Summary

School performance in adolescents: An educational neuropsychology perspective
Students in secondary school show large individual differences in school performance, even when they follow exactly the same classes. What could cause these differences? The present thesis investigated whether three factors, namely sex differences, breakfast consumption, and sleep, are determinants of individual differences in adolescents’ school performance. It also examined neuropsychological mechanisms that might explain the influence of these determinants on school performance. See Chapter 1 for an introduction.

The study in Chapter 2 investigated whether sex differences in vocabulary could explain girls’ better performance on a language subject (Dutch). This question was investigated in two samples. In the first sample, 123 adolescents aged 14–20 years completed a vocabulary test with an open-ended answer format. In the second sample, 556 adolescents aged 12–18 years completed a multiple-choice version of this test. In both samples, boys outperformed girls in knowledge of abstract nouns, yet vocabulary predicted report marks for language only in girls. It thus appears that vocabulary is not the mechanism underlying sex differences in language performance at school.

The results of the first study emphasized the importance of examining mechanisms underlying sex differences in vocabulary more closely. In Chapter 3, we found that sex differences in vocabulary disappeared when words were presented in the context of a sentence. This was the result of a within-subjects experiment in 87 adolescents aged 13–15 years. They completed a 20-item multiple-choice vocabulary test with abstract nouns, of which half were presented in a sentence and half without a sentence. When words were presented without a sentence, boys outperformed girls. When words were presented in a sentence, girls’ performance improved to boys’ level, whereas no improvements for boys were found.

The study in Chapter 4 investigated another mechanism underlying sex differences in school performance. Here, the relation between executive functions and school performance was examined. In a sample of 173 healthy adolescents in preuniversity education, aged 12–18 years, two objective tests of executive functions (Sorting Test and Tower Test from the Delis-Kaplan Executive Function System, D-KEFS) did not relate to report marks. A self-report measure of executive functions (Behavior Rating Inventory of Executive Function – Self-Report Version, BRIEF-SR) did relate to report marks, but could not predict report marks after controlling for grade, sex, and level of parental education. Moreover, these results did not differ for boys and girls. Thus, in healthy, high-performing adolescents these executive function tests were no better predictors of school performance than demographic variables.

In Chapter 5, self-reported cooperation skills were investigated in a study in 1,630 adolescents aged 14–15 years. Cooperation skills can be considered a measure of school performance, since
many schools aim to teach their students how to cooperate. Results showed that girls reported better cooperation skills than boys. Adolescents who reported better planning and initiative on the Amsterdam Executive Function Inventory (AEFI) also reported better cooperation skills. Nevertheless, executive functions could not explain sex differences in cooperation skills.

In Chapter 6, the effects of breakfast consumption on school performance were examined. Breakfast skipping is common in adolescents, but research on the effects of breakfast skipping on school performance is scarce. A survey study of 605 adolescents aged 11–18 years showed that adolescents who habitually skip breakfast performed less well at school than breakfast eaters. The findings were similar for younger and older adolescents, and for boys and girls. Adolescents with an evening chronotype were more likely to skip breakfast, but chronotype was unrelated to school performance. Furthermore, attention problems partially mediated the relation between breakfast skipping and school performance.

The study in Chapter 7 investigated whether the relation between sleep and school performance in adolescents depends on the school performance measure used: objective school grades, self-reported school performance, or parent-reported school performance. Data from 561 adolescents aged 11–18 years showed that self- and parent-reported school performance correlated moderately with school grades. Sleepiness predicted school grades and self-reported school performance. Sleep quality predicted parent-reported school performance. Thus, the relation between sleep and school performance depends on the measure of school performance that is used.

In the study in Chapter 8 we found support for the hypothesis that sleep influences school performance in adolescents through executive functions. This was a cross-sectional study in 2,842 ninth-grade students aged 14.25–15.25. Sleep quality was related to school performance measured with standardized tests of language and mathematics, and this effect was mediated by self-reported executive functions on the AEFI. For sleepiness, no effect on school performance was seen. However, there was still a significant indirect effect of sleepiness on school performance through executive functions. For language performance, these relations were stronger in boys than in girls.

The conclusion of the thesis (Chapter 9) is that sex differences, breakfast consumption and sleep all have been shown to be determinants of individual differences in school performance of adolescents. With this thesis, more knowledge has been acquired on the neuropsychological mechanisms underlying these relations. The approach used in this thesis may be called ‘educational neuropsychology’. This may be a promising new discipline that complements existing disciplines in the field of education, since it has access to findings from neuroscience and a language to translate these findings to behaviors in the classroom.
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