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Does Bilingual Education Benefit the Social and Cognitive Development of Monolingually-Raised Children? Evidence from a longitudinal study

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1. Introduction

The question of whether child bilingualism enhances cognitive development continues to be debated. Although there is a large body of research pointing to advantages for bilingual over monolingual children in certain executive functions (Bialystok & Martin, 2004; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Hernández, Martin, Barceló, & Costa, 2013), other studies have not replicated these findings, highlighting external factors that may have been overlooked (Antón, Carreiras, & Duñabeitia, 2019; Paap, Johnson, & Sawi, 2015). Advantages have also been found for bilinguals' social skills (Fan, Liberman, Keysar, & Kinzler, 2015; Han, 2010; Sun, Yussof, Mohamed, Rahim, Bull, Cheung, & Cheong, 2018). However, most of this literature reports cross-sectionally and/or on children raised with two languages at home, making it difficult to pinpoint the amount of L2 exposure necessary for potential advantages to materialise.

Our study contributes to the continuing discussion over the purported benefits of child bilingualism for social and cognitive development by employing a longitudinal design, incorporating different levels of L2 exposure, and controlling for variables left unchecked in previous studies. The present paper considers the results of the second year of this longitudinal study, tracking the social and cognitive development of children educated – but not raised – bilingually, and comparing them with children both educated and raised monolingually.

The study takes place in Spain and follows children whose first language (L1) is Spanish and second language (L2) is English, testing them on attention (Test of Everyday Attention for Children, TEA-Ch2, Manly, Anderson, Crawford, George, Underbjerg, & Robertson, 2016) and social development (Social Skills Improvement System Rating Scales, SSiS, Gresham & Elliott, 2008). It administers the complete battery of the TEA-Ch2, setting it apart from previous studies, which have focused on a selection from this battery. Further,

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by monitoring vocabulary development in both languages, the study speaks to questions about the degree and type of L2 exposure that is optimal for L2 vocabulary progression and puts paid to older, yet persistent concerns over potential negative repercussions of bilingualism on L1 vocabulary development (see Grosjean & Byers-Heinlein, 2018, for a review).

To recall our first testing phase, Chamorro and Janke (2020) reported modest advantages for some of the children attending bilingual education, who were separated into a higher-exposure group (HiEx) and a lower-exposure group (LoEx) and then compared with a control group of monolinguals (MON). First, the study confirmed that L2 receptive vocabulary scores were indeed in line with the degree of L2 exposure: HiEx > LoEx > MON. Second, with respect to attention, the HiEx outperformed the MON on two tasks, Balloons 5 (selective attention with inhibitory control) and SART (sustained attention with response inhibition), whereas the LoEx only outperformed them on one (Balloons 5). Third, with regard to social skills, the HiEx scored higher than the MON on two measures, namely communication (where they also outperformed the LoEx) and co-operation. With these results in mind, we can turn to our second testing phase, which asked whether this pattern of results would remain, increase or disappear one year on (i.e. after two years in bilingual education).

1.1. Aims of the present study

As detailed in Chamorro and Janke (2020), this longitudinal study follows three groups of children attending primary education with different amounts of L2 exposure and monitors their cognitive, social and L2 vocabulary development by assessing them on a complete suite of attention and social tests, as well as receptive vocabulary and several background measures. Our questions for this second testing phase were:

(1) After two years of primary education, did bilingually-educated children outperform the MON on English receptive vocabulary? Did the HiEx outperform the LoEx?

(2) After two years of primary education, did bilingually-educated children outperform the MON on the attention skills measures? Did the HiEx outperform the LoEx?

(3) After two years of primary education, did bilingually-educated children outperform the MON on the social skills measures? Did the HiEx outperform the LoEx?

2. Method

2.1. Participants

The children tested at the end of Year 1 of primary education were revisited at the end of Year 2 (ages 7-8). Those in the HiEx group received 40% of the curriculum in English (Natural Sciences, English Language, Arts & Crafts, Performing Arts) and 60% in Spanish (Social Sciences, Maths, Spanish

Language, Religion, PE). Those in the LoEx group received 30% in English (Social Sciences, Natural Sciences, English Language) and 70% in Spanish (Maths, Spanish Language, Religion, PE, Arts & Crafts, Music)[2]. The children in the MON group followed a Spanish curriculum with three hours of English Language per week.

51 of the 59 original children were available for testing. The HiEx comprised 21 children (13 girls), with a mean age of 7.8 years (range: 88-99 months), the LoEx comprised 16 children (6 girls), with a mean age of 7.8 (range: 88-100), and the MON group was composed of 14 children (6 girls), with a mean age of 7.7 (range: 89-99 months).

2.2. Materials

2.2.1. Background measures

During phase one, we collected important background measures. To collate information on socio-economic status, immigrant status, ethnic background, families' educational background, and children's L2 exposure outside of school, parents completed a questionnaire. This confirmed that all children came from monolingual Spanish families and none were migrants or differed in their ethnic background. We also tested non-verbal reasoning and working memory. The results of Raven's Coloured Progressive Matrices, (Raven, Raven, & Court, 1998) demonstrated that all children performed similarly on non-verbal reasoning and that their scores were in line with the standardised score for their age (F=0.29, df=2, p=0.75). Results of the Digit Span task (Wechsler Intelligence Scales for Children-Revised, Wechsler, 1974) were also uniform, with all children obtaining the expected minimum span of 4 for this working memory task.

During this second testing phase, we retested Spanish vocabulary, using Test de Vocabulario en Imágenes Peabody, PPVT-III (Dunn, Dunn, & Arribas, 2006) so as to keep track of the children's L1 receptive vocabulary development. Again, all children performed within the standard for their age and comparably to one another (F=0.95, df=2, p=0.40). They also showed a significant improvement from Year 1 to Year 2 (F=50.17, df=1, 48, p<0.001). We return to the importance of this in the Discussion.

Table 1 summarises these background measures[3].

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[2] We originally intended to include bilingual schools with a larger difference in the English exposure children received. However, state bilingual schools in Spain offer a similar program at this stage of primary education with 30% in English and 70% in Spanish. Therefore, we decided to test fee-paying bilingual schools but could not find schools that differed more in their L2 exposure (we did not consider international schools, as their curriculum is entirely in English and many of their pupils do not come from monolingual Spanish families).

[3] Family educational level was calculated on a scale from 0 to 4 (0=no qualification; 1=Secondary Education; 2=Further Education; 3=Higher Education Certificate/Diploma; 4=Bachelor's degree with honours) based on the parents' highest educational qualification.

Table 1. Means (SDs) of each group's age (Year 2), family educational level, and raw scores in Raven's (Year 1), Digit Span (Year 1), and PPVT-III (Year 2).

	HiEx	LoEx	MON
Age	7.83 (3.26)	7.83 (4.25)	7.71 (2.98)
Family Education	3.78 (0.42)	3.76 (0.44)	3.62 (0.50)
Raven's	26.61 (3.35)	25.75 (3.92)	26.14 (3.11)
Digit Span	4.09 (0.30)	4.06 (0.25)	4.00 (0.00)
PPVT-III	99.05 (13.14)	104.06 (10.33)	102.36 (9.09)

2.2.2. Experimental measures

2.2.2.1. English vocabulary

To continue to monitor L2 vocabulary development, the British Picture Vocabulary Scales, BPVS3 (Dunn & Dunn, 2009) was re-administered in Year 2. Just as with studies on children with L2 English (see Mahon & Crutchley, 2006), all groups performed below the standardised score for their age, as scores for this test are based on native speakers. Testing assessed whether children's L2 proficiency differed according to the degree of English exposure they received in their respective schools.

2.2.2.2. Social skills

Children's social skills were reassessed via the SSiS (Gresham & Elliott, 2008) in keeping with similar studies (Han, 2010). This test evaluates seven skills: communication (taking turns, making eye contact, using appropriate tone of voice and gestures, being polite), co-operation (helping and sharing with others, following rules/directions), assertion (initiating behaviours, e.g. asking for information, introducing oneself, responding to others' actions), responsibility (respecting others' property, communication with adults), empathy (showing concern for others' feelings/viewpoints), engagement (joining activities/inviting others to join, initiating conversations and interacting with others, making friends), and self-control (responding appropriately in conflict situations, e.g. disagreeing or teasing, and non-conflict situations, e.g. taking turns or compromising). In the first year of the study, parents had completed this test but because SSiS employs a self-rating version of the questionnaire for children aged 8-12, in this second year, children answered the questions themselves.

2.2.2.3. Cognitive skills

For cognitive abilities, we re-administered the TEA-Ch2 (Manly et al., 2016). Unlike previous studies, which used a sub-set of its tasks (Bak, Long, Vega-Mendoza, & Sorace, 2016; Garraffa, Beveridge, & Sorace, 2015; Vega-Mendoza, West, Sorace, & Bak, 2015), we continued to administer the complete battery[4]. This includes nine tasks on selective attention (ability to focus on a specific cue while inhibiting distractors), sustained attention (ability to focus over a long period of time) and switching attention (ability to switch between different instructions). Each task is explained below, in the order completed by the children. All of them start with practice trials.

(1) Hector Cancellation: Children have 10 seconds to find and cross out as many yellow oval targets on a page as possible. There are six trials, two where there are only targets, and four with targets and distractors. The score is the mean number of targets found within the time limit.

(2) Hector-B Cancellation: Children find and cross out all yellow oval targets on a page containing distractors. This is an untimed single-trial task but completion time is recorded. The score is the time in seconds per target found.

(3) Hecuba Visual Search: Children have 30 seconds to examine a series of boxes, consecutively, on a page, stating whether the target (yellow oval) is present or not. They must find it among distractors, and inspect as many boxes as possible. There are two trials, and the score is the mean correct responses in the time given.

(4) Vigil: In this auditory task, children count the number of tones they hear in each trial, after which they state the number they counted. There are 10 trials and the score is the total correct responses.

(5) Troy Dual Task: Children complete two tasks simultaneously: they cross out the yellow oval targets on a page with distractors as quickly as possible while counting the number of tones they hear, after which they state the number of tones they counted. There are 4 trials and the score is the mean number of targets found, weighted for accuracy.

(6) Cerberus: Children hear a series of trials containing different sounds and press the spacebar as soon as they hear a dog bark, ignoring distracting sounds. There are 15 trials in this computerised task and the score is the mean response time in milliseconds, weighted for accuracy.

(7) Simple Reaction Time (SRT): Children watch the screen, which has a centred fixation box, and press the spacebar whenever a blue blob appears. For this single-trial computerised task, they have to focus their attention for a long period of time (six minutes approximately, depending on performance). The score is the mean response time in milliseconds.

(8) Sustained Attention to Response Test (SART): Children watch the screen, where different-coloured shapes appear, consecutively, at a regular pace. They press the spacebar after every shape except triangles. For this single-trial computerised task, they have to focus their attention for a long period of time

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[4] In Year 1, the children completed the version for ages 6-7 (i.e. TEA-Ch2 J), but in this second testing phase, they completed the TEA-Ch 2 A version, which is for ages 8-15.

(five minutes approximately, depending on performance). The score is the number of no-go responses (i.e. when pressing the space bar after a triangle).

(9) Reds and Blues, Bags and Shoes (RBBS): Children switch between two tasks: they sort four repeating stimuli according to colour in some trials or whether they are held in the hand/worn on the foot in others. There are 4 trials in this computerised task, and in two of them they alternate between the tasks within the same trial. The score is the mean response time in milliseconds, weighted for accuracy.

2.3. Procedure

With written consent from schools and parents, children were tested individually in a quiet room in their schools. Tests were administered in different sessions, which took place on different days. In one session, they completed the BPVS, and in another, the TEA-Ch2 and the PPVT. The SSiS was administered by the children's main teacher during class. Except for the BPVS, tasks were conducted in Spanish. Recall that the other background measures had been gathered in Year 1.

3. Results

Performance differences on the experimental measures were investigated by subjecting the raw scores to regression analyses (generalised linear models). Several co-variates (gender, parent education level, and exposure to English outside school) were included to monitor potential influences on our variables of interest, namely BPVS, attention (9 variables), and social skills (7 variables). When a significant difference between the predictors (the groups) was found, paired comparisons were conducted for the HiEx group vs. the LoEx group, the HiEx group vs. the MON group, and the LoEx group vs. the MON group. All multiple comparisons report Sidak-corrected p-values.

Starting with our comparison of L2 vocabulary in Year 2, this measure continued to reveal results that could be predicted on the basis of the amount of L2 exposure children received at their respective schools (see Figure 1). BPVS scores were significantly different between the groups ($F=55.88$, $df=2$, $p<0.001$). The HiEx performed better than the LoEx ($p<0.001$) and the MON (HiEx mean=68.95, SD=11.81; LoEx mean=38.50, SD=14.75; MON mean=28.64, SD=7.71). The LoEx also performed better than the MON but this difference was only marginal ($p=0.08$). There was no Group-by-Year interaction ($F=0.39$, $df=2$, $p=0.681$), indicating that the increase in vocabulary scores over the year did not vary between groups. Co-variates did not influence results.

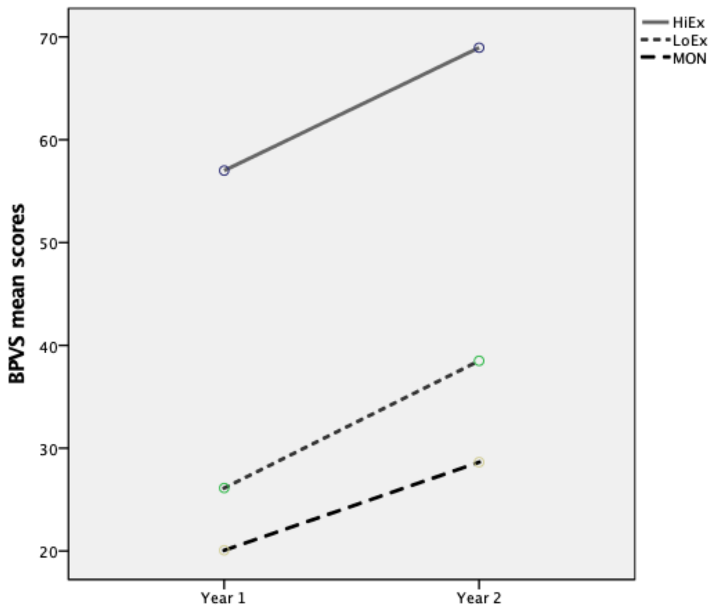

Figure 1. English vocabulary development of each group over two years.

With regard to attention skills, our question was whether differences found in Year 1 would remain, increase or disappear in Year 2. Recall that the TEA-Ch2 includes nine tasks testing three types of attention: selective, sustained, and switching. Unlike Year 1[5], analyses of the Year 2 results showed no significant differences between groups on any of the measures, although numerically, the bilingual groups, particularly the HiEx, performed better than the MON on all measures but one, namely Cerberus (see Table 2 for the results on the attention tasks[6]). With respect to one of the co-variates, children who reported exposure to English outside of school outperformed those that did not on two measures: Troy Dual Task ($t=2.64$, $df=49$, $p=0.01$) and Cerberus ($t=2.90$, $df=49$, $p=0.006$). No other co-variates influenced the results.

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[5] In Year 1, the HiEx performed significantly better than the MON in two measures: the equivalent task to Hector-B Cancellation, where also the LoEx performed significantly better, and SART.

[6] Note that since Hector-B Cancellation, Cerberus, SRT, and RBBS are measured in response times, lower scores indicate a better performance. This is also true for SART (i.e. fewer triangle trials where participants pressed the space bar).

Table 2. Mean scores (SDs) for each group on attention.

	HiEx	LoEx	MON
Hector canc.	14.27 (1.91)	13.87 (1.39)	13.43 (1.98)
Hector-b canc.	2.97 (0.62)	3.27 (0.68)	3.15 (0.83)
Hecuba Visual	10.17 (1.96)	9.38 (1.50)	9.54 (2.13)
Vigil	8.29 (1.27)	8.63 (1.41)	7.50 (1.74)
Troy Dual T.	10.39 (2.27)	9.58 (2.23)	9.30 (1.89)
Cerberus	1285.33 (332.22)	1227.36 (530.77)	1208.18 (385.26)
SRT	668.33 (93.30)	620.70 (93.91)	671.31 (86.60)
SART	7.43 (4.94)	8.06 (4.48)	9.36 (4.73)
RBBS	1553.03 (291.18)	1497.64 (248.25)	1629.58 (233.88)

Our question concerning social skills was the same as for attention: whether any of the differences found in Year 1 would remain, increase or disappear in Year 2. Again, unlike Year 1[7], the Year 2 results showed no differences between the schools on any of the measures, although numerically the LoEx performed better than the other two groups on all social skills (see Table 3). Co-variates did not influence results.

Table 3. Mean scores and (SDs) for each group on the social skills test.

	HiEx	LoEx	MON
Communication	13.71 (3.07)	14.50 (2.16)	14.21 (2.97)
Cooperation	16.76 (3.11)	18.06 (1.91)	15.57 (2.65)
Assertion	14.52 (3.97)	15.06 (2.32)	14.93 (3.69)
Responsibility	15.76 (3.21)	17.69 (2.02)	15.57 (2.85)
Empathy	13.81 (3.06)	15.88 (1.45)	13.71 (3.27)
Engagement	15.67 (4.02)	17.13 (2.63)	16.21 (3.09)
Self-Control	10.95 (2.84)	12.69 (2.63)	11.29 (3.73)

4. Discussion

Our data from this second testing phase do not yet show support for the hypothesis that bilingualism, when restricted to the school environment, translates into cognitive or social benefits for the developing child. However, close monitoring of this question over the next few years is key to forming any strong conclusions; these years may demonstrate that advantages materialise over a longer time period.

[7] In Year 1, the Hi-Ex outperformed the MON in Communication, where they also outperformed the LoEx, and Cooperation.

Our results on receptive vocabulary are in line with what we have come to expect on the basis of L2 immersion: L2 improves with greater exposure and L1 does not suffer as a consequence. With respect to the children's English receptive vocabulary development, we note first that the differences between the groups mapped with the amount of English exposure received by the children in their respective schools. In accordance with Year 1, the children in the group with the higher degree of exposure to English (HiEx) continued to perform substantially better than those with the lower degree of exposure (LoEx). Equally, the LoEx continued to outperform the MON as they did in Year 1, although the difference between these two groups was nothing like that between the HiEx and the LoEx, as illustrated in Figure 1.

Looking at the L2 vocabulary performance of all groups with respect to Year 1, it is clear that all children's performance improved after a further year of education. However, the angles of the inclines in Figure 1 are not markedly different between the groups, illustrating that the rate of improvement between Year 1 and 2 did not vary between groups, with the distance between them remaining constant. On the basis of the marked difference between the HiEx and the other two groups in Year 1, one might have expected the HiEx to accelerate their pace of learning and leave these groups still further behind. The fact that this has not happened suggests that higher exposure could be integral to an initial surge in vocabulary increase but that once vocabulary starts growing, the small difference in amount of L2 exposure between the groups was not sufficient to impact this second phase of learning. This is a possibility that will be monitored in the coming years.

Children's scores on receptive Spanish vocabulary, namely their L1, did not differ in the first testing phase (see Chamorro & Janke, 2020) and neither did they in the current one. This result supports the growing consensus in the scientific community that bilingualism is not detrimental to L1 vocabulary development (Grosjean & Byers-Heinlein, 2018), a conclusion that must reach parents if fears about bilingualism creating a confused linguistic system in the language-learning child are to be put to rest.

Our Year 2 results on attention are paltry with regard to a bilingual advantage. Although the bilingual groups, particularly the HiEx, did score slightly higher than the MON on all but one of the measures, none of these reached significance. At this stage, then, there is little to support this hypothesis. One of the co-variates, however, did influence the outcomes on two of the tasks, namely the Troy Dual Task and Cerberus. Specifically, children who had reported exposure to English outside of the school outperformed children who did not. The type of exposure received outside of a formal school setting is of course different to that available in the classroom (Armon-Lotem & Meir, 2019) so it could be type of exposure rather than amount of exposure that is key here. It is worth noting that both of these tasks tap selective attention, where some inhibitory control must be exercised as participants must focus on a specific target, ignoring distractors. These findings are in line with previous studies investigating selective attention with similar tasks, which found a bilingual advantage (Bialystok, 1992; Costa et al., 2008; Kapa, 2010; Nicolay & Poncelet, 2013, 2015; Yang & Lust, 2004).

The results for the children's social skills are also different from the first year. The two aspects that indicated a bilingual advantage in Year 1 (communication and co-operation) did not continue to do so one year on. We are less confident with these comparisons, however, due to the difference in data collection methods between Year 1 and 2 for this task. In Year 1, parents rated their children but in Year 2, the responsibility shifted to the children, who were expected to rate themselves. It is perhaps more pertinent to wait for next year's results, where again the child must self-report, before drawing any conclusions about social development in bilingually-educated children.

In conclusion, the data from the second testing phase of this longitudinal study do not continue to illustrate the modest benefits of bilingual education reported in phase one. Whether the current plateau represents a stage of development or is indicative of the absence of any advantage is an on-going question that will be returned to in the third phase. Receptive vocabulary development in both L1 and L2, however, show more conclusive results. L1 vocabulary development is not hampered by early access to an L2 and the greater the L2 exposure, the better the children's performance in the L2. This seems to be the case even when the difference of exposure is moderate as was the case here.

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