reading strategies and, to a lesser extent, knowledge of reading goals and comprehension criteria appear to be the more important domains of metacognitive knowledge.

The Contributions of Vocabulary and Metacognition to NL Reading in Comparison to FL Reading

Our third research question was: Are the contributions of the factors indicating more language-specific knowledge and more general reading skills the same for FL reading as they are for NL reading? The results can be summarized as follows:

- (1) According to the most parsimonious and yet fitting model for the grade 8 data, the influence of vocabulary knowledge differs between NL and FL, whereas the influence of metacognition does not.
- (2) According to the most parsimonious and fitting model for the grade 10 data, the influence of vocabulary knowledge does not differ between NL and FL, and the influence of metacognition only marginally does.

The Mediating Role of Vocabulary and Metacognition in the Correlation between NL and FL Reading

Our fourth research question was: To what respect is the correlation between NL and FL reading mediated by metacognitive knowledge? The results can be summarized as follows:

- (1) Metacognitive knowledge can indeed (to a large degree) explain the *common* variance of NL and FL reading comprehension; at grade 10 it can explain a little more common variance than at grade 8.
- (2) Surprisingly, however, the NL and FL vocabulary factors can also explain a substantial amount of the *common* variance of NL and FL reading, especially at grade 8. At grade 10, the vocabulary factors can only partly explain the common variance of NL and FL reading. This finding suggests that vocabulary knowledge may not exclusively be considered as a largely language-specific factor, as we assumed when we planned our study.

Discussion and Conclusions

In this final section, we discuss our findings first from a theoretical and then from an educational perspective.

Theoretical Considerations

As was said in the introduction, earlier studies of FL reading comprehension sought to identify the principal sources of FL reading comprehension in the distinction between two factors, (1) a more language-specific factor, usually measured with a FL vocabulary test (and sometimes also with a FL grammar test), and (2) a more general factor, usually called reading ability and measured with a NL reading comprehension test (Bernhardt & Kamil, 1995; Bossers, 1991, 1992; Carrell, 1991; Hacquebord, 1989; Taillefer, 1996). The design of our study was planned as an improvement on the design of these earlier studies in that (a) we did not use NL reading comprehension as a measure of general reading ability to predict FL reading comprehension but treated NL reading comprehension as one of two instances of reading comprehension, juxtaposed to FL reading comprehension (Figure 3), (b) we measured NL vocabulary knowledge in addition to FL vocabulary knowledge, (c) we attempted to tap several aspects of general reading ability with four metacognitive knowledge tests, and (d) we regressed both NL and FL reading comprehension on their respective language-specific predictors (vocabulary) and on predictors assumed to indicate more general reading skills. We consider both our design and our results, summarized in the previous section, as an important step forward in comparison to the earlier studies. But let us consider the question of whether we have made genuine progress in the unravelling of the more language-specific knowledge and more general reading skills assumed to underlie reading comprehension.

Our study is the first one, to our knowledge, which, on the basis of covariance structure analyses, found evidence for some cross-language influence of NL and FL vocabulary knowledge on reading comprehension in the other language (i.e. FL and NL, respectively).¹¹ This finding suggests that vocabulary tests cannot be considered as language-specific measures exclusively.

Furthermore, our subtest of text characteristics (measured in the NL) might be seen as somewhat biased in favour of the NL; of the four metacognitive subtests, it turned out to be the strongest NL reading predictor with increasing grade levels (Table 5). Yet, at the grade 10 level, it was one of the strongest metacognitive predictors of FL reading too, its possible NL bias notwithstanding. These findings call for further development of (componential) theories of NL and FL reading comprehension and, of course, further empirical research to test such theories. Our results still warrant a major distinction between vocabulary knowledge on the one hand and metacognitive knowledge on the other, but our study has also shown that, although playing fundamentally different roles, vocabulary and metacognitive knowledge can only be regarded as only mainly, but not exclusively indicating language-specific knowledge versus more general reading skills. In further theoretical and empirical work, the very notion of language specific knowledge versus general reading skills, i.e. distinguishing between two categories of factors underlying reading comprehension, should perhaps be called into question. In essence, it rests on the distinction between language knowledge in particular and cognition in general, a distinction theoretically viable but empirically almost impossible to assess. Vocabulary knowledge is both a source and a result of reading comprehension (Anderson & Freebody, 1985) and does itself contain language-specific knowledge and more general skills (Sternberg & Powell, 1983). Thus, trying to find reading components that are either of an exclusively language-specific nature or of a more general or 'universal' nature, does not seem to be a fruitful research strategy.

A more fruitful approach might be to concentrate on the distinction made by Alexander et al., (1991) between knowledge about one's cognition ('knowing that') and knowledge about the regulation of that cognition ('knowing how'). Of the four metacognitive subtests of our study, one

subtest (knowledge of text characteristics) appears to be more of the 'knowing that' type, whereas the other three appear to be more of the 'knowing how' type. It is the knowledge of text characteristics subtest which turned out to be of increasing importance in both NL and FL reading, with increasing grade and age levels. It would be worthwhile to explore whether this finding can be explained in terms of the distinction made by Alexander et al. One may also wonder whether this effect of knowledge of text characteristics is the result of paying explicit, conscious attention to these text characteristics (a result of explicit metacognitive processes, in other words), or is it simply the incidental byproduct of extensive reading practice, perhaps in combination with the presence of intelligent problem solving skills, spontaneously and unconsciously applied during reading?

To end these theoretical considerations, let us briefly reflect upon the question of whether the results of our study can be interpreted as evidence for a form of the so-called threshold hypothesis (Alderson, 1984). This hypothesis holds that (NL) reading ability, including knowledge of reading strategies, reading goals and text characteristics cannot be transferred to FL-reading as long as FL-knowledge remains below a particular threshold. Importantly, this hypothesis implies that a well developed (NL) reading ability cannot make up or compensate for a lack of FL-proficiency as long as the latter is 'below the threshold'. Transfer of reading ability is 'short-circuited' by low FL-proficiency. We found that FL vocabulary played a much more important role in predicting FL reading comprehension in grade 8 than in grade 10, whereas metacognition played a more important role in grade 10 than in grade 8. Thus, it appears that most of the students in our grade 8 sample, having had almost 2 years of English (FL) instruction, found themselves below the "threshold".

Educational Considerations

Finally, what is the relevance of our study from an educational perspective? As we mentioned in the introduction, the main aim of our study was to find out at which grade and academic level it would be most appropriate to implement a reading strategies instructional program. In this respect, the most relevant finding of our study is that metacognitive knowledge was not entirely implicated in vocabulary knowledge (except in the case of NL vocabulary knowledge and NL reading comprehension among grade 6 students). This finding demonstrates that, for older students (grades 8 and 10) metacognitive knowledge appears to play a significant role in both NL and FL reading comprehension. Some students in these two grades must have spontaneously acquired some knowledge of reading strategies, reading goals and text characteristics, since a review of teaching materials showed that in these materials hardly any attention is paid to this kind of metacognitive reading skills (Oostdam and Rijlaarsdam, 1995). Those who have acquired such knowledge performed better on NL and FL reading comprehension tasks than those who had not. It is most likely that this relationship must be given both a causal and a consequential interpretation. Stronger students spontaneously apply or transfer their metacognitive knowledge while performing reading assignments in FL. It thus appears that, in the educational setting investigated in this study (grades 6, 8 and 10 in the Netherlands), poorer students in grade 6 to 8, not having spontaneously acquired knowledge of reading strategies, reading goals and text characteristics, stand a good chance of profiting from instruction of these types of knowledge.

Notes

1. For ease of reference we will not distinguish between *second* and *foreign* language learning in this paper. Some of the studies referred to and our own study were conducted in a foreign rather than a second language learning setting. We will thus use the label FL (foreign language) throughout this paper.
2. Carrell does not specify her raw correlations, but from her regression analyses one can infer higher native x second/foreign language correlations for the group of second-language learners with relatively high second-language proficiency than for the group of foreign-language learners with relatively low proficiency in the foreign language.
3. We acknowledge that some elements of metacognitive knowledge do imply some elementary linguistic knowledge. For instance, in our measure of metacognitive knowledge, to be presented in section 2.2.1, students had to highlight structural markers, such as "for instance", "in the first place", "finally", and thereby demonstrate familiarity with such phrases. Testing materials were in students' NL, Dutch. Thus, students had to highlight the Dutch equivalents of these phrases. However, in an earlier stage of the project a foreign language questionnaire of metacognitive knowledge was pretested and it turned out that this questionnaire in EFL did not provide additional or other information to the Dutch version and therefore it was dropped from the final study.
4. Whenever we use the term 'metacognition', 'metacognitive knowledge of oneself as a reader, of reading strategies, reading goals and text characteristics' is meant.
5. Fortunately, the loss of information due to absence of students at one or more testing sessions or their incomplete task completion, and consequently their 'listwise deletion' from the data set seems to be random. We computed also the descriptive statistics with all available data per variable and compared them with the 'listwise deleted' data, and the

descriptives did not differ significantly from the ones reported here.

6. We also obtained data on French as a foreign language (French reading comprehension and French vocabulary) from a relatively small sample of grade 10 students ($N = 66$). However, we consider this sample too small to properly conduct covariance structure analyses on. Therefore, we do not report on the French data.
7. The two Dutch booklets can be requested from the first author.
8. All test scores except for knowledge of reading goals and criteria are split up into two parts. This latter variable consisted of just three questions, each question was considered an indicator for the latent variable.
9. The difference in fit between two nested models is again χ^2 -distributed with ($df_2 - df_1$) degrees of freedom. At grade 8 and 10 the degrees of freedom for the difference in fit is four because of the four (fixed) zero regressions for the components of metacognitive knowledge. At grade 6 the degrees of freedom for the difference in fit is 3, because the regression on knowledge of goals and criteria was already fixed at zero (see Table 5).
10. Since the measurement model (i.e. the regressions of the observed scores on the latent variables) is fixed, this part of the model is rather restrictive which may (partly) explain the relatively low (a)gfi.
11. Verhoeven's study (1994) used similar techniques, but had a different scope, i.e. early bilingual development (6-8 yr.), and he did not use vocabulary measures to 'predict' reading comprehension. In his modelling of the relationship between L1 and L2 vocabulary knowledge, there turned out to be hardly any relationship between the measures: $\beta \leq .14$.

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Table 1
Number of students
and

their distribution over grades and language

	<i>NL</i>	<i>NL and FL</i>
Grade 6	132	n.a.
Grade 8	178	169*
Grade 10	178	105*
Total	488	274

* Of the 178 students from grade 8 and grade 10, 169 respectively 105 also performed the EFL tests. At grade 10 66 students performed the French as a foreign language tests instead of the EFL tests (cf. note 6).

Table 2

Metacognitive knowledge

Mean (M), standard deviation (s), sample size (n) and reliability (r_{xx})

per grade level,

and maximum possible score (max.) for each of the four parts

METACOGNITIVE KNOWLEDGE														
	<i>n</i>	oneself (max.=63)				goals/criteria (max.=13)			characteristics (max.=74)			strategies (max.=39)		
		<i>M</i>	<i>s</i>	<i>r_{xx}</i>	<i>M</i>	<i>s</i>	<i>r_{xx}</i>	<i>M</i>	<i>s</i>	<i>r_{xx}</i>	<i>M</i>	<i>s</i>	<i>r_{xx}</i>	
Grade 6	132	44.77	8.87	.84	2.02	1.47	.20	26.45	9.34	.89	14.31	5.01	.65	
Grade 8	178	46.19	7.06	.83	4.27	2.47	.64	36.31	12.65	.95	19.22	5.40	.71	
Grade 10	178	39.39	9.07	.87	4.94	2.16	.48	42.69	9.90	.89	22.31	5.28	.58	

Table 3

Reading comprehension

Mean (M), standard deviation (s), sample size (n) and reliability (r_{xx})

per grade level,

and number of test items, i.e. the maximum possible score (k)

		READING COMPREHENSION				
		<i>M</i>	<i>s</i>	<i>r_{xx}</i>	<i>n</i>	<i>k</i>
Grade 6	Dutch (NL)	12.76	4.18	.76	132	25
Grade 8	Dutch (NL)	16.38	5.32	.87	178	28
	English (FL)	18.06	5.87	.89	169	31
Grade 10	Dutch (NL)	20.72	4.42	.78	178	30
	English (FL)	15.79	4.96	.88	105	24

Note. No across age or language comparisons can be made.

Table 4

Vocabulary knowledge

Mean (M), standard deviation (s), sample size (n) and reliability (r_{xx})

per grade level

and number of test items, i.e. the maximum possible scores (k)

		VOCABULARY KNOWLEDGE				
		M	s	r_{xx}	n	k
Grade 6	Dutch (NL)	36.73	9.82	.91	132	60
Grade 8	Dutch (NL)	45.87	9.71	.93	178	64
	English (FL)	50.60	12.47	.97	169	64
Grade 10	Dutch (NL)	47.60	8.76	.94	178	60
	English (FL)	44.55	12.49	.97	105	60

Note. No across age or language comparisons can be made.

Table 5

Regression of NL reading comprehension on NL vocabulary knowledge, assessment of oneself as a reader, knowledge of strategies, of text characteristics and of reading goals and criteria and the percentages of explained variance in reading comprehension by all five predictors (%).

Fit of the model: statistical test (χ^2 , df, p), goodness of fit (gfi), adjusted goodness of fit (agfi) and comparative goodness of fit (cfi)

	Regression						Fit of the model	
	Vocabulary	Oneself	Characteristics	Strategies	Goals/criteria	%		
Grade 6 (N=132)	.65 [*]	-.12	.06	.29	0 ⁺	64	$\chi^2 = 59.41$ df = 56 ⁺ p = .35	gfi= .94 agfi= .90 cfi= .99
Grade 8 (N=178)	.32 [*]	.08	.26 [*]	.19 [*]	.21 [*]	62	$\chi^2 = 67.95$ df = 55 p = .11	gfi= .95 agfi= .92 cfi= .99
Grade 10 (N=178)	.58 [*]	.19 [*]	.42 [*]	-.06	-.13	65	$\chi^2 = 58.19$ df = 55 p = .36	gfi= .95 agfi= .92 cfi= 1.00

* statistically significant ($p < .05$)

+ the regression of knowledge of goals & criteria was fixed at zero, because of estimation problems, probably due to the floor effect. Inspection of the Modification Index showed that this fixation at zero was realistic.

Table 6

Regression of FL reading comprehension on FL vocabulary knowledge, assessment of oneself as a reader, knowledge of strategies, of text characteristics and of reading goals and criteria and the percentages of explained variance in reading comprehension by all five predictors (%).

Fit of the model:

statistical test (χ^2 , df, p), goodness of fit (gfi), adjusted goodness of fit (agfi) and comparative goodness of fit (cfi)

	Regression						Fit of the model	
	Vocabulary	Oneself	Characteristics	Strategies	Goals/criteria	%		
Grade 8 (N=169)	.72*	.02	.08	.10	.14*	76	$\chi^2 = 53.34$ df = 55 p = .53	gfi= .95 agfi= .92 cfi= 1.00
Grade 10 (N=105)	.38*	-.06	.29*	.34*	.09	60	$\chi^2 = 51.22$ df = 55 p = .62	gfi= .93 agfi= .89 cfi= 1.00

* statistically significant (p < .05)

Table 7

Comparison of the fit of three models with different restrictions on the equality of regression weights (β 's, cf. Figure 3) for NL and FL reading comprehension on vocabulary knowledge and metacognitive knowledge at grade 8 and grade 10.

Fit of the model: statistical test (χ^2 , df, p), goodness of fit (gfi), adjusted goodness of fit (agfi) and comparative goodness of fit (cfi)

GRADE 8 (N=169)		χ^2	df	p	gfi	agfi	cfi
1.	No equality constraints	129.47	127	.42	.92	.90	1.00
2a.	Equality constraints for metacognitive knowledge only ($\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$)	134.60	131	.40	.92	.90	1.00
2b.	Equality constraint for vocabulary knowledge only ($\beta_1=\beta_6$)	157.38	128	.04	.90	.88	.99
3.	Equality constraints for all predictors ($\beta_1=\beta_6$, $\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$)	162.67	132	.04	.90	.88	.98
GRADE 10 (N=105)							
1.	No equality constraints	125.22	127	.53	.88	.86	1.00
2a.	Equality constraints for metacognitive knowledge only ($\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$)	135.70	131	.37	.87	.84	1.00
2b.	Equality constraint for vocabulary knowledge only ($\beta_1=\beta_6$)	128.60	128	.47	.87	.85	1.00
3.	Equality constraints for all predictors ($\beta_1=\beta_6$, $\beta_2=\beta_7$, $\beta_3=\beta_8$, $\beta_4=\beta_9$, $\beta_5=\beta_{10}$)	136.01	132	.39	.87	.85	1.00

Table 8

*The estimated covariance (correlation) between NL and FL reading comprehension
under three different conditions (i.e. models),
for both grade 8 and 10*

	Grade 8	Grade 10
no mediating predictors (correlation)	.61 (37.2%)	.62 (38.4%)
vocabulary knowledge of the respective language is partialled out	.07 (0.5%)	.21 (4.4%)
metacognitive knowledge is partialled out	.10 (1.0%)	.07 (0.5%)

FIGURE 1

Metacognitive knowledge

Language knowledge

FIGURE 2

FIGURE 3

Metacognitive knowledge

Language knowledge