Investigating the bilingual advantage: The impact of L2 exposure on the social and cognitive skills of monolingually-raised children in bilingual education

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Abstract

Most research reporting that bilingual children exhibit enhanced cognitive skills and social awareness relative to their monolingual peers focuses on children raised and educated bilingually, making it difficult to pinpoint the degree of second language exposure necessary for such advantages to materialise. The current study measures the social and cognitive skills of Spanish children educated bilingually yet raised monolingually to explore (a) whether bilingual education alone confers advantages, and (b) whether greater second language exposure is key to producing them. It compares three groups of monolingually-raised children in their first year of primary education (i.e. 6-7 years old): one group educated in mainstream "monolingual" education, one group enrolled in English-Spanish bilingual education with a ratio of 40-60 English-Spanish exposure, and one group enrolled in English-Spanish education with a ratio of 30-70 English-Spanish exposure. After one year of primary education, children attending bilingual education scored significantly higher than monolingual children on a sub-set of cognitive (selective attention; response inhibition) and social (communication; co-operation) skills, with the higher exposure bilingual school outperforming the lower exposure bilingual school on some of these measures.

Keywords

Bilingual education, cognitive skills, social skills, L2 exposure, Spanish, English

1. Introduction

The question of whether child bilingualism enhances cognitive development continues to be debated. Although a large body of research points to advantages for bilingual children over monolingual children in terms of certain executive functions (Bialystok, 1999; Bialystok & Martin, 2004; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Hernández, Martin, Barceló, & Costa, 2013; Kovács, 2009; Siegal, Iozzi, & Surian, 2009), other studies fail to replicate these findings and highlight a number of external factors that have been overlooked (Antón, Carreiras, & Duñabeitia, 2019; Paap, Johnson, & Sawi, 2015). In addition, the literature typically reports on children raised with two languages at home (see Hansen et al., 2016 for an exception), making it impossible to pinpoint the amount of exposure necessary for any advantages to materialise.

The current study asks whether bilingual education alone reaps cognitive and social benefits and if so, whether these benefits increase as a function of second-language (L2) exposure. It approaches these questions by focusing on Spanish children raised monolingually, yet educated bilingually. The timing of bilingual exposure is held constant across children and the amount of bilingualism experienced clearly delineated. A further novel contribution is that rather than assessing children on only a sub-set of cognitive tests (e.g. Bak, Long, Vega-Mendoza, & Sorace, 2016; Garraffa, Beveridge, & Sorace, 2015; Vega-Mendoza, West, Sorace, & Bak, 2015), a complete suite of cognitive as well as social tests are administered: seven tasks probing two aspects of attention (selective, sustained) and seven tasks tapping into social skills (communication, cooperation, assertion, responsibility, empathy, engagement, self-control). To our knowledge, this is the first study to employ a full set of tests on both aspects, thereby permitting a detailed analysis of bilingually-educated children's cognitive and social skills.

1.1 The effects of bilingualism on general cognition

Research exploring the potential advantages of bilingual acquisition on general cognition has proposed that bilingualism enhances executive functions. Executive function skills refer to domain-general cognitive abilities, such as inhibition of specific information/responses, switching of attention between tasks, and monitoring and updating of information in working memory (Miyake & Friedman, 2012; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000). The hypothesis of the so-called bilingual advantage is that some cognitive skills are enhanced by bilingual speakers' language control abilities, namely the constant switching between languages and inhibition of the unwanted language while selecting the required one (see Green, 1998), a feat achieved efficiently despite both languages always being activated to some extent (Blumenfeld & Marian, 2013; Lagrou, Hartsuiker, & Duyck, 2013; Thierry & Sanoudaki, 2012). Since language control appears to make use of domain general executive functions (Craik & Bialystok, 2006; Green & Abutalebi, 2013), bilingual speakers may transfer this ability to non-linguistic cognitive domains and thus outperform monolinguals on tasks requiring inhibitory control or attentional switching.

With regards to inhibitory control, a large number of studies have found a bilingual advantage in conflict-resolution tasks such as the Simon task, the Stroop task, the Flanker task, or the Dimensional Change Card Sort task. In the case of the Simon task, for example, participants must press the right key if they see a red square on the computer screen and the left key if they see a green square. Stimuli appear on the left or right sides of the screen so that position information is congruent or incongruent with the square's colour. In congruent trials, a red square appears on the right and in incongruent trials, it appears on the left. Participants must exercise inhibitory control to ignore the position information in the incongruent trials, so bilinguals are expected to outperform monolinguals due to their language control abilities. Research comparing bilingual and monolingual speakers on tasks requiring interference inhibition demonstrate a bilingual advantage (Bialystok, 1999, 2006; Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008, 2012; Bialystok, Craik, & Ryan, 2006; Bialystok & Martin, 2004; Bialystok, Martin, & Viswanathan, 2005; Carlson & Meltzoff, 2008; Costa et al., 2009; Costa, Hernández, & Sebastián-Gallés, 2008; Costa & Sebastián-Gallés, 2014; Hernández et al., 2013; Luk, De Sa, & Bialystok, 2011; Martin-Rhee & Bialystok, 2008; Prior & Gollan, 2011; Prior & MacWhinney, 2010; Tao, Marzecová, Taft, Asanowicz, & Wodniecka, 2011). However, it has been claimed that tasks which depend upon inhibition of an automated response instead, such as the Day-Night task, do not show a bilingual advantage (Bialystok et al., 2008; Carlson & Meltzoff, 2008; Martin-Rhee & Bialystok, 2008; Robertson, Manly, Andrade, Baddely, & Yiend, 1997). Martin-Rhee and Bialystok (2008) explain these results by distinguishing between the types of inhibitory control used: while response inhibition tasks require abstention from a response pattern, interference inhibition tasks involve supressing one of two conflicting alternatives, and it is the latter that reflects bilinguals' language control experience. However, other studies have reported a bilingual advantage in response inhibition tasks (Bialystok & Shapero, 2005; Cape, Vega-Mendoza, Bak, & Sorace, 2018; Ryan, Bialystok, Craik, & Logan, 2004).

A bilingual advantage has also been found for cognitive flexibility (i.e. attentional or task switching) (Bialystok, 1999; Bialystok & Shapero, 2005; Prior & MacWhinney, 2010). However, it has been suggested that not all bilinguals may demonstrate this switching advantage as not all bilingual populations language-switch to the same extent (Costa et al., 2009; Green & Abutalebi, 2013; Prior & Gollan, 2011). Therefore, only those bilinguals who frequently switch between their languages are predicted to exhibit higher cognitive flexibility.

The bilingual advantage is a controversial topic as other studies have not replicated cognitive benefits (Antón et al., 2019; Antón, Duñabeitia, Carreiras, & Estévez, 2014; Duñabeitia et al., 2014; Gathercole et al., 2014; Paap, 2014; Paap & Greenberg, 2013; Paap, Johnson, & Sawi, 2014; Paap & Sawi, 2014). One of the main claims of this body of research is that the advantage indicated in previous work may be due to researchers not controlling carefully for potential contributory factors, such as socio-economic status, amount of L2 exposure, or age of L2 acquisition (Paap et al., 2015).

The controversial mixed evidence surrounding this topic calls for further research to tease apart the bilingual experience and identify what factors may relate to potentially enhanced cognitive abilities (Bonfieni, Branigan, Pickering, & Sorace, 2019a, 2019b; Kubota, Chevalier, & Sorace, 2019). Most of the aforementioned studies have focused on children raised with two languages at home and/or the community since early childhood, but not on children restricted to learning their L2 in a bilingual school, which is a bilingual experience substantially different from that of simultaneous bilinguals. Our study investigates how this type of bilingual experience (i.e. immersion/bilingual education) affects children's attentional/executive and social skills. Since this group of speakers is exposed to the L2 later, and less intensively than simultaneous bilinguals, the lack of L2 fluency may lead them to employ greater attentional resources than simultaneous bilinguals when processing the L2 because they are learning academic subjects in a language they have not yet mastered (Nicolay & Poncelet, 2013; Segalowitz & Hulstijn, 2005). However, lack of L2 fluency means they do not experience frequent language switching, so higher cognitive flexibility may not ensue (Costa et al., 2009; Green & Abutalebi, 2013; Prior & Gollan, 2011).

Only a few studies have examined the potential cognitive advantages of children attending bilingual or immersion programmes. Nicolay and Poncelet (2013) tested a group of 8-year-olds attending an English-immersion school in France from 5 years of age, where the L2 was used to teach 40% of the curriculum, and compared it with a group of 8-year olds attending a mainstream French school. Groups were matched for age, verbal and nonverbal reasoning and socio-economic status, and tested on attentional and executive measures: alerting, selective attention, divided attention, mental flexibility, response inhibition and interference inhibition. After 3 years, children in the immersion programme exhibited some cognitive benefits: they were faster on the alerting, selective attention, divided attention and mental flexibility tasks but not on the response inhibition or interference inhibition tasks. In a follow-up study, Nicolay and Poncelet (2015) excluded the possibility of their findings being the product of greater cognitive development in the immersion group at the time of their enrolment. They conducted a longitudinal study, testing 5-year-olds starting an English-immersion programme in France and compared them with 5-year-olds starting a monolingual French programme, again all matched for age, verbal and nonverbal reasoning, and socio-economic status. The children were retested three years later, at age 8. Initially, there were no differences with regards to any attentional and executive measures. However, three years later, the immersion group were significantly faster than the monolingual children on all tasks. These findings suggest that after three years in an immersion setting, cognitive advantages emerge due to the intensity with which the children must focus their attention when learning academic subjects in a language in which they are not fluent. Length of exposure in an immersion setting was also an important factor in Carlson and Meltzoff (2008), who reported no executive functioning advantages for children enrolled in an immersion kindergarten for only six months, and by Bialystok and Barac (2012), who found that length of time in the immersion programme related positively to executive control performance.

In a related study, Cape et al. (2018) investigated executive function abilities in monolingually-raised English children attending Gaelic-medium education versus children attending English-medium education. All were in Year 5 (mean age = 9.5). Contrary to Nicolay and Poncelet (2013, 2015), Cape et al. (2018) found that children attending Gaelic-medium education demonstrated an advantage for the response inhibition task but not for task switching. These results support the proposal put forward by Costa et al. (2009), Green and Abutalebi (2013), and Prior and Gollan (2011), namely that a task-switching advantage does not occur in this type of bilingual because they do not switch frequently between languages. Further bilingual advantages for response inhibition tasks were reported by Bialystok and Shapero (2005) and Ryan et al. (2004). Cape et al. (2018) propose that inhibition of a habitual response reflects more closely the experience of these bilinguals, who have a dominant language.

1.2 Development of social skills in bilingual speakers

Less research has been conducted on the social skills of bilingual children yet those available suggest that a multilingual environment provides a setting in which a number of disparate social skills can flourish. These skills straddle the social-cognitive divide, making it more difficult to ascertain what underpins their development; that is, whether the social skills are inextricably bound up with executive function or whether high performance on some of them can advance independently of certain cognitive skills. Another point of interest is the degree and manner of exposure required for a bilingual advantage in social competence to become visible - an issue shared with that of executive functioning and purported cognitive advantages, as detailed above.

Developmentally, executive function has been shown to correlate with social competence (Hughes, Dunn, & White, 1998; Posner & Rothbart, 2000). Indeed some examples of social awareness, such as social perspective taking, as measured by Theory-of-Mind tasks, tap heavily into social and cognitive skills so it is unsurprising that these are found to develop hand-in-hand (Apperly, Samson, & Humphreys, 2009; Carlson & Moses, 2001). Bilinguals have outperformed monolinguals on this task (Kovács, 2009), a result that might be expected if the bilingual advantage is tied to an aspect of executive function that also underpins Theory-of-Mind tasks. It is difficult to conceive of a social skill that does not include some cognitive ability, but a number of studies have reported bilinguals exceeding monolinguals in areas of social competence, where either general cognitive ability or specific examples of executive function have been controlled. Stephens (1997), for example, used the Preschool Interpersonal Problem-Solving Test (Shure, 1990) to compare balanced bilinguals with monolinguals on social problem-solving measures and found that bilinguals scored better on three of them (talking, categories, solutions). General cognitive ability (Raven's Progressive Matrices) had been controlled for. Subsequent studies controlled for more specific examples of cognition, such as Siegal et al. (2009), who employed the Conversational Violations Test (CVT), to compare bilingual (Slovenian-Italian), Italian monolingual and Slovenian monolingual children on their ability to spot violations of conversational maxims. They also tested children on the Day/Night and DCCS tasks (see Section 1.1). Bilinguals outperformed both monolingual groups on most aspects of the CVT, and although no groups differed on the Day/Night task, the bilinguals and Slovenian monolinguals scored higher than the Italian monolinguals on the DCCS task. Given that the bilinguals and Slovenian monolinguals performed equally well on the DCCS task, the authors suggested that factors other than executive functioning were at the source of the bilinguals' superior performance on the CVT. More recently, inhibitory control was ruled out as a contributory factor for a bilingual advantage demonstrated in Yow and Markman (2015), which tested bilingual and monolingual children's ability to interpret a speaker's referential intent. For this experiment, children needed to integrate multiple cues (speaker's eye gaze, context of situation, semantics of request) to understand what a speaker was trying to convey. The groups did not differ on inhibitory control (Day/Night task) nor did inhibitory control skills contribute to better performance. What these studies suggest so far is that bilingualism does afford children some privileges in tasks emulating social settings and that it might be possible to isolate these from the solely cognitive aptitude required for executive function tests. A further issue is the kind of bilingual setting that can encourage social competence to develop, more specifically how much exposure is necessary before any advantage emerges.

For cognitive skills, it has been argued that a linguistic threshold must be reached for any advantages to surface (Cummins, 1976) yet a growing body of work indicates that for socio-emotional development, a high level of proficiency might not be necessary. Rather, exposure to a multilingual setting per se can provide the kind of environment in which social skills flourish. Again, the kinds of competencies grouped under the term social are a heterogeneous set so the relevance of the particular studies at this stage is restricted to illustrating that balanced bilingualism might not be necessary for effects to materialise rather than pinpointing precisely what this set of social skills comprises. Genessee, Tucker, and Lambert (1975) examined social sensitivity and role taking, using an interpersonal verbal communication game (where one player is blind-folded and the other explains the game, incorporating that person's perspective). Three groups (Kindergarten, Grade 1, Grade 2) who were either monolingual, partially immersed in an L2 environment or totally immersed in an L2 environment were monitored on the number of rules they explained, the amount of information they gave about the materials, and so-called extra information. The crucial measure was information about the materials, given the blind fold, and it was indeed this variable that correlated with the degree of L2 experience: children totally immersed gave most information, after which came the partially immersed children, and lastly, the monolinguals. Age, socio-economic status, verbal and non-verbal reasoning had been controlled for. They concluded that children educated in a non-native setting were more attuned to their listeners' communicative needs than those restricted to a native-speaking school environment. More recently, Fan, Liberman, Keysar & Kinzler (2015) reported this same staggered effect with respect to L2 proficiency and performance on a social communication task. 72 6-year-olds were divided according to whether they were bilingual, multilingual or monolingual and measured on reaction times and eye gazes on a task in which they needed to incorporate another person's visual perspective to ascertain what object that person was referring to. Bilinguals and multilinguals outperformed the monolinguals and their respective scores on general cognition (KBIT) and executive functioning (DCCS) make this result especially interesting: bilinguals scored better on KBIT and DCCS than the other groups, yet despite the multilinguals' lower executive functioning scores, they scored similarly to the bilinguals with respect to social communication. Subsequent work (Liberman, Woodward, Keysar, & Kinzler, 2016) suggests that the social benefits of multilingual exposure emerge in infancy.

These cross-sectional experiments are complemented by projects that have monitored specific indicators of social competence over time. Han (2010), for example, tracked kindergarten children's socio-emotional development across a five-year period using teacher-reported data from the Social Rating Scale (Gresham & Elliott, 1990), which monitors social skills (i.e. cooperation, assertion, responsibility and self-control) and problem behaviours (i.e. impulsive reactions, verbal and physical aggression). Fluent bilinguals and non-English dominant bilinguals outperformed monolinguals on socio-emotional well-being, and had the lowest levels of internalising and externalising behavior problems, suggesting that bilingualism benefited socio-emotional well-being (see also Collins, Toppelberg, Suárez-Orozco, O'Connor & Nieto-Castañon, 2011). More recently, Sun et al. (2018) confirmed a beneficial effect of bilingualism on social-emotional development in a study of Singaporean bilingual preschoolers, all of whom were learning English with an additional language of either Tamil, Malay or Mandarin. For all children, those with the largest bilingual receptive vocabularies and greater frequency of output in their respective languages performed better on the Strength and Difficulties Questionnaire, which measures social-emotional and behavioral strengths/difficulties (Goodman, 1997). Bilingual proficiency was flagged as a factor contributing positively to socio-emotional development in Oades-Sese, Esquivel, Kaliski, and Maniatis (2011), which demonstrated that in a group of low-income preschoolers, those with greater bilingual proficiency (where this meant native-like proficiency in one language and moderately functional in the second) fell into the two highest groups on a teacher-rated scale of social competence ranging from fully competent to vulnerable. The profiles of social competence were based upon temperament, emotional regulation, autonomy, acculturation level, as well as results on the Penn Interactive Peer Play Scale (McWayne, Sekino, Hampton, & Fantuzzo, 2002). The longitudinal design revealed that those children categorised as socially competent had significantly better academic outcomes two years later. Finally, there is work suggesting multilingualism is also beneficial to social aptitude reflected in children's academic writing. Hsin and Snow (2017) compared the incidence of social-perspective taking acts in the written work of language-minority and English-only students (Grades 4-6). Language-minority students (described as 'formerly limited English proficient') matched or surpassed English-only students on perspective acknowledgement and perspective articulation.

1.3 Aims of the present study

We have seen that the bilingual advantage with respect to executive function skills remains controversial. This is partly due to the myriad variables present in the bilingual environment, including children's socio-economic status, the variability in terms of language exposure at home, age of acquisition and immigrant status, all of which cloud results. Many of these issues apply to research on bilinguals' socio-emotional development, too. In particular, the amount of exposure necessary for advantages to surface remains unclear.

This investigation examines whether the purported social and cognitive benefits found in bilingually-raised children extend to children educated but not raised bilingually. Socio-economic status, immigrant status, age of acquisition of English (L2), Spanish vocabulary, non-verbal reasoning and working memory are all controlled, enabling us to avoid the concerns raised previously (see Section 1.1). The groups differ in terms of the amount of English they encounter at school so as to explore how amount of L2 exposure might impact the bilingual advantage, another novel aspect of this study. Our higher exposure group (HiEx) attends a bilingual school where 40% of the curriculum is in English and our lower exposure group (LoEx) attends a bilingual school where 30% of the curriculum is in English[1]. Our third group acts as a control, raised and educated in a monolingual Spanish

[1] Our original intention was to include bilingual schools whose English exposure differed more sharply. However, all bilingual schools in Spain offer a similar programme at this stage of primary education, with the great majority offering a 30%-70% split for English and Spanish, respectively. Consequently, we could not find bilingual schools that differed more in their L2 exposure (we excluded international schools, as their curriculum is entirely in English and many of their pupils do not come from monolingual Spanish families).

environment (MON). The three groups were assessed on a complete suite of attention and social skills tests. The results from this study contribute to the question of which, if any, aspects of executive and social skills are privileged in the bilingual speaker.

Our research questions are:

(1) After one year of bilingual/monolingual education, will bilingually-educated children outperform MON on English vocabulary? Will the HiEx outperform the LoEx?

(2) After one year of bilingual/monolingual education, will bilingually-educated children outperform MON on the attention skills tests? Will the HiEx outperform the LoEx?

(3) After one year of bilingual/monolingual education, will bilingually-educated children outperform MON on the social skills tests? Will the HiEx outperform the LoEx?

2. Method

2.1 Participants

Three groups of Spanish children participated. They attended fee-paying schools and were tested at the end of their first year of primary education (ages 6-7). The HiEx attended a bilingual school in Madrid, where 40% of the curriculum was in English (Natural Sciences, English Language, Arts & Crafts, Performing Arts) and 60% in Spanish (Social Sciences, Mathematics, Spanish Language, Religion, Physical Education). The LoEx attended a bilingual school in Córdoba, where 30% of the curriculum was in English (Social Sciences, Natural Sciences, English Language) and 70% in Spanish (Mathematics, Spanish Language, Religion, Physical Education, Arts & Crafts, Music). The "monolingual" group

(MON) attended a mainstream school in Madrid, where the curriculum, except for three hours of English Language per week, was in Spanish. All children in the study came from monolingual Spanish families.

67 children participated but 8 were excluded because they failed the standardised criteria in one of the background measures (see next section). The HiEx comprised 26 children (17 girls, 9 boys) with a mean age of 6;10 years (range: 75-87 months). The LoEx comprised 17 children (7 girls, 10 boys) with a mean age of 6;11 years (range: 77-88). The MON comprised 16 children (6 girls, 10 boys) with a mean age of 6;9 years (range: 77-87 months).

2.2 Materials

Background measures

Background questionnaire

To control for socio-economic status, immigrant status and ethnic background, which have been shown to affect executive function abilities (Noble, Norman, & Farah, 2005; Sarsour, Sheridan, Jutte, Nuru-Jeter, Hinshaw, & Boyce, 2011), parents completed a questionnaire. This gathered information about the children's language exposure outside of school and the families' educational level. The answers confirmed that all participants came from monolingual Spanish families and none were migrants or differed in their ethnic background.

Nonverbal intelligence

To control for nonverbal reasoning, the children completed the Raven's Coloured Progressive Matrices, (Raven, Raven, & Court, 1998) for which children identified the missing piece that completed a given pattern. Four of the 67 children tested were excluded as they performed below the standardised score for their age on this test. The remaining children obtained similar scores (*Wald chi-square*=1.10, *df*=2, *p*=0.58; HiEx mean score = 26.6, LoEx mean score = 25.7, MON mean score = 25.4).

Working memory

Working memory relates to executive function abilities (Davis & Pratt, 1996; Gordon & Olson, 1998; Keenan, Olson, & Marini, 1998), so an auditory forward digit span task (DST) was administered. The Digit Span is a subtest of the Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974). Children were read strings of digits and repeated them back to the experimenter in the same order. A further four of the 67 children tested were excluded as they obtained a digit span of 3; the rest obtained a span of 4.

Spanish vocabulary

To control for the children's first language (L1) receptive vocabulary, the Test de Vocabulario en Imágenes Peabody, PPVT-III (Dunn, Dunn, & Arribas, 2006) was administered. Children had to select the picture that corresponded with the Spanish word spoken by the experimenter. All children performed similarly and no children had to be excluded as their raw scores fell within the standard for their age on this test (*Wald chi-square*=0.55, *df*=2, *p*=0.76; HiEx mean score = 87.9, LoEx mean score = 90.4, MON mean score = 87.5).

Table 1 provides a summary of mean ages, family educational level[2], and scores in background measures for the three groups.

<Table 1>

Experimental measures

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

English vocabulary

To test the children's L2 vocabulary, the British Picture Vocabulary Scales, BPVS3 (Dunn & Dunn, 2009) was used, which is a widely used standardised assessment of receptive vocabulary for children aged 3-16 years with a reliability of 0.91 (Dunn & Dunn, 2009) and has been used by similar studies on children attending bilingual schools (e.g. Nicolay & Poncelet, 2013, 215). In this test, children selected the picture that corresponded with the English word provided by the experimenter. Children performed below the standardised score for their age, which was expected and consistent with studies on children with L2 English (see Mahon & Crutchley, 2006) as these scores are based on native speakers of English. However, for this measure, our aim was to ensure that children's L2 proficiency was indeed different between the three schools, rather than just assuming this based on their school and their English exposure there. The children's raw scores were used for the comparative analyses.

Social skills

To analyse the children's social skills, the parents' Spanish version of the Social Skills Improvement System Rating Scales, SSiS (Gresham & Elliott, 2008) was used, following similar studies (e.g. Han, 2010). The SSiS is a standardised test suitable to assess social skills in primary school-aged children, which includes a Social Skills composite that has demonstrated internal consistency, with a coefficient alpha of 0.97 (Gresham & Elliot, 2008). This composite evaluates different social 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, such as asking for information, introducing oneself, and responding to others' actions), responsibility (respecting others' property, ability to communicate with adults), empathy (showing concern for others' feelings/viewpoints), engagement (joining activities and inviting others to join, initiating conversations and interacting with others, making friends), and self-control (responding appropriately in conflict situations, such as disagreeing or teasing, and non-conflict situations, such as taking turns or compromising). It was completed by the children's parents, who answered questions about their child's behaviour in different social situations. Analyses were conducted on the raw scores obtained for each of the skills.

Cognitive skills

To test cognitive abilities that relate to attention, the Test of Everyday Attention for Children, TEA-Ch2 (Manly, Anderson, Crawford, George, Underbjerg, & Robertson, 2016) was administered. The TEA-Ch2 is an established standardised tool for clinical assessment in children aged 5-15 years, and the validity and reliability of this test for assessing attentional functions for clinical and research purposes with Spanish children has been validated (Pardos, Quintero, Zuluaga, & Fernández, 2016). In addition, some of the tasks in the first edition of this test have been used previously to measure inhibitory control in bilinguals (e.g. Bak et al., 2016; Garraffa et al., 2015; Vega-Mendoza et al. 2015). However, given the mixed evidence on the bilingual advantage, we administered the complete battery so as to include different aspects of attention with a wide range of tasks. The version for 6-7 year-old children (TEA-Ch2 J) had seven tasks that focus on selective attention (the ability to focus on a specific cue while inhibiting distracting information) and sustained attention (the ability to focus on a task over a long period of time). The individual tasks are explained below, in the order completed by the children. Each task started with practice trials.

SELECTIVE ATTENTION

(1) Balloon Hunt

Children found and crossed out as many balloons as possible on a given page within 15 seconds. There were four trials, two in which the page contained only balloons, and two in which the page contained balloons and distractors. The score was the mean targets found within the time limit.

(2) Balloons 5

Children found and crossed out all the balloons on a given page containing distractors. The task contained a single trial and children did not have a time limit, but completion time was recorded. The score was the time in seconds per target found.

(3) Hide&Seek Visual

Children examined a series of boxes on a given page, stating whether the target (a red ball) was present or absent, one box at a time. They had to find this target among distractors, and were given a time limit of 60 seconds to inspect as many boxes as possible. There were two trials for this task, and the score was the mean correct responses in the time given.

SUSTAINED ATTENTION

(4) Barking

In this auditory task, children heard ten trials and counted the number of dog barks in each trial, after which they had to state the number of barks counted. The score was the total correct responses.

(5) Hide&Seek Auditory

Children listened to a series of trials containing different sounds. They pressed the spacebar as quickly as possible if they heard a dog bark, ignoring other sounds. The task had 14 trials. This was a computerised task and the score was the mean response time in milliseconds, weighted for accuracy.

(6) Simple Reaction Time (SRT)

Children watched the screen, where there was a fixation box in the centre, and pressed the spacebar every time a blue blob appeared. This was a single-trial task, requiring them to focus their attention for a long period of time (six minutes, depending on the children's performance). It was a computerised task and the score was the mean response time in milliseconds.

(7) Sustained Attention to Response Test (SART)

Children watched the screen, where different coloured shapes appeared, consecutively, at a regular pace. They pressed the spacebar after every shape except for triangles. This was a single-trial task for which they needed to focus their attention for a long period of time (five minutes approximately, depending on their performance). It was a computerised task and the score represented the number of no-go trial responses (i.e. when they pressed the space bar after a triangle).

2.3 Procedure

With written informed consent from the schools and parents, children were tested individually in a quiet room in their respective schools. The tests were administered in two different sessions, each lasting approximately 45 minutes and taking place on different days. During one session, children completed the Raven's, Digit Span and BPVS tests. In the other, they undertook the TEA-Ch2 and PPVT. Except for BPVS, all tasks were conducted in Spanish, the children's L1. The background questionnaire and SSiS were also in Spanish. These were mailed one month in advance and collected on arrival.

3. Results

To investigate performance differences on the experimental measures, the data were subjected to regression analyses (generalised linear models). Several co-variates (gender, parent education level, exposure to English outside school) were included in the models to control for potential influences on the dependent variables: BPVS scores, social skills scores (comprising 7 dependent variables), and attention scores (also comprising 7 dependent variables). When a significant difference between the independent variables (i.e. the schools) was found, paired comparisons were conducted for HiEx vs LoEx, HiEx vs MON and LoEx vs MON, which explored the nature of the school differences. All multiple comparisons report *Sidak*-corrected *p*-values.

Addressing the children's BPVS scores first, the results clearly reflected the children's amount of exposure to English at their respective schools. Children's English vocabulary was significantly different between the schools (*Wald chi-square*=102.2, *df*=2, $p<0.001$), with children in the HiEx performing significantly better than children in the LoEx ($p<0.001$) and than children in the MON (HiEx mean score = 60.11, LoEx mean score = 27.24, MON mean score = 18.56). The LoEx also performed significantly better than the MON ($p=0.02$). Co-variates did not have a significant influence on the results.

Our second question was whether bilinguals would outperform monolinguals on attention tests and whether the HiEx would outperform the LoEx. Recall that the TEA-Ch2 included seven tasks testing the children's selective and sustained attention. Analyses revealed significant school differences for two of the seven measures: *Balloons 5* ($F=11.82$, $df=2$, $p<0.001$), where both bilingual groups performed significantly better than the MON (HiEx vs MON, $p<0.001$; LoEx vs MON, $p<0.001$), and *SART* ($F=3.145$, $df=2$, $p=0.05$), where only the HiEx performed significantly better than the MON ($p=0.02$). In addition, a marginally significant difference was found for the *Barking task* (*Chi-squared*=7.87, $df=4$, $p=0.09$). Paired comparisons revealed that only the LoEx performed significantly better than the MON ($p=0.02$) on this measure. The remaining measures were not significantly different between any of the groups. Table 2 illustrates the mean scores and standard deviations (SDs) for each group on the attention measures[3]. Co-variates did not have a significant influence on the results.

<Table 2>

The TEA-Ch2 also provides overall scores for selective attention (based on the Balloon Hunt, Balloons 5 and Hide&Seek Visual tasks), sustained attention (based on the Barking, Hide&Seek Auditory, SRT and SART tasks), and everyday attention, which is the sum of the overall scores for selective and sustained attention. Table 3 illustrates the mean scores and SDs for each group on each type of attention. Here it can be seen that the bilingual groups achieved higher scores than the monolingual group on all types of attention, despite the differences not reaching significance.

<Table 3>

Our third comparison focused on the children's social skills, again asking whether bilingual children would score more highly than monolingual children and within the bilingual group, whether HiEx would outperform LoEx. Children received scores on seven aspects of social skills, as rated by their parents. These included communication, cooperation, assertion, responsibility, empathy, engagement and self-control. Table 4 illustrates the mean scores and SD for each of the social skills for the three schools.

<Table 4>

Overall, the means pointed in the expected direction. Bilingual children's scores exceeded that of monolingual children on all measures and, the HiEx's scores exceeded that of the

[3] Note that since the Balloons 5, SRT, and Hide&Seek Auditory tasks are measured in response times, lower scores indicate a better performance than higher scores. This is also true for the SART task (i.e. fewer triangle trials where participants pressed the space bar).

LoEx on all measures except for *Empathy* and *Responsibility*. However, the differences reached significance only for *Communication* (*Wald chi-square*=10.14, *df*=2, *p*=0.006) and *Cooperation* (*Wald chi-square*=4.50, *df*=2, *p*=0.01). Specifically, for *Communication*, Hi-Ex outperformed Lo-Ex (*p*=0.002) and MON (*p*=0.009), and for *Cooperation*, Hi-Ex outperformed only MON (*p*=0.03). No other comparisons reached significance. Co-variates, which were included in every analysis, had minimal influence: for *Communication,* family education was significant (*p*=0.04) yet the mean scores for those children whose parents had been in higher education (16.61) was slightly lower than for those children whose parents had stopped at further education (17.79).

4. Discussion

The present study focused on the potential cognitive and social advantages that bilingual education may confer on children raised in a monolingual environment. Three groups of Spanish children raised monolingually were assessed, two attending bilingual primary education and one attending mainstream primary education. Children had similar age, immigrant status, Spanish vocabulary, non-verbal reasoning, and working memory, and gender, socio-economic status, and L2 exposure outside of school were controlled for. To investigate the impact that amount of L2 exposure in bilingual education has on the bilingual advantage, the bilingual groups differed on this variable: the HiEx received 40% of the curriculum in English and the LoEx received 30% in English. The three groups were measured on a complete suite of attention and social skills tests to address three research questions: (1) whether bilingually-educated children would outperform MON on English vocabulary after one year of bilingual education, and whether the HiEx would outperform the LoEx; (2) whether bilingually-educated children would outperform MON on attention skills after one year of bilingual education, and whether the HiEx would outperform the LoEx; and

(3) whether bilingually-educated children would outperform MON on social skills after one year of bilingual education, and whether the HiEx would outperform the LoEx.

As expected, the children's English vocabulary was significantly different between the groups, with the HiEx group performing significantly better than the other two and the LoEx group performing significantly better than the MON. These results reflect the differences in degree of L2 exposure that the children received in their respective schools. This measure allowed us to ascertain that the groups' English proficiency was indeed different rather than just assuming this on the basis of their attending either a bilingual (with higher or lower English exposure) or mainstream school. Establishing their English proficiency, in addition to controlling for the aforementioned external and individual factors, was essential to any subsequent claim that group differences found on the cognitive or social measures could be linked to children's exposure to, and experience with, their L2.

To explore whether bilingual children would outperform monolingual children on the attention tests and whether the HiEx would outperform the LoEx, all children completed the TEA-Ch2, which includes seven tasks probing selective and sustained attention. Significant differences were found for two of these measures: *Balloons 5*, where both bilingual groups outperformed the MON, and *SART*, where only the HiEx outperformed the MON, potentially due to their higher L2 exposure. Recall that *Balloons 5* is a selective attention measure, where some inhibitory control must be exercised as participants focus on a specific visual target, ignoring distractors. Our findings echo previous studies investigating selective attention with similar tasks, which have also found a bilingual advantage (Bialystok, 1992; Costa et al., 2008; Kapa, 2010; Nicolay & Poncelet, 2013, 2015; Yang & Lust, 2004). *SART*, however, is a response inhibition task and, as discussed in the introduction, some studies have not reported a bilingual advantage for this type of task (Bialystok et al., 2008; Carlson & Meltzoff, 2008; Martin-Rhee & Bialystok, 2008; Robertson et al., 1997), while others have (Bialystok & Shapero, 2005; Cape et al., 2018; Ryan et al., 2004). Researchers who have reported no advantage in response inhibition tasks yet have in interference inhibition tasks suggest that the latter better resemble bilinguals' language control experience as participants must inhibit one of two conflicting alternatives (Martin-Rhee & Bialystok, 2008). However, as suggested by Costa et al. (2009), Green and Abutalebi (2013), and Prior and Gollan (2011), the type of bilingual experience described by these authors only represents balanced bilinguals, who frequently switch between their two languages. This differs from speakers who have one clear dominant language and do not switch so frequently, such as our current children, whose access to bilingualism is restricted to school. In fact, as Cape et al. (2018) contend, response inhibition tasks reflect more closely the bilingual experience of speakers with one dominant language, which relates directly to our groups, who were not exposed to the L2 at home or the community, but only at school, making Spanish their dominant language. Rather than switching between English and Spanish, our children exercise constant inhibition of their dominant language while using the L2 at school, which indeed resembles more closely the inhibition of a habitual response, as tapped into by *SART*. Unfortunately, the TEA-Ch2 version for 7-8 year-old children (TEA-Ch2 J) does not include an interference inhibition task, so children could not be tested on this aspect at this stage. It is included in the 8-15 year-old version (TEA-Ch2 A), so this will form part of a follow-up study on the same children (see below).

With respect to social measures, our results are modestly in the direction of the bilingual advantage hypothesis. As a group, the bilinguals scored slightly higher than the monolinguals but of these differences, only those for communication and co-operation were significant. Again, as time progresses, these differences might become more pronounced, and a longitudinal follow-up of these children will enable us to track this possibility. On the basis of the current results, however, we can note that some advantages do materialise in populations whose access to bilingualism is restricted to the school setting so it does not seem to be the case that for these social skills a balanced bilingual environment, where children constantly switch between languages throughout the day, is necessary (see Collins et al., 2011). Our findings also resonate with the aforementioned longitudinal project of Han (2010). Having tracked the socio-emotional trajectories of children from kindergarten to 5th grade, the author reported that the fluent bilingual group, together with the non-English dominant bilingual group, surpassed the monolingual groups (both English and non-English) on all measures. Yet there was a further difference between the two groups that fared most well; specifically, the rate of positive change on approaches to learning, interpersonal skills and self-control increased more in the non-English dominant bilingual group than in the fluent bilingual group. One could speculate that a child in the process of garnering an L2 might develop more confidence in their interpersonal communications as they progress linguistically, which would explain the steeper curve of development for this population relative to the fluent bilingual group on the socio-emotional skills monitored, a possibility that a subsequent longitudinal study may pursue. As children age, the way of collecting data for SSiS changes. From age 8, children are expected to complete the questionnaires themselves and it will be interesting to monitor how these self-perceptions of socio-emotional measures change over time and whether increased L2 proficiency impacts on them.

The fact that a significant bilingual advantage was evident in only two of the attention tests and two of the social measures could be because our test groups were only nearing the end of their first year of bilingual education. We have seen that length of exposure in an immersion setting is an important contributory factor with respect to bilingual advantages in executive functioning measures (Bialystok & Barac, 2012; Carlson & Meltzoff, 2008; Han, 2010; Nicolay & Poncelet, 2013, 2015). One limitation of the current study, having focused on children's scores at one point in time, is that it cannot anticipate the children's developmental trajectory. A future longitudinal study on the same children will be able to move this question forward by ascertaining not only if there is an advantage, but at what point it emerges (i.e. the length of exposure necessary) and whether it is sustained. It is possible that in a future testing phase, a more robust bilingual advantage may surface.

A further limitation was the small L2 exposure difference between the bilingual schools (see Section 1.3), which may have contributed to the limited differences found between the two groups on both measures. However, with longer exposure to bilingual education, this small contrast may lead to further significant differences between these groups. This will be addressed in the follow-up study mentioned above so as to reliably answer the question of whether different levels of L2 exposure in bilingual education affect the bilingual advantage.

To conclude, after just one year of bilingual immersion restricted to the school environment, we can report a moderate indication of a bilingual advantage on a sub-set of cognitive and social measures for our bilingual children. Whether or not the differences between groups will increase as a function of L2 exposure is a question that can only be addressed by tracking the same children's development over time.

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Table 1. Means and SDs (in parentheses) of each group's age, family educational level, and raw scores of the background tests: Raven's, Digit Span, and PPVT-III.

	Age	Family Education	Raven's	Digit Span	PPVT
HiEx *N* = 17 girls, 9 boys	6.83 (3.31)	3.78 (0.42)	26.62 (3.62)	4.09 (0.30)	87.91 (9.98)
LoEx *N* = 7 girls, 10 boys	6.92 (4.25)	3.76 (0.44)	25.74 (3.83)	4.06 (0.25)	90.41 (13.65)
MON *N* = 6 girls, 10 boys	6.75 (3.38)	3.62 (0.50)	25.45 (3.45)	4.00 (0.00)	87.55 (15.48)

Note. HiEx, LoEx and MON stand for Higher Exposure bilingual group, Lower Exposure bilingual group and Monolingual group, respectively.

Table 2. Mean scores and SDs (in parentheses) for each group on the TEA-Ch2 attention tasks.

	Balloon Hunt	Balloons 5	HideSeek Visual	Barking	HideSeek Auditory	SRT	SART
HiEx	16.32	1.28***	10.10	9.35	1548.28	699.80	8.81*
	(3.03)	(0.28)	(1.79)	(0.74)	(614.87)	(131.25)	(3.71)
LoEx	16.28	1.26***	9.65	9.76.	1435.43	698.66	11.24
	(3.38)	(0.21)	(1.91)	(0.56)	(656.40)	(119.58)	(4.13)
MON	16.46	1.75	10.62	9.25	1283.35	721.47	11.81
	(3.05)	(0.48)	(1.87)	(0.68)	(375.38)	(239.11)	(4.87)

Note. HiEx, LoEx and MON stand for Higher Exposure bilingual group, Lower Exposure bilingual group and Monolingual group, respectively.

Note. Significance codes: '***' p<0.001; '*' p<0.05; '.' p<0.1.

Table 3. Mean scores and SDs (in parentheses) for each group on the TEA-Ch2 types of attention.

	Selective attention	Sustained attention	Everyday attention
HiEx	32.90 (7.58)	44.33 (5.34)	78.23 (10.06)
LoEx	32.66 (5.85)	45.09 (4.36)	77.75 (7.57)
MON	30.03 (7.00)	43.07 (6.43)	73.10 (10.12)

Note. HiEx, LoEx and MON stand for Higher Exposure bilingual group, Lower Exposure bilingual group and Monolingual group, respectively.

Table 4. Mean scores and SDs (in parentheses) for each group on the Parent-Rated Social Skills Scales.

	Communication	Cooperation	Assertion	Responsibility	Empathy	Engagement	Self-Control
HiEx	18.62**	14.98*	17.55	14.57	14.02	16.34	13.05
	(2.30)	(2.31)	(2.45)	(2.95)	(3.07)	(2.41)	(4.16)
LoEx	16.36	14.23	15.49	14.61	15.31	16.18	12.77
	(1.94)	(2.12)	(2.37)	(2.45)	(2.34)	(3.42)	(3.52)
MON	16.48	13.01	16.40	13.52	14.41	15.49	11.08
	(2.60)	(2.81)	(2.99)	(3.03)	(2.96)	(2.42)	(3.64)

Note. HiEx, LoEx and MON stand for Higher Exposure bilingual group, Lower Exposure bilingual group and Monolingual group, respectively.

Note. Significance codes: '**' $p<0.01$; '*' $p<0.05$.