Study strategies of first-year undergraduates with and without dyslexia
and the effect of gender

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Abstract
For students to be successful in higher education, they need not only have motivation and sufficient intellectual ability, but also a wide range of study skills as well as the metacognitive ability to determine when a change in strategy is needed. We examined whether first-year undergraduates with dyslexia (N=100) differ from peers without learning disabilities (N=100) in the use of study strategies. The Learning and Study Strategies Inventory was used and potential gender differences were investigated. Matched for age, gender and field of study, fluid intelligence scores were comparable between groups. The self-reports showed that knowledge of test taking strategies was more limited in the dyslexic group. Also, ‘fear of failure’ was higher in the dyslexic students. Further analyses revealed group × gender interactions for motivation, time management and fear of failure, with female undergraduates outperforming their male counterparts. Implications for secondary education and university, as well as college student support services are discussed.

Keywords: adult dyslexia, study strategies, metacognition, LASSI, gender differences
Introduction

Any successful performance requires task-related skills and motivation. This certainly applies to studying in higher education with the aim to obtain a degree in a scientific discipline. Yet skills and motivation alone do not explain why some students succeed while others do not. To have the ability to switch between skills (in case they prove ineffective) and use them accordingly is another necessity for becoming successful in one’s studies. In this paper we examine which study strategies are applied in higher education by students with and without dyslexia and the differences between them.

The DSM-5 [1] defines dyslexia as a specific learning disorder characterized by problems with spelling, decoding, and accurate and/or fluent word recognition. It is distinct from reading and/or spelling difficulties caused by inadequate instruction or an impoverished home environment [2-3]. In individuals with dyslexia, reading/writing is at a significantly lower level seeing age and educational level. Impairments are resistant to remedial teaching – that is to say, the requirements of the ‘response to instruction’ model [4] are met. Plus, any reading and writing deficit cannot be attributed to external and/or individual factors such as socio-economic status (SES), cultural background, or intelligence.

While there is evidence of a genetic component in dyslexia [5-6], the prevalence of the disorder depends on environmental factors too. For instance, it has been reported that dyslexia is more prevalent in languages with less transparent letter-to-sound mappings (English) than in more transparent mappings, such as Italian [7] and Welsh [8]. With inconsistent mappings, more time and effort is needed to reach ceiling performance and obtain higher proficiency levels [9].

In addition to the reading and/or spelling deficits, individuals with dyslexia often show specific problems with vocabulary [10], (working) memory [11], attention [12], processing speed [13], lexical retrieval and arithmetic [14-15]. This remains true for students attending higher education who were diagnosed as dyslexic in primary school and have worked hard throughout their education to overcome their problems [12-13].

Metacognition, which is defined by Flavell (1976, 1979) as ‘cognition about cognition’, is an important factor pertaining to study skills [16-17]. In other words, metacognition suggests an intrinsic ability to distinguish between cognitive skills as they are not equally appropriate in every situation, which involves both the monitoring and regulation of underlying cognitive processes. Metacognition is crucial in higher education as proper use of study strategies affects academic achievements in the long term [18]. Pinto, Iliceto, and Melogno (2012) [19] demonstrated that students are fairly proficient at calling upon
metacognitive skills, as evidenced by their ability to explain how they arrived at the correct solution. The authors also observed clear gender and study-related differences in that the male students and students in the hard sciences outperformed the female students non-verbally, whereas female students and students in humanities outperformed their male peers in all metalinguistic abilities tested.

Studies on the topic of metacognition suggest that metacognitive skills are not as sophisticated in dyslexic students as they are in non-dyslexics [20-24]. Job and Klassen (2012) [22] found that adolescents with dyslexia were less accurate in predicting their performance. They overestimated their ability in a spelling and ball-throwing task, with the accuracy of their performance predictions decreasing with increasing difficulty levels. The authors called this ‘optimistic miscalibration.’ Comparing college students with and without dyslexia, Mason and Mason (2005) [23] reported that dyslexic students showed deficits in their metacognitive skills, resulting in problems with selecting and using effective cognitive strategies such as note taking and organizing academic tasks. Sideridis, Morgan, Botsas, Padeliadu, and Fuchs (2006) [25] found some evidence of metacognitive knowledge predicting learning disabilities. Generally they observed that the knowledge students with dyslexia had about how they could monitor and control their learning was one of the best predictors of their performance. Similarly, Trainin and Swanson (2005) [26] argued that successful college students with dyslexia compensate for their cognitive difficulties and processing deficits by relying on metacognition (e.g. learning tricks and strategies to cope with a problem and seeking help in time). It is clear that, based on practice and experience, metacognitive knowledge makes students aware of (potential) problems, prompting control processes that can help them reach the goal pursued.

Kirby, Silvestri, Allingham, Parrila, and La Fave (2008) [27] looked at relationships between the learning strategies of students with dyslexia (n = 36) and without (n = 66) and their reading skills using different reading tasks and the Learning and Study Strategies Inventory (LASSI) [28]. The ten subscales of the latter test measure different types of metacognitive knowledge. They found that, compared to the controls, the students with dyslexia attained significantly lower scores on the LASSI ‘selecting main ideas’ and ‘test taking strategies’ subscales but significantly higher scores on the ‘time management strategies’ and ‘study techniques’ subscales. The authors, moreover, found correlations between reading ability and the ‘selecting main ideas’ and ‘test taking strategies’ subscales. Kirby et al. (2008) [27] concluded that the study strategies of dyslexic students were determined both by their weak reading skills and their compensatory techniques.
In contrast, Tops, Callens, Desoete, Stevens, and Brysbaert (2014) [29] did not observe any significant difference in metacognitive skills between dyslexic and non-dyslexic students. They asked 100 students with and 100 students without dyslexia to rate their confidence in a word spelling and proofreading task, and found that the two groups performed equally well in their estimations. Students with dyslexia were aware of how they performed and had good insight in which word spellings they knew and which they knew not.

Previous studies also suggested the role of gender in academic performance [19,30-32]. Sheppard (2009) [32] found that girls with dyslexia performed significantly better than boys with dyslexia on standardized school performance tests like SATs, CAT verbal and GCSE. Although the gender difference was present in typically developing peers as well, it failed to reach significance.

The aforementioned studies notwithstanding, effects of gender and dyslexia on school performance are still understudied. In the present study, we followed Kirby et al. (2008) [27] and used a Dutch translation of the LASSI to compare the metacognitive abilities of first-year undergraduates with dyslexia and peers without learning deficits. At the same time we also looked for potential gender differences. Based on the literature, we hypothesized that the knowledge of and beliefs about learning strategies and study goals of students with dyslexia would be less well developed than that of matched controls, with female students achieving higher scores than males.

Method
This study was approved by the ethical committee of Ghent University. Prior to their participation, all students agreed to the study terms by way of signing a written consent. The students were paid for their participation and informed that they could stop the experiment at any time without having to state a reason and without consequence.

Participants
Participants were 200 undergraduates who had recently embarked on their first year of higher education in the surroundings of Ghent (one of the main cities in the Dutch-speaking half of Belgium). Half of them had been diagnosed with dyslexia at primary or secondary school. The 100 students in the control group had no such diagnosis or any other known neurological impairment (e.g. autism spectrum disorder, specific language impairment). All
participants had normal or corrected-to-normal vision and were native speakers of Dutch. The study and control groups were matched in terms of age, gender and field of study (see [13] for more details).

All candidates for the dyslexia group were invited on the basis of them having applied for special facilities (e.g. extended examination time); this information was retrieved from the institutes’ student services. Eligible candidates were examined by trained diagnosticians to verify whether they met the three criteria for dyslexia as defined by the Dutch Dyslexia Foundation [33]. To obtain a sufficiently large sample, we originally recruited 120 dyslexic students. Of these, a small number declined participation once the study had been explained to them, while some did not attend all scheduled sessions. All 100 students completing the study met the dyslexia criteria in that (i) their reading and/or writing skills were significantly poorer than expected given their age and educational level, (ii) the ‘resistance to instruction’ criterion was met, implying that they had followed remedial programs and received individual tutoring in primary or secondary school for a minimum period of six months, (iii) their reading and/or writing impairment could not be attributed to individual or external factors such as intelligence, cultural background or SES.

The majority of controls registered via an online application form that the school made public or via the guidance counsellors working at the school. Some controls, however, were suggested by the dyslexic students who had asked their fellow students to join, in which case we selected several candidates at random.

The general characteristics of the two groups can be found in Table 1 (mean age, gender, college or university). The groups did not differ with regard to SES as based on parental educational level (mother: $\chi^2(3) = 4.855, p = .183$; father: $\chi^2(3) = 2.634, p = .452$), with the parent’s education varying between lower secondary school, higher secondary school and post-secondary education (university or college). Table 1 also lists the results of two reading tests [34-35] and a word spelling test [36] taken by the two groups. The control students achieved scores within the normal range on all three tasks, while the average score of the students with dyslexia was more than 1.5 standard deviation below this level (see Table 1 for effect sizes).

The students completed the Kaufman Adolescent and Adult Intelligence Test, Dutch version [37] to assess the groups’ mean fluid IQs. The results showed a non-significant difference ($F(1, 198) = 0.84; p = .36$): 107 ($SD = 10.8$) for the controls and 105 ($SD = 11.0$) for the students with dyslexia.
Instruments

One of the most widely used methods to assess metacognition is by self-reports in which respondents evaluate their metacognitive knowledge about their thinking processes, problem-solving skills and work strategies. We opted for the Learning and Study Strategies Inventory (LASSI) and asked our students to complete the validated Dutch version published by Lacante and Lens (2005), who reported alpha reliabilities ranging from .68 to .86 for the different subscales.

The LASSI provides a profile of students’ strengths and weaknesses in three metacognitive domains as assessed with ten different 8-item scales, except for the ‘selecting main ideas’ scale, which has five items. Lacante and Lens (2005) argued that the ten scales can be grouped under three knowledge domains:

1. The first domain assesses self-knowledge in terms of how students deal with various situations and consists of three scales: The first scale is the attitude scale which measures the respondent’s mind-set towards education (e.g. ‘I don’t care whether I finish my education or not, meeting the right partner is more important for me now’). The second scale is the motivation scale, which evaluates the level of determination (effort, persistence) to complete one’s studies (e.g. ‘I manage to hold on, even if I have to do things that don’t interest me’). The last scale is the fear of failure scale. It examines the extent to which the respondent experiences performance anxiety during tasks.

2. The second domain gauges metacognitive knowledge with regard to time management, concentration, self-testing, and the use of study techniques. It includes the time management scale, which evaluates how respondents manage, self-regulate and monitor their learning process, and explores the efficiency of planning and organization strategies (e.g. ‘I only study when I feel the pressure of an exam’). The second and third contributing scales are the concentration scale, which assesses the ability to direct and maintain attention when studying (e.g. ‘I fully pay attention when studying’), and the self-testing scale, which questions the ways in which students prepare for academic tests (how to make revisions, rehearse material or prepare for exams, use new information in a new situation and apply principles and methods). Finally, the second domain also includes the study techniques scale, which tests the ability to make use of organization strategies (e.g. ‘I take the material and use my own words to understand it’).
The third domain examines respondents’ metacognitive knowledge of strategies for various tasks and contexts by means of three scales. First, the information elaboration scale assesses how well students are able to process new information by making use of reasoning skills, imagery and verbal elaborations. Second, the selecting main ideas scale examines students’ ability to recognize the key topics and themes in a text (e.g. ‘It is hard for me to decide what is important enough it requires studying by heart’). Finally, the test taking strategies scale evaluates whether students know which strategy to use when preparing for an exam.

Procedure
The LASSI was part of a larger protocol [13, 29, 40-41], which also involved an intelligence test, various reading and spelling tests, a personality inventory, as well as a semi-structured interview about socio-emotional and academic functioning. The students completed all tests individually in a quiet room with one of three test administrators seated at the opposite side of the table. The tests were administered in two 3-hour standardized sessions, in which the order of the tests was counterbalanced in such a way that two similar tests were distributed across the two sessions. The students with dyslexia started either with part one or part two according to an AB-design, with the matched control taking the tests in the same order. Each participant was allowed a break halfway each session but additional breaks were allowed if needed. Participants could end their participation at any point without consequences. All sessions were videotaped. The test administrators were the first two authors and a test psychologist. After having agreed on the protocol and test guidelines, they reviewed the recordings of each other’s first ten sessions. Any deviations from the protocol were briefly discussed to obtain consistency in testing procedures.

Statistical analyses
We used mixed-effects regression modelling (per recommendations by Baayen et al. [42-44]) to analyze the effects of group and gender on the LASSI scores. Mixed-effects models contain both independent variables of interest - including factors with a small number of levels (such as gender), or continuous variables (e.g. age) and random effects. In the present study, per-item responses were not available and we used aggregate scores per subtest per subject.
The linear mixed-effects model was implemented using the lmer function of the lme4 package [45] in R [46]. All continuous measures entered into the final model were centered and z-transformed. We predicted individual LASSI scores and included data from all subtests in one model. The model was built stepwise by adding one variable at a time to define the measures that improved the model fit (as indicated by AIC and $R^2$). After establishing all significant main effects, we tested for possible interactions. For the random effects structure, we added random intercepts per subject, and also tested whether random slopes were necessary, which was not the case.

Model fit is usually evaluated by the squared correlation between the fitted and observed values ($R^2$). In the case of mixed-effects models, this method only estimates the residual variance and ignores the random effects present in the model. Following the suggestion by Nakagawa and Schielzeth (2013) [47], we also calculated a marginal and conditional $R^2$, the former being an estimation of the fixed-effects structure alone, while the latter incorporates both fixed and random effects.

Effect sizes were calculated using Cohen’s $d$. Because the model was fit to z-transformed scores, each estimated model coefficient $\beta$ is identical to Cohen’s $d$. For post-hoc pairwise comparisons of the model predictions, we used the lsmeans package [48], which calculates least square means, performing a Kenward-Roger estimation for the degrees of freedom of the model, as well as a Tukey HSD $p$-value adjustment for the comparison of groups of estimates.

**Results**

Table 2 presents the average LASSI scores for the two student groups as well as for the male and female students separately. In addition, we present effect sizes measured in Cohen’s $d$. Most effect sizes between groups were small ($d < 0.40$). Between students with and without dyslexia, there was only a medium effect size for test taking strategies. Students with dyslexia performed worse than students without dyslexia, $d = 0.63$. Between male and female students, a medium effect size was observed for anxiety for failure. Lower scores mean a higher rate of fear of failure to make it consistent with the other scales, as lower scores also correspond to more problematic study-related behavior. Female students reported more anxiety for failure than their male counterparts, $d = 0.45$. For time strategies, we observed also an (almost) medium effect size. Female students had better time management skills than male students, $d = 0.39$. 
As can be gleaned from Table 3, there were significant Pearson’s product moment correlations among a number of LASSI scores. The time management, concentration and motivation subtests formed a triad with high pairwise correlations in the range of $r = 0.59$ to $r = 0.65$. Similarly, the measure of test taking strategies showed moderate to high correlations with concentration, $r = 0.45$, fear of failure, $r = 0.46$ and selecting main ideas, $r = 0.53$. Considering these correlations, the scales or clusters in the LASSI differed from the three domains suggested by Lacante and Lens (2005) [39].

Mixed effects regression

The best model for predicting the individual LASSI scores included interactions for LASSI subtest × dyslexia group, LASSI subtest × gender, the type/level of the student’s secondary education, paternal occupations, as well as random intercepts per subject. None of the IQ measures, nor the inclusion of the participant’s age, handedness, or mother tongue improved the model fit any further. The resulting model for 195 participants (see Supplementary Information 1) was checked for normality of residuals and heteroscedasticity (model criticism, see [44]), and values causing residuals over 2.50 SD above or below the prediction were deleted. This affected 33 measures, which corresponds to less than 1.69% of the data. The final model was then fit again to the remaining data. Based on $R^2$, our final model described 36.89% of the variance in the data (marginal $R^2 = 0.09$; conditional $R^2 = 0.33$).

Effects of Group

As is shown in Figure 1, the linear mixed-effects regression analysis generated significant main effects of group for test taking strategies ($\beta = d = -0.66, t(962) = -4.71, p < .001$) and fear of failure ($\beta = d = -0.35, t(995) = -2.47, p = .014$), with dyslexic students scoring lower than their non-dyslexic peers.
Effects of Gender

There were main effects of gender on attitude (β = d = -0.45, t(995) = -3.11, p = .002), motivation (β = d = -0.46, t(975) = -3.24, p = .001), time management (β = d = -0.43, t(975) = -3.00, p = .003), and study techniques (β = d = -0.37, t(984) = -2.62, p = .009), with female students scoring better than male students on all these scales. The opposite was found for fear of failure (β = d = 0.56, t(1005) = 3.87, p < .001), where the male students reported less anxiety than the female students.

Interaction of Gender and Group for fear of failure

While the initial model-building process based on all subscales did not require the inclusion of a 3-way LASSI subscale × gender × group interaction, we found two significant 2-way interactions for fear of failure × gender, as well as fear of failure × group. To follow up on a potential interaction restricted to this subtest, we ran a linear regression with identical specifications (albeit without the random effects structure) and found a marginally significant group × gender interaction (β = d = -0.48, t(168) = -1.68, p = .09). Pairwise comparisons with least square means and Tukey p-value adjustments (see Supplementary Information 2) revealed an effect of gender in the control population (β = d = -0.73, t(168) = -3.56, p = .003), but not in the dyslexia group (β = d = -0.25, t(168) = -1.19, p = .633), as well as an effect of group for the male students (β = d = 0.61, t(168) = 2.74, p = .034), but not for the female students (β = d = 0.13, t(168) = 0.68, p = .907).

The effect sizes for the differences described above ranged from small (d = 0.13) to large (d = 0.73).

Discussion

Inspired by the body of literature suggesting that an adequate degree of metacognition may help students with dyslexia to compensate for their reading and spelling difficulties [25], we investigated whether undergraduates with dyslexia attending the first year of university or college in the Dutch speaking part of Belgium would differ from their non-dyslexic peers in their study attitudes and metacognitive knowledge about study strategies. For this we used the Dutch version of the LASSI [39]. Additionally we looked at gender differences.

The results showed that self-reported fear of failure was higher in the students with dyslexia, while their knowledge of test taking strategies was less advanced than it was in
matched non-dyslexics. Surprisingly, the responses to the other LASSI scales did not significantly differ between the two student groups. There were also gender-specific differences in that female students had higher scores on the motivation and attitude subscales than their male counterparts. This was true for both the dyslexic and the typically developing group. More than the male students, the female students reported that their university/college study programs were either relevant or important to them and that they had developed a sufficient understanding of how their training and academic performance related to their future life goals. Also, their knowledge of planning and monitoring was higher than that of their male counterparts, making them better at assuring the timely completion of academic tasks and avoiding procrastination while still being able to include non-academic activities in their schedules. The male students were, moreover, less able to apply different and/or efficient study techniques than the female students.

The effects of dyslexia and gender were largely additive. We observed that metacognitive knowledge about study attitude, motivation, time management and study techniques was better in female students than in their male counterparts. Students with dyslexia performed significantly worse than typically developing peers on test taking strategies. In addition, students with dyslexia reported more fear of failure than the control students. Only for the fear of failure scale, did we find a marginally significant group x gender interaction effect, with highest scores for female students with dyslexia and lowest scores for typically developing males.

We thus observed few differences in the metacognitive abilities of undergraduates with dyslexia and matched controls, while gender variations within both groups were more pronounced. Our results are partly in line with the results of Kirby et al. (2008) [27] and our previous study [29]. In the latter study, we likewise did not find evidence for deficits in the metacognitive skills of dyslexic students based on a word spelling task and a proofreading task. Despite that dyslexic students presented with more fear of failure and had less knowledge about test taking strategies, we found no significant differences between students with dyslexia and typical students, despite that our groups were large enough to observe effect sizes of $d = .4$ with 80% power. We did observe that the male students with dyslexia were more susceptible to fear of failure than their non-dyslexic peers, whereas this difference was absent in the female students.

Whereas previously published studies reported less sophisticated metacognitive skills in students with dyslexia compared to typically developing controls [20-24], we found no meaningful differences in the present or in the previous study [29], suggesting that
students with dyslexia are similarly equipped for the early stages of higher education. Whether this will enable them to continue their studies equally successfully as their matched controls, is a matter of future study. Future studies will also have to explicate whether differences between the present study and older ones can be attributed to national differences in educational systems, or to the fact that underpowered studies producing significant results are more likely to be accepted for publication - as opposed to studies with null-effects [49-50].

As for the limitations of the current study, we need to mention the sole use of the LASSI to gauge the students’ metacognitive skills. We opted for this self-report questionnaire based on the dyslexia study by Kirby et al. (2008) [27], so that we could directly compare our results with theirs. However, the LASSI only gives information about metacognitive abilities as perceived by the students themselves. It is possible that groups of students differ in abilities and still have the impression of doing equally well. In future research, it would be wise to add other, less subjective measures of metacognition (such as think-aloud protocols) to the test battery. Other studies [51-52] also suggest that maternal and paternal educational levels explain more variance in their offspring’s metacognitive skills than, for instance, their child’s IQ, age, handedness, or language - although the fact that none of these factors reached significance might result from the studies’ small subgroup sizes.

Also, our findings may not extend to other languages and/or educational systems even though there are similarities in the cognitive profiles of Dutch-speaking and English-speaking undergraduates [13] and in personality profiles [41]. Furthermore, we observed correlations between the LASSI scales in our sample that did not correspond with the three domains as suggested by Lacante and Lens (2005) [39]. Likewise, Cano (2006) [53] found a three-factor model when exploring the latent structure of scores on the LASSI among 1000 college students that also differed from these domains. The discrepancies merit further investigation.

Despite these limitations, we think that our study uncovered important information in that, overall, the metacognitive abilities of first-year Dutch-speaking undergraduates with dyslexia are similar to those of typical peers, suggesting that, as far as metacognition is concerned, they can be as successful in their academic careers as students without the disorder. It also suggests that no extra practice in metacognition is needed for students with dyslexia. At the same time, we observed that students coming from less demanding high school curricula and from parents with less education scored lower. These are groups that
may profit from extra practice in metacognition. However, this applies to students without dyslexia too.

Finally, in terms of academic support, our results indicate that disability services ought to be aware that a ‘one size fits all’ approach may not be advised. This was particularly clear for fear of failure: Males with dyslexia were very much aware of their own fears, whereas males with normal reading seemed not so aware. In females, fear of failure reached to such an extent that help may be needed in order to reduce the fear. In metacognition research, accurately identifying deficiencies in study skills and finding the optimal strategies to help individuals or specified groups of students, is the next challenge.
Acknowledgements

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References


41. Tops W, Verguts E, Callens M, Brysbaert M. Do students with dyslexia have a different personality profile as measured with the Big Five? PloS One. 2013; e64484. doi: 10.1371/journal.pone.0064484


49. Fanelli D. Negative results are disappearing from most disciplines and countries. Scientometrics. 2011; 90: 891-904.


Table 1.

General Information About the Student Groups With and Without Dyslexia

<table>
<thead>
<tr>
<th></th>
<th>Students without dyslexia</th>
<th>Students with dyslexia</th>
<th>Effect size</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>(SD)</td>
</tr>
<tr>
<td>Gender</td>
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<tr>
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<td>46</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>54</td>
<td>54</td>
<td></td>
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<td>Studies</td>
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<tr>
<td>University</td>
<td>66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College for higher education</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>19.40</td>
<td>(1.00)</td>
<td>19.11</td>
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<tr>
<td>Fluid IQ</td>
<td>106.80</td>
<td>(10.80)</td>
<td>105.40</td>
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<tr>
<td>Word reading</td>
<td>100.40</td>
<td>(10.60)</td>
<td>77.00</td>
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<tr>
<td>Pseudoword reading</td>
<td>59.70</td>
<td>(13.10)</td>
<td>40.90</td>
</tr>
<tr>
<td>Word spelling</td>
<td>24.60</td>
<td>(2.80)</td>
<td>17.50</td>
</tr>
</tbody>
</table>

*Note.* Fluid IQ = KAIT; Dekker, Dekker, & Mulder, 2004; Word reading = Dutch word reading, number of words read correctly in 1 minute time (EMT; Brus & Voeten, 1991); Pseudoword reading = number of pseudowords read correctly in 1 minute time (de Klepel; van den Bos et al., 1999); word spelling = number of words spelled correctly in a word dictation task (GL&SCHR; Depessemier & Andries, 2009). Effect sizes calculated according to Cohen’s d (positive d-values represent better performance of the controls and negative values better performance of the students with dyslexia).
Table 2.

Average LASSI Scores per Subtest for Females and Males, as well as Students With and Without Dyslexia

<table>
<thead>
<tr>
<th>LASSI measure</th>
<th>Dyslexia without (N=100)</th>
<th>Dyslexia with (N=99)</th>
<th>Gender female (N=117)</th>
<th>Gender male (N=82)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Attitude</td>
<td>31.9 (3.84)</td>
<td>31.03 (4.25)</td>
<td>32.04 (3.82)</td>
<td>30.67 (4.28)</td>
</tr>
<tr>
<td>Concentration</td>
<td>24.6 (4.97)</td>
<td>24.85 (4.83)</td>
<td>25.13 (4.93)</td>
<td>24.20 (4.79)</td>
</tr>
<tr>
<td>Anxiety for failure*</td>
<td>26.0 (5.46)</td>
<td>24.81 (5.06)</td>
<td>24.41 (5.07)</td>
<td>26.80 (5.33)</td>
</tr>
<tr>
<td>Selecting main ideas</td>
<td>17.5 (3.53)</td>
<td>16.85 (3.11)</td>
<td>16.99 (3.75)</td>
<td>17.54 (2.65)</td>
</tr>
<tr>
<td>Information elaboration</td>
<td>27.9 (4.61)</td>
<td>29.10 (4.45)</td>
<td>28.26 (4.40)</td>
<td>28.89 (4.78)</td>
</tr>
<tr>
<td>Motivation</td>
<td>26.7 (4.41)</td>
<td>27.00 (4.99)</td>
<td>27.68 (4.74)</td>
<td>25.67 (4.39)</td>
</tr>
<tr>
<td>Study techniques</td>
<td>25.6 (4.14)</td>
<td>25.08 (4.47)</td>
<td>25.97 (4.39)</td>
<td>24.54 (4.06)</td>
</tr>
<tr>
<td>Test taking strategies</td>
<td>29.3 (4.10)</td>
<td>26.73 (4.25)</td>
<td>27.96 (4.29)</td>
<td>28.21 (4.52)</td>
</tr>
<tr>
<td>Time management</td>
<td>22.8 (5.50)</td>
<td>23.09 (5.41)</td>
<td>23.77 (5.69)</td>
<td>21.80 (4.88)</td>
</tr>
<tr>
<td>Self-testing</td>
<td>23.8 (4.59)</td>
<td>24.13 (3.77)</td>
<td>24.08 (4.44)</td>
<td>23.85 (3.85)</td>
</tr>
</tbody>
</table>

Note. * lower scores for anxiety for failure indicate more fear of failure, which makes it consistent with the other scales where lower scores correspond to more problematic study-related behaviour.
### Table 3.

**Pearson's Product Moment Correlations between LASSI Measures**

<table>
<thead>
<tr>
<th>LASSI measure</th>
<th>Attitude</th>
<th>Motivation</th>
<th>Time management</th>
<th>Anxiety for failure</th>
<th>Concentration</th>
<th>Information elaboration</th>
<th>Selecting main ideas</th>
<th>Study techniques</th>
<th>Self testing</th>
</tr>
</thead>
<tbody>
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<td>Attitude</td>
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<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>.645*</td>
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<td>-</td>
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<tr>
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<td>-.022</td>
<td>.027</td>
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<td>-</td>
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<tr>
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<td>.589*</td>
<td>.649*</td>
<td>.228*</td>
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<td>-</td>
</tr>
<tr>
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<td>.217*</td>
<td>.096</td>
<td>.088</td>
<td>.199*</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>.063</td>
<td>.109</td>
<td>.306*</td>
<td>.221*</td>
<td>.286*</td>
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<tr>
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<td>.239*</td>
<td>.233*</td>
<td>-.101</td>
<td>.069</td>
<td>.224*</td>
<td>.188*</td>
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<tr>
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<td>.395*</td>
<td>.318*</td>
<td>-.196*</td>
<td>.256*</td>
<td>.323*</td>
<td>.070</td>
<td>.492*</td>
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<tr>
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<td>.314*</td>
<td>.460*</td>
<td>.454*</td>
<td>.201*</td>
<td>.526*</td>
<td>.107</td>
<td>.011</td>
</tr>
</tbody>
</table>

*Note:* High correlations are underlined. *p < .05.
Figure 1. Representation of the fixed-effects structure of the linear mixed-effects model predicting LASSI scores for each combination of group and gender. Effects are averaged over parental and participant educational level. Error bars show 95% confidence intervals. Asterisks indicate significant differences after pairwise comparisons with TukeyHSD p-value adjustments. Low scores for anxiety for failure indicate high rates of fear of failure.