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Dutch and English literacy and language outcomes of dyslexic students in regular and bilingual secondary education

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Introduction

Developmental dyslexia can be defined as a specific learning disability manifested by difficulties in learning to read and write despite having adequate cognitive ability, motivation, access to instruction, and intact peripheral sensory mechanisms (Lyon, 1995). This disorder often has a long-lasting impact on literacy and school outcomes, as individuals with dyslexia are likely to receive lower grades, experience higher levels of academic frustration and reach lower levels of educational and occupational attainments in adulthood (e.g. Boetsch, Green & Pennington, 1996; Bosman & Braams, 2005; Goldston et al., 2007; Poleij, Leseman & Stikkelbroek, 2009). Whereas foreign language instruction is a major stumbling block for many dyslexic individuals at secondary education (e.g. special issue *Levende Talen*, 2007), surprisingly little research has been devoted to dyslexia and foreign language learning (but see e.g. Bekebrede, van der Leij & Share, 2009; Downey, Snyder & Hill, 2000; Figueredo, 2006; Helland & Kaasa, 2005; Schneider & Ganschow, 2000).

At the same time, cross-cultural communication is becoming increasingly important, demanding spoken and written mastery of the world's dominant languages, and especially of English. In the Netherlands this development has led to an increase in the number of schools providing bilingual secondary education (BiSE) (European Platform; Verspoor, Bot & Rein, 2010), where instruction is most commonly provided in Dutch and English. Whereas Dutch is a language with a semi-transparent orthography, English is characterised by an opaque orthography with inconsistent spelling. Transparent and opaque orthographies lead to different paths and rates of literacy development (e.g. Seymour, Aro & Erskine, 2003), and English is thought to be particularly difficult

for dyslexic populations. Indeed, anecdotal evidence suggests that not all BiSE schools are eager to accommodate students with dyslexia (e.g. *Balans Magazine*, November 2011). It remains, however, an open question as to whether dyslexic students in the Dutch context are unable to profit from the potential benefits of bilingual secondary education in English and Dutch. This exploratory study will compare language and literacy outcomes on measures of Dutch and English of adolescents with and without dyslexia, attending either regular secondary education (RSE) or BiSE to shed light on this matter.

Dyslexia is characterised by reading and spelling difficulties, with difficulties with phonological processing as one of its main underlying causes (e.g. Goswami, 2002; Vellutino et al., 2004). Being able to use speech codes to represent information in the form of (parts of) words is necessary for connecting sounds (phonemes) to letters (graphemes) and vice versa. Phonological processing difficulties are argued to impact on phonological recoding (i.e. reading words by sounding out the letters). Phonological recoding difficulties have been attested for dyslexic participants from an early age to adulthood in many different languages, including Dutch (van der Leij & van Daal, 1999; Yap & van der Leij, 1993) and English (Bruck, 1998; Herrmann, Matyas, & Pratt, 2006; Snowling, Nation, Moxham, Gallagher & Frith, 1997; Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Körne, 2003). Regardless of whether phonological processing skills are measured in a learner's first or second language, these skills have been found to (partly) determine individual differences in the development of second language word-based skills (e.g. Bekebrede et al., 2009; Comeau, Cormier, Grandmaison & Lacroix, 1999; Dufva & Voeten, 1999; Gholamain & Geva, 1999; Lesaux & Siegel, 2003). Phonology-orthography connections are essential in learning to read. Semantics become increasingly important during reading acquisition: associations between semantics and orthography allow exception words with inconsistent mappings between letters and sounds to be processed in a more economic fashion. Semantic (or broader oral language) and orthographic knowledge might thus constitute a compensatory factor for readers who show difficulties on the phonology-orthography pathway.

This hypothesis of orthographic compensation is in line with studies that report that subgroups of dyslexic students who show superior orthographic knowledge tend to be those who read better in English than expected on the basis of their first language reading abilities (e.g. Bekebrede et al., 2009; Miller-Guron & Lundberg, 2000; van der Leij & Morfidi, 2006). The ability to rely on orthographic competence could thus aid in reading English. However, it has also been proposed that non-dyslexic foreign language learners are able to use orthographic knowledge in learning the spelling of the foreign language, whereas dyslexic learners cannot (e.g. van Berkel et al., 2007). There are thus two different viewpoints on the ability to use orthographic skills of foreign language learners with dyslexia.

Given that individuals with dyslexia attending higher levels of education and those with better intellectual abilities are likely to have better than average verbal abilities (e.g. Kuijpers et al., 2003; van Viersen et al., submitted), it is possible that they may be able to compensate for any problems with reading using more general language skills. The extent to which such compensation may manifest themselves may however depend on how such skills are tested. For example, a measure such as semantic fluency, in which timed retrieval of words from certain categories is demanded, might be more difficult for people with dyslexia, as they generally face difficulties in retrieving verbal information from memory (e.g. Perfetti & Goldman, 1976, Wolf & Bowers, 1999; Vellutino et al., 2004). The present study will assess dyslexic secondary school students in each of these areas, i.e., it will tap reading outcomes, phonological recoding, orthographic competence, and semantic knowledge in both Dutch and English, comparing dyslexic students with their non-peers in both regular secondary education (RSE) and bilingual secondary education (BiSE).

Bilingual secondary education in the Netherlands has witnessed a substantial increase in recent years (see De Bot & Maljers, 2009 for an historical overview). As noted above, the two languages in which classes are taught are most often Dutch and English. Language learning does not only take place in classes devoted to the language in question, but also in the other courses of the curriculum, reflecting Content and Language Integrated Learning (Marsh, Maljers & Hartiala, 2001).

Verspoor, de Bot and Van Rein (2010) recently evaluated the effectivity of BiSE by comparing performance of students attending BiSE and RSE on pre- and post language tests at the start and end of one year of instruction. The post-test measurements show that the students attending BiSE outperform those following regular (pre-university level) secondary education on English language competence. Qualitative analysis shows that these benefits are present in both (receptive) vocabulary and writing skills. In the writing task, the students attending BiSE produced longer and more complex sentences, used more different verb inflections, more complex words with lower frequencies, and made fewer errors overall. These results are in line with earlier work on bilingual secondary education in the Netherlands showing gains in English language proficiency and at the same time no negative effects on Dutch language proficiency (Admiraal, Westhoff and de Bot, 2006; Huibregtse, 2001).

With respect to both language and literacy outcomes, a recent study by van der Leij, Bekebrede and Kotterink (2010) assessed the effect of concurrent instruction in Dutch and English (20-25 minutes of English per week) on reading acquisition in both languages by primary school children in the Netherlands. Results showed that within a timespan of one year, concurrent reading instruction in Dutch and English had positive effects both on the acquistion of English as L2 and Dutch as L1: The children receiving concurrent instruction outperformed those with instruction in Dutch only on most English and some of the Dutch tests. Such findings align with those that concurrent instruction does not necessarily put an additional burden on the language and literacy learning process or slows down the L1 learning process (e.g. Bialystok, Luk & Kwan, 2005; Geva & Siegel, 2000). The study by van der Leij et al., (2010) focussed on primary school children without dyslexia. Whether these findings can be extended to dyslexic students and to the bilingual second education context, where students are older and English language instruction is more extensive, remains unclear.

Taken together, the findings concerning bilingual (secondary) education in the Netherlands, along with both national and international research on foreign language acquisition by dyslexic students, lead to the following questions for this exploratory study:

(i) Do students attending bilingual secondary education outperform their peers attending regular secondary education on English literacy and oral language?

(ii) Do students with dyslexia show poorer performance on literacy and language measures in L1 and L2 than non-dyslexic students?

(iii) Do dyslexic students at BiSE show equal benefits of bilingual education as their non-dyslexic BiSE peers?

Assuming that bilingual instruction and practice yield better performance on L2 measures an affirmative answer is anticipated to the first question. This prediction is based on the findings by Verspoor et al. (2010) and van der Leij et al., (2010). Additionally, bilingual instruction could have a positive effect on reading across languages (Bialystok et al., 2005; Geva & Siegel, 2000), rendering the expectation that BiSE should score higher than RSE on L1 measures as well. Main effects of school type (BiSE, RSE) should be attested to endorse this hypothesis.

With respect to the second question an affirmative answer is expected for literacy, i.e., we expect a main effect of literacy type (No dyslexia, Dyslexia) on the literacy tasks. This is not necessarily the case for the language tasks, however: given that the students in this study, all at pre-university level of secondary education, might possess verbal compensation skills (e.g. Kuijpers et al., 2003)), any effect of literacy skills may be weakened or may disappear altogether for the language tasks.

The final question presupposes a positive answer to the first. Assuming that this is indeed the case, a positive answer might yield interactions between school type and literacy type. Furthermore, benefits of BiSE would be confirmed by significant differences between outcomes of dyslexic students at BiSE compared to RSE education. Once again, however, this may only hold for certain tasks. More specifically, it is expected that word reading, (partly) tapping phonological recoding, will

be poorer in both groups of dyslexic students (BiSE-D and RSE-D) than the students without literacy difficulties, and that receptive vocabulary might be a relative strength in the dyslexic groups.

Method

Participants

Type of education (regular secondary education vs bilingual secondary education) and Literacy ability (regular vs dyslexic) were used to divide the participant groups, yielding four groups of 15 students (see Table 1): 1) regular secondary education – regular participants (RSE), 2) bilingual secondary education – regular participants (BiSE), 3) regular secondary education – dyslexic participants (RSE-D), and 4) bilingual secondary education – dyslexic participants (BiSE-D). Participants were recruited at three schools that included both RSE and BiSE. All three schools were registered at the European Platform, the national body responsible for internationalisation in education, as providing bilingual secondary education. At the time of testing, two of the three schools were classified by the Dutch Inspectorate of Education as providing a good level of education (the highest classification possible), and the third was considered 'weak' (the second classification level). The schools were approached, agreed to participate and subsequently selected potential participants themselves.[1] Students and their parents had to approve of the student's participation prior to testing. There were no age differences between the different groups.

In order to ascertain whether the participants differed in terms of self-evaluation and self-image, they completed – in addition to the literacy and language tasks – the *Zelf-Evaluatie en Zelfbeeld* questionnaire (Meijer, 2002). This instruments presents participants with questions on emotions, worries, and lack of self-esteem. They can fill in answers ranging from 'not at all' (score=1) to 'very strongly' (score=5). A higher score relates to increased anxiety/fear of failure and poorer self-

[1] Given that schools selected participants, a selection bias cannot be ruled out. In a larger scale study, it would of course be preferable to adopt a procedure of random selection, and to also follow pupils longitudinally from the final year of primary school to for example the third year at secondary school.

esteem. Raw scores were used, leading to a minimum of 34 and a maximum score of 170. Results (Table 1) show that ZEZ outcomes were not high. An ANOVA with school type and literacy type as between-subjects factors, however, did show an effect of school type ($F(1, 59) = 8.394$, $p = .005$: students attending BiSE showed more confidence than those attending RSE. There was no effect of literacy type ($F = .406$, $p > .05$), and no interaction between the two ($F = .002$, $p > .05$). This means that the dyslexic and non-dyslexic groups did not differ in terms of ZEZ outomes, nor that school type impacted on literacy type (or vice versa). This finding is important as literacy (and language) outcomes for the dyslexic vs non-dyslexic students are thus not likely to differ because of anxiety.

--Table 1 here--

Measures

Literacy

Reading. A one-minute word-reading test in both Dutch (Eén minuut test, Brus & Voeten, 1997, EMT-Dutch) and English (OMT-Eng, Fawcett & Nicolson, 1996) was presented. For both of these timed tasks, participants had to read as many words correctly and quickly as possible in the time span of one minute. The words are presented on A4 paper in columns and increased in complexity. The maximum number of words that can be read is 116 in the Dutch and 120 in the English task. Additionally, a two-minute pseudoword reading test in Dutch (Klepel, van den Bos, Spelberg, Scheepstra & de Vries, 1994) was presented. The Klepel is similar to the EMT-Dutch, except that the time span is two minutes and pseudowords are presented. Whereas the EMT measures word reading accuracy and fluency, the Klepel taps into phonological recoding, as the targets are all novel words.

English word reading accuracy was further determined by a task tapping reading accuracy of English words (van der Leij & Morfidi, 2006) and English accuracy pseudowords test (McDougall, Borowsky, MacKinnon & Hymel, 2005). These tasks require the participants to read aloud the words presented on two cards; the words have to be read as accurately as possible without measuring the

time taken to read the targets. Given that English orthography is less transparent that Dutch, timed reading is of less importance than in Dutch. The number of correctly read targets was recorded, with a maximum score of 40. The pseudowords were derived from the real words (e.g. *desk* – *dosk*).

Orthography. To tap orthographic skills, the Dutch orthographic test of Horsley (2005) was used. The student has to choose the correct spelling out of three possibilities of a target, e.g. *gulukkig-gelukig-gelukkig* for Dutch spelling of *gelukkig* (*happy*). The complexity of the targets increases as the task proceeds. The maximum score is 70. A similar design was used to measure English orthographic knowledge (Olson, Forsberg, Wise & Rack, 1994, reported in Bekebrede et al., 2009). Unlike the Dutch selection task, the English selection task consists of two potential spellings (e.g. *believe-beleave*) for 40 words.

Language proficiency

Vocabulary. Receptive vocabulary was measured through the Dutch Peabody Picture Vocabulary Test (PPVT-Dutch, Dunn, Dunn & Schlichting, 2005) and the English PPVT (PPVT-ENG, Dunn & Dunn, 2007). The design of both tasks is identical. Four pictures are presented and the participant has to select the picture belonging to the target word (e.g. *vitamin*). Standardised scores are used.

Semantic fluency. To tap semantic fluency, the semantic fluency measures reported in van der Leij and Morfidi (2006) were used. In both Dutch and English, participants have to name as many items as possible in one minute for the categories animals and food. The order of presentation of these categories is reversed across languages. The correct number of answers were tallied.

Procedure

The orthographic tests were presented in group sessions. All other tasks were presented individually. These latter sessions were recorded. Total testing time took approximately 50 minutes. Scoring and coding was conducted after testing. Statistical analyses for group comparisons consist of univariate

analyses of variance with school type (RSE and BiSE) and literacy (dyslexic or non-dyslexic) as between-subjects variables.

Results

Literacy

Outcomes on the literacy tasks are displayed in Table 2 and in Figures 1 through 7.

--Table 2 and Figures 1 through 7 about here --

These tasks yielded relatively high correct scores in both languages on the orthographic tasks. Close to ceiling scores are also attested for the English accuracy reading tasks. In contrast, scores on the timed (Dutch) pseudoword reading task, the Klepel, are not as high. Statistical analyses (Table 2, columns on the right) establish that there is an effect of school type (BiSE > RSE) for both languages in the the English timed word-reading test (Figure 2), the Dutch and English pseudoword reading tests (Figures 3 and 5), and the English orthography task (Figure 7).

There is also an effect of group (non-dyslexic > dyslexic participants) on the Dutch and English timed word-reading tasks (Figures 1 and 2), the pseudoword reading tasks (Figures 3 and 5), and orthograhic selection tasks (Figures 6 and 7), but not for the English accuracy word reading task (Figure 4). There is an interaction between school type and literacy type for the English pseudoword reading task (Figure 5), reflecting the fact that the BiSE-D participants show a relative advantage compared to both types of RSE students. However, bear in mind that the raw score differences are minimal. The pattern of results for the literacy measures (for school and group) remains the same when class level (year 2-6) is entered as a covariate.

To assess whether there are differences between the two groups of dyslexic participants, i.e., dyslexic-BiSE vs. dyslexic-RSE, independent samples t-tests were run on the literacy measures. There

are no differences between the two groups on Dutch measures of literacy (Figures 1, 3 and 6), but BiSE-D students outperform the RSE-D on the English word-reading tasks (words (Figure 4): $t(28) = 2.376$, $p < .025$, pseudowords (Figure 5): $t(28) = 3.819$, $p < .001$). The difference between BiSE-D and RSE-D groups on the English orthography selection task (Figure 7) is not statistically significant at the .05 value ($t(28) = 1.876$, $p = .071$).

Significant positive correlations are attested across groups between the EMT-Dutch and OMT-ENG ($r = .763$**) and the Dutch and English orthographic tasks ($r = .368$**); this also holds within each of the four groups.

Language

Results on the language tests are presented in Table 3 and Figures 8 through 11.

--Table 3 and Figures 8 through 11 about here --

Statistical analyses (righthand columns of Table 3) show that the BiSE participants obtain higher scores than the RSE group on the Dutch and English receptive vocabulary tasks (Figures 8 and 9, respsectively), as well as on the English semantic fluency task (Figure 11). In addition to an effect of school type, there was also an effect of literacy type, with non-dyslexic outperforming the dyslexic group on both Dutch and English semantic fluency measures (Figures 10 and 11, respectively). There were no interactions between school and literacy type.

To further assess the difference between the two dyslexic groups, independent samples t-tests were run on the language measures. There are no differences between the two dyslexic groups on the Dutch language tasks ($p > .05$) (Figures 8 and 10). However, the BiSE-D group shows better performance on both English tasks, PPVT (Figure 9; $t(28) = 4{,}723$, $p < .001$) and semantic fluency (Figure 11; $t(28) = 2.411$, $p < .023$), mirroring the main effect of school.

Correlation analyses between the Dutch and English tasks show significant weak to moderate correlations between PPVT-Dutch and PPVT-ENG (r = .515**) and Dutch and English semantic fluency tasks (r = .475**), when all children are taken together. These correlations are not attested for either RSE groups separately. They do surface for the BiSE-No dyslexia group (r = .807** and r = .525* respectively) and on the semantic fluency task for the BiSE-D group (r = .618*).

Discussion

This exploratory study aimed to establish whether bilingual secondary education negatively affects literacy and language outcomes in English and Dutch for students with dyslexia. A range of tasks was used to assess the language and literacy skills in both languages of students attending bilingual and regular secondary education, divided into non-dyslexic participants and individuals with dyslexia. Our first research question asked whether students attending bilingual secondary education would outperform their peers attending regulary secondary education on English literacy and oral language tasks. The results showed a clear advantage of BiSE students compared to RSE students on measures of English language, i.e., receptive vocabulary and semantic fluency, and literacy, i.e., timed word-reading, pseudoword reading, and orthograpic competence. Additionally, the BiSE students outperformed RSE students on Dutch receptive vocabulary and Dutch timed pseudoword reading.

These findings sit well with those reporting benefits of BiSE in the Netherlands (Admiraal et al., 2006; Huibregtse 2001; Verspoor et al., 2010), as students receiving bilingual education outperform those attending regular education on measures of English language and literacy. The language tasks used in the present study complement those used in the Verpoor et al. (2010) study, where vocabulary was assessed using what was essentially a self-report task, and writing skills were determined using a range of global and more detailed morphosyntactic measures. As such, our findings both expand and corroborate these earlier findings showing the benefits of bilingual secondary education in the Dutch context.

In addition to higher scores on the English tasks, the BiSE group also showed enhanced performance on some Dutch language and literacy measures. This finding could indicate that there was a general language benefit for the BiSE students compared to those attending RSE. Such an interpretation aligns with findings by van der Leij et al. (2010), who reported positive effects of concurrent (literacy/language) instruction on the acquistion of English as L2 and Dutch as L1 at the primary level, as well as findings showing that bilingual education does not necessarily slow down L1 learning (e.g. Bialystok, Luk & Kwan, 2005; Geva & Siegel, 2000). Further support for this view stems from the significant correlations that were attested between the Dutch and English timed word-reading and orthographic tasks and the Dutch and English measures of receptive vocabulary and semantic fluency. We cannot however rule out the possibility that the higher scores in Dutch are the result of a selection bias, i.e., those students who choose to attend bilingual secondary education may generally be more language-oriented.

Our second research question concerned the language and literacy development of students with dyslexia and asked whether this group would perform more poorly on literacy and language measures in both their L1 Dutch and their L2 English than non-dyslexic students. Differences with respect to literacy type were indeed attested. As anticipated, the dyslexic participants were outperformed by their non-dyslexic peers on both Dutch and English literacy tasks, with the sole exception of English word reading. Furthermore, the dyslexic participants showed poorer performance on Dutch and English semantic fluency, in line with anticipated word retrieval (e.g. Perfetti & Goldman, 1976) and timed naming difficulties (e.g. Wolf & Bowers 1999), but not on receptive vocabulary, a supposed relative strength for highly educated participants (Kuijpers et al., 2003; van Viersen et al., submitted). Additionally, there was an interaction between type of education and literacy group for English pseudoword reading, indicative of an advantage of BiSE participants with dyslexia compared to both non-dyslexic and dyslexic participants attending RSE.

Given the affirmative answer to the first research question (i.e., BiSE > RSE), we are now in a position to answer the third research question, namely whether dyslexic students at BiSE show equal

benefits of bilingual education as their non-dyslexic BiSE peers. The predicted interactions between school type and literacy type were only attested for one task, namely the English pseudoword reading task, and as noted above, the differences in raw scores were minimal. There were however significant differences between the dyslexic students at BiSE and their dyslexic peers at RSE on English timed word and pseudoword reading tasks, as well as English vocabulary and semantic fluency, i.e., as predicted, it appears to be the case that, for the sample of students tested here, and for the range of literacy and language tasks employed, dyslexic students at bilingual secondary education show similar advantages in English language and literacy skills as their non-dyslexic peers. The difference between the dyslexic students at BiSE and their dyslexic peers at RSE was also approaching significance ($p = .07$) for English orthography selection task; it is possible – though of course by no means guaranteed – that this difference may reach significance with a larger sample.

Given the exploratory nature of the present study, a number of caveats are in order at this juncture. First, a small sample of students was tested and this included only students attending the highest level of secondary education. This selection is therefore not representative of the BiSE population at large. Second, it remains unclear what the development of the students was in the years prior to starting BiSE. For instance, the findings might also reflect the possibility that students who enrol for bilingual secondary education already have enhanced language and literacy skills compared to RSE at the onset of BiSE. In other words, as suggested above, there may be a(n unavoidable) selection bias in our data. Without specific data concerning the students' entry level, we cannot test this possibility for the current sample. On a related note, the BiSE students showed higher self-esteem than those attending RSE, which may also be indicative of a (n unavoidable) selection bias. In short, then, on the basis of this study alone, the direction of the effects cannot be ascertained. Longitudinal research is required to assess the levels of Dutch and English prior to bilingual education and the contributions of type of education to the language and literacy outcomes.

The findings on dyslexia should similarly be interpreted with caution. The dyslexic participants performed more poorly than the non-dyslexic participants, and at the same time a literacy and language advantage for those attending BiSE was attested compared to those attending RSE. Our tentative interpretation of these findings at this stage is that the advantage the BiSE-D group shows over the RSE-D group is driven by the knowledge gained from added exposure to English. It should however be noted that only reading tasks were presented. Productive spelling abilities were not targeted, for example; given that spelling is potentially more difficult than reading, it is possible that the BiSE advantage observed in the English literacy tasks employed in the present study, may not hold for other tasks. Furthermore, the timed English word reading task showed much more variation than the (pseudo)word reading accuracy task and the spelling selection task; it is possible that these latter tasks might have been fairly easy for all groups. Nevertheless, differences were strong enough to surface on all English literacy tasks.

Despite these caveats, our findings show that implicit policies of excluding dyslexic students from BiSE are not warranted. The group of BiSE students with dyslexia in the present study were able to cope with bilingual education. It might of course be the case that some groups or individuals are able to do this more easily than others (e.g. Bekebrede et al., 2009), who may lack the compensatory skills required. One important area for future research, which was not addressed in this study, is the underlying cognitive skills related to dyslexia, such as phonological awareness, rapid automatised naming, visual attention span, and working memory. For a complete picture of the foreign language development of dyslexic students attending bilingual secondary education, tasks tapping into these areas should be included in the test battery of future studies.

This study is a first exploratory study into bilingual secondary education and dyslexia in the Netherlands. Future steps should chart individual profiles of students, i.e. strengths and weaknesses, more elaborate testing, as well as baseline and additional follow/up measurements. For now, the conclusion is that BiSE is not too difficult and may in fact sometimes be beneficial for the group of dyslexic students under scrutiny here.

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Table 1. Participant characteristics per group

	BiSE	**BiSE-D**	**RSE**	**RSE-D**	**Total**
Total	15	15	15	15	60
Mean age (year, month)	16.58 (1.5)	15.64 (1.4)	16.34 (0.94)	16.39 (0.90)	16.24
N female	4 (27%)	5 (67%)	11 (73%)	7 (47%)	27 (45%)
Year 2	1	4	-	-	5
Year 3	3	1	3	4	11
Year 4	2	6	7	4	19
Year 5	7	3	5	7	22
Year 6	2	1	-	0	3
Mean ZEZ (max=170)	67.9 (12.4)	71.1 (21.1)	83.1 (21.3)	86.8 (25.6)	

Table 2. Means (SD) for the tasks per group on literacy outcomes

Literacy	BiSE-NoD	BiSE-D	RSE-NoD	RSE-D	Fschool	η^2_p	FGroup	η^2_p	FSxG	η^2_p
EMT-Dutch (max=116)	100.1 (11.7)	80.2 (15.8)	95.0 (13.6)	67.2 (9.7)	1.853		33.704 ***	.376	.026	
OMT-ENG (max=120)	100.1 (13.9)	82.3 (18.3)	73.7 (19.1)	60.3 (12.9)	33.798 ***	.376	13.968 ***	.200	.278	
Klepel-Dutch (max=116)	59.3 (9.5)	41.0 (8.4)	53.2 (13.4)	35.4 (9.5)	4.718*	.078	45.085 ***	.446	.008	

Accuracy words-ENG	37.4	35.7	35.5	31.1	11.820	3.3		0.		
(max=40)	(1.3)	(2.5)	(1.6)	(3.9)	***	62		0		
Accuracy	39.9	39.4	38.9	38.4	23.994	.30	21.277	.2	4.2	.0
pseudowords-ENG	(0.26)	(0.63)	(1.5)	(1.5)	***	0	***	74	87*	71
(max =40)										
Orth-Dutch	68.1	65.1	67.8	66.5	1.561		21.438	.2	3.3	
(max=70)	(0.96)	(2.6)	(1.0)	(1.8)			***	77	76	
Orth-ENG	39.9	39.1	39.5	38.4	6.547*	.10	19.052	.2	.20	
(max=40)	(0.26)	(0.80)	(0.99)	(1.1)		5	***	54	4	

*p < .05, **p < .01, ***p < .001. Effect sizes are only provided when main effects are attested.

Table 3. Means (SD) for the tasks per group on language outcomes

Language	BiSE-NoD	BiSE-D	RSE-NoD	RSE-D	Fschool	η^2_p	FGroup	η^2_p	FSxG	η^2_p
PPVT-Dutch	111.2	110.7	106.3	106.4	5.632*	.09	0.015		.02	
	(7.9)	(6.8)	(7.3)	(7.7)		1			4	
PPVT-ENG	98.7	95.3	77.5	76.3	68.431	.55	0.955		.20	
	(9.9)	(7.5)	(9.3)	(10.5)	***	0			6	
Sem-Dutch	36.3	32.0	33.8	30.9	1.306		4.677*	.0	.20	
	(7.1)	(7.4)	(4.9)	(5.6)				77	1	
Sem-ENG	26.0	21.5	17.9	16.1	18.898	.25	4.092*	.0	.81	
	(7.1)	(6.8)	(4.5)	(5.2)	***	2		68	7	

*p < .05, **p < .01, ***p < .001. Effect sizes are only provided when main effects are attested.

Figure 1. Average scores on one-minute word reading task in Dutch (EMT; max. 116)

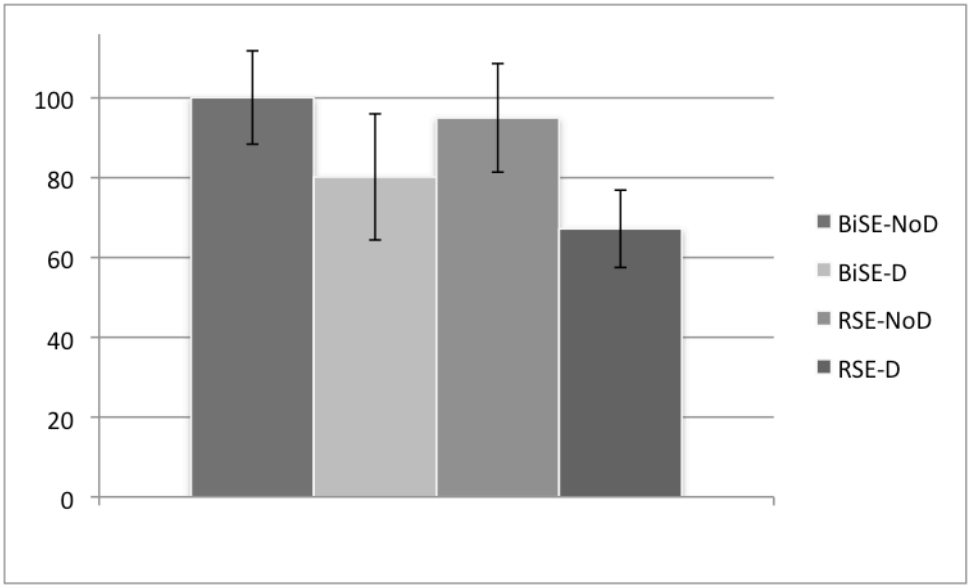

Figure 2. Average scores on one-minute word reading task in English (OMT; max. 120)

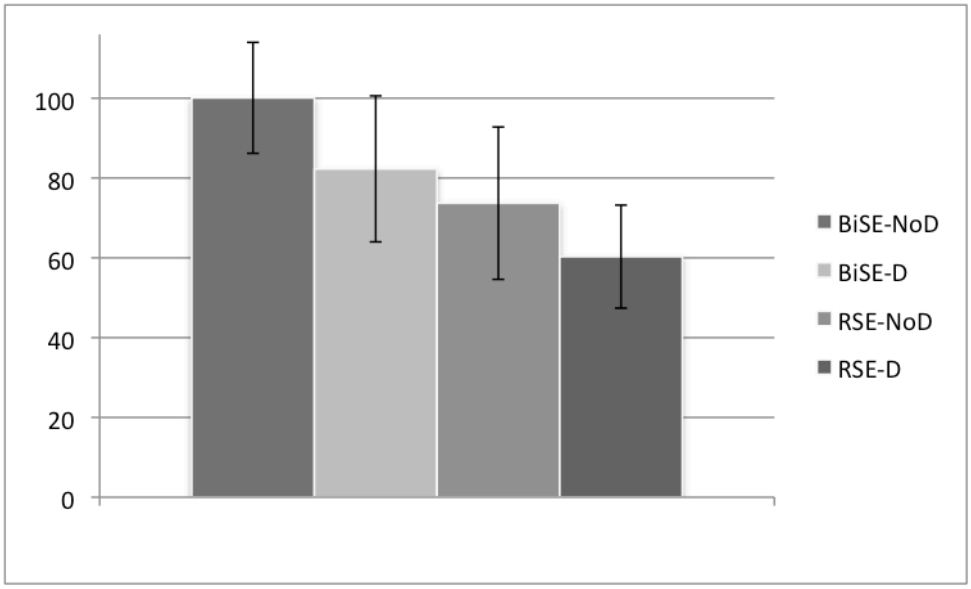

Figure 3. Average scores on pseudoword reading task in Dutch (Klepel; max. 116)

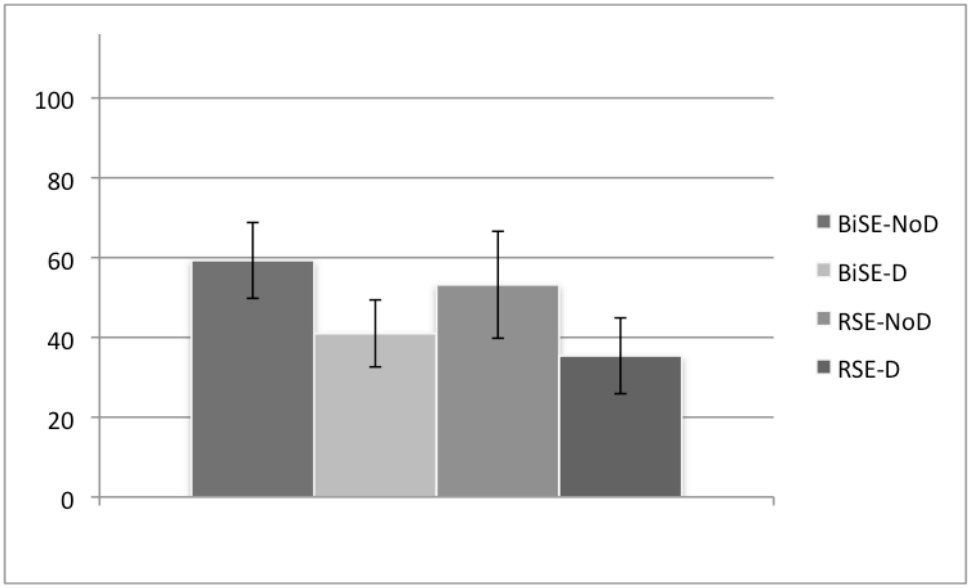

Figure 4. Average scores on word reading task in English (max. 40)

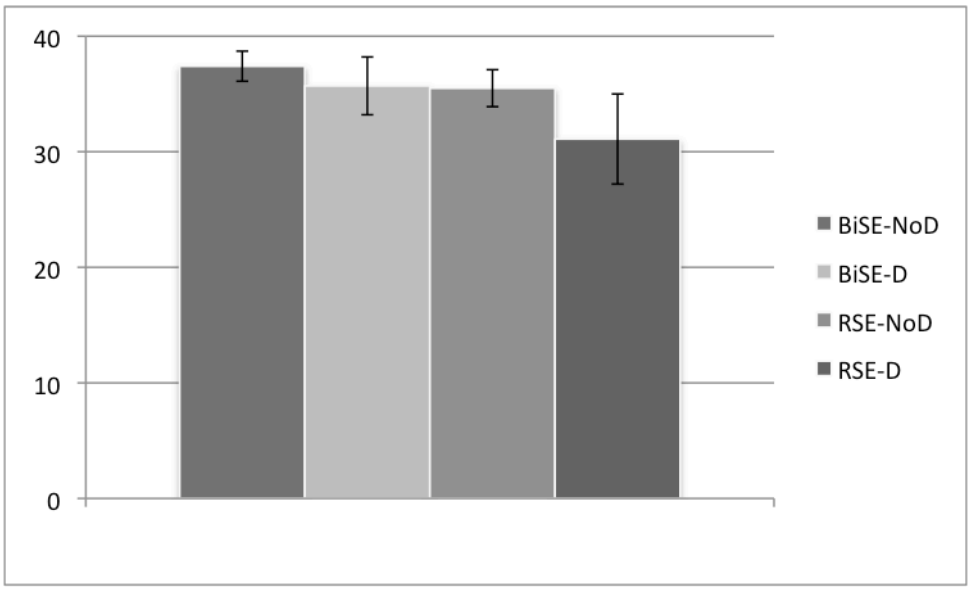

Figure 5. Average scores on pseudoword reading task in English (max. 40)

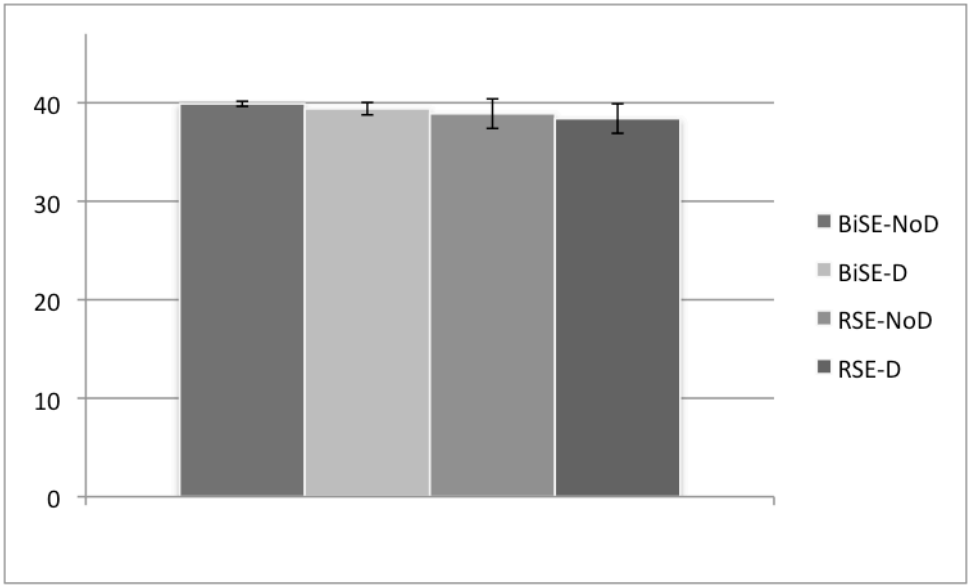

Figure 6. Average scores on orthographic task in Dutch (max. 70)

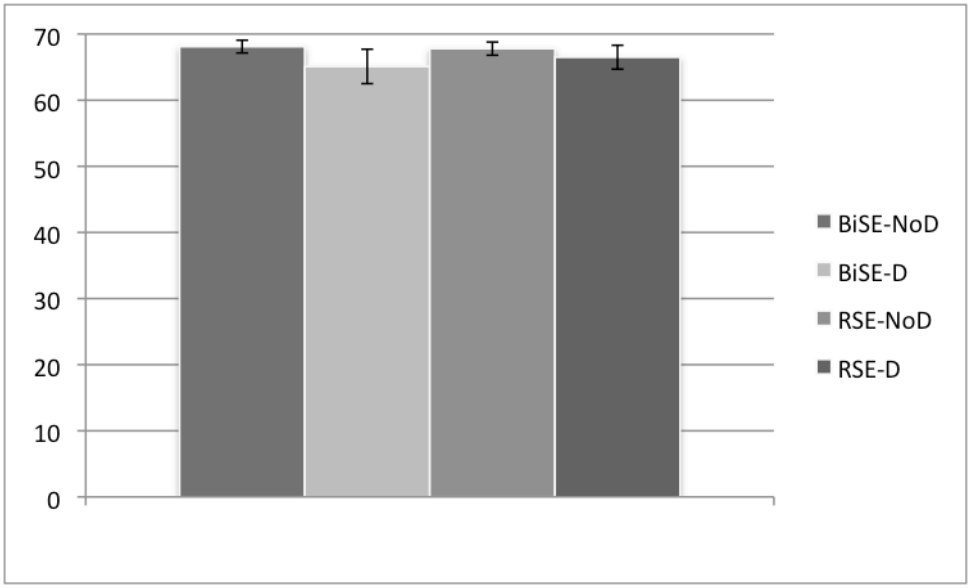

Figure 7. Average scores on orthographic task in English (max. 40)

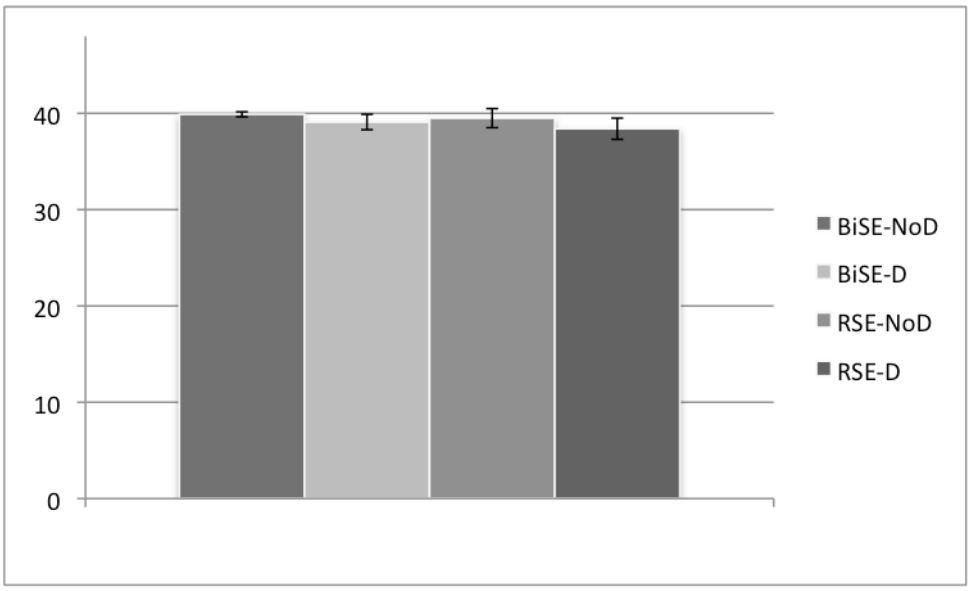

Figure 8. Average scores on vocabulary task in Dutch

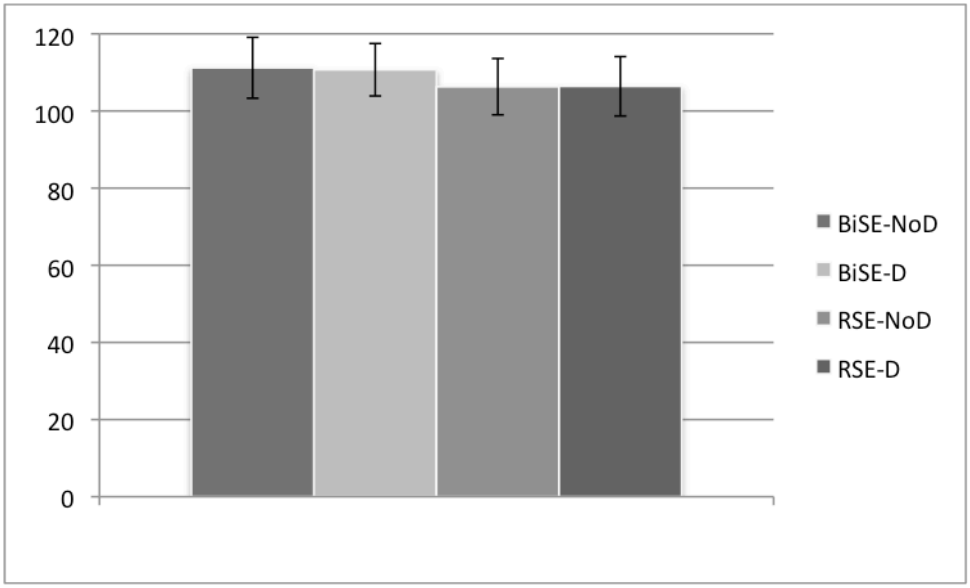

Figure 9. Average scores on vocabulary task in English

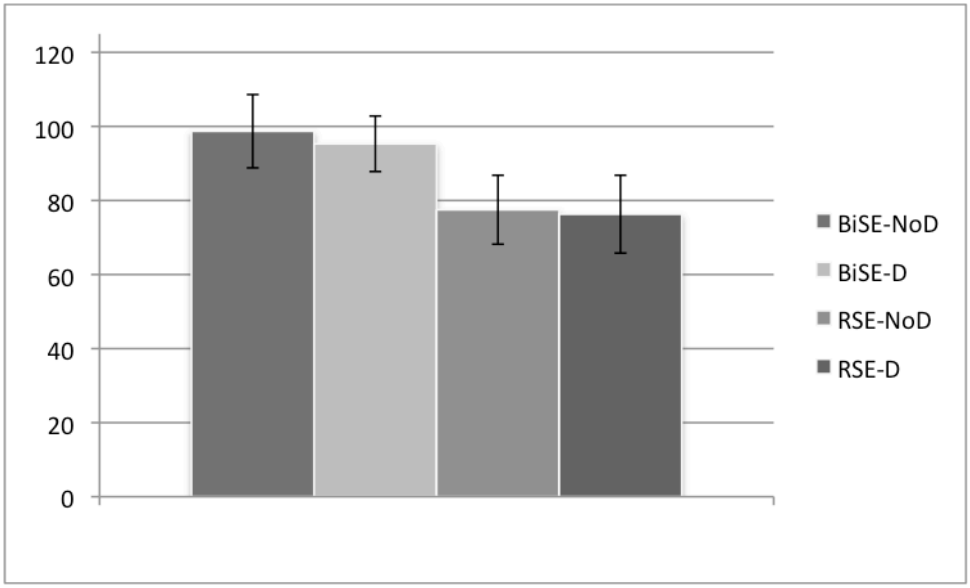

Figure 10. Average scores on semantic fluency task in Dutch

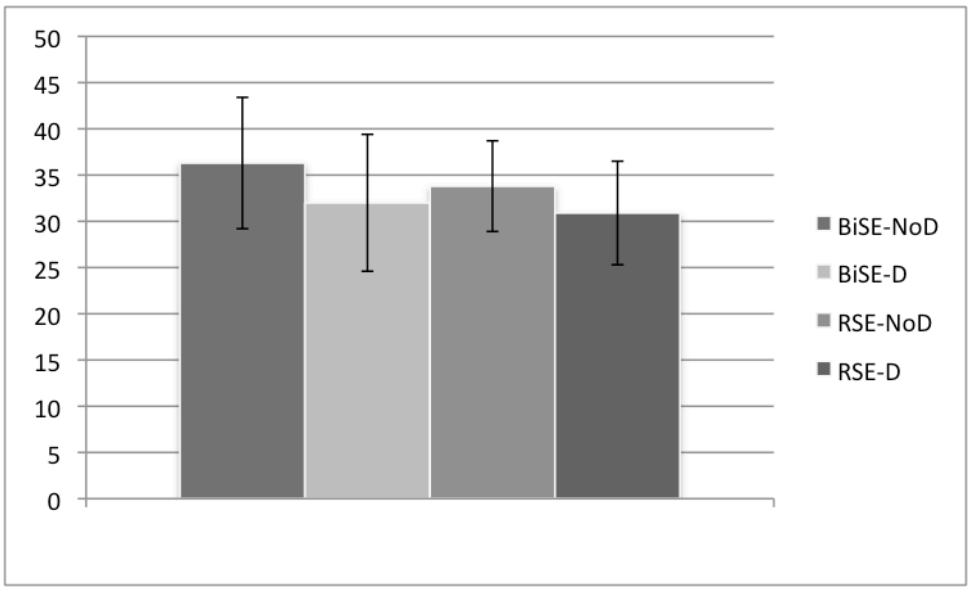

Figure 11. Average scores on semantic fluency task in English