Ampersand 10 (2023) 100115

Contents lists available at ScienceDirect

Ampersand

journal homepage: www.elsevier.com/locate/amper

Educational bilingualism: Reflections on a longitudinal study of children's cognitive and linguistic development

Gloria Chamorro [a,*], Vikki Janke [b]

[a] Departamento de Filologías Extranjeras y sus Lingüísticas, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain
[b] Department of Modern Languages and Linguistics, University of Kent, Canterbury, UK

A B S T R A C T

Our longitudinal study examined the cognitive and linguistic development of bilingually-educated, yet monolingually-raised, Spanish children, exploring (a) whether bilingual education procured a bilingual advantage, (b) whether greater L2 exposure was key to producing it, and (c) how development proceeded over time.

We compared three groups of children in Years 1 and 2 of primary education in Spain: one attending monolingual education (MON), and two attending English-Spanish bilingual education, where one group received higher exposure (HiEx) and the other lower exposure (LoEx) to English. Children were tested in their schools on attention and L1 and L2 vocabulary skills, as well as several background measures.

Across both years, the groups differed in their English vocabulary: HiEx outperformed LoEx and MON ($p < 0.001$), and LoEx outperformed MON ($p = 0.02$) but there were no differences in the children's L1 vocabulary scores. After one year of schooling, bilingually-educated children scored higher than MON on certain cognitive skills (interference suppression, $p < 0.001$; response inhibition, $p = 0.02$) but these differences did not materialise after a second year. The present paper combines these results from our two previously published studies with other current literature on educational bilingualism into a discussion on how future work on this population could progress.

1. Introduction

The discussion on child bilingualism and the degree to which it benefits cognitive development continues. The reader will be familiar with the large body of research pointing to enhanced executive functions for bilingual over monolingual children (e.g. Bialystok and Martin, 2004; Costa et al., 2009; Hernández et al., 2013) as well as with studies that have reported no bilingual advantage (e.g. Antón et al., 2019; Gathercole et al., 2014; Paap et al., 2015).

Executive functions refer to domain-general cognitive abilities, such as inhibitory control (i.e. the ability to suppress irrelevant or conflicting information or dominant responses), cognitive flexibility (i.e. the ability to switch attention between tasks), or monitoring (i.e. the ability to update information in working memory) (Miyake and Friedman, 2012; Miyake et al., 2000). The claim that bilinguals may have an advantage in these skills relates to their language control abilities, that is, the constant switching between languages and the inhibition of the non-target language while selecting the target one, which they can efficiently do despite both languages being simultaneously activated to some extent (Blumenfeld and Marian, 2013; Lagrou et al., 2013; Thierry and Sanoudaki, 2012). The idea is that these language control abilities (i.e. inhibition, switching, updating) employ domain-general executive processes, which generalise to non-linguistic tasks engaging executive control (Craik and Bialystok, 2006; Green and Abutalebi, 2013).

These abilities have been explored extensively but as yet, reliable conclusions have not been drawn. Interference suppression has been investigated with tests such as the Simon task, the Stroop task, and the Flanker task, where participants must focus on a relevant cue while suppressing an irrelevant one. In these tasks, a large number of researchers have found a positive effect of bilingualism (Bialystok, 1999, 2006; Bialystok et al., 2004, 2005, 2006, 2008, 2012; Bialystok and Martin, 2004; Carlson and Meltzoff, 2008; Costa et al., 2008, 2009; Costa and Sebastián-Gallés, 2014; Hernández et al., 2013; Luk et al., 2011; Martin-Rhee and Bialystok, 2008; Prior and Gollan, 2011; Prior and MacWhinney, 2010; Tao et al., 2011). Others, however, have not (Gathercole et al., 2014; Paap and Greenberg, 2013; Paap and Sawi, 2014; Samuel et al., 2018). To explore response inhibition, researchers have commonly used tests such as the Day/Night task, where participants must inhibit an inappropriate but prepotent response tendency. Here again, some have found an advantage for bilinguals (Bialystok and Shapero, 2005; Cape et al., 2018; Ryan et al., 2004), while others have not (Bialystok et al., 2008; Carlson and Meltzoff, 2008; Martin-Rhee and

* Corresponding author. Departamento de Filologías Extranjeras y sus Lingüísticas, Facultad de Filología, Universidad Nacional de Educación a Distancia (UNED), Paseo Senda del Rey 7, despacho 003, 28040, Madrid, Spain.
E-mail addresses: gchamorro@flog.uned.es (G. Chamorro), V.Janke@kent.ac.uk (V. Janke).

https://doi.org/10.1016/j.amper.2023.100115
Received 1 July 2022; Received in revised form 15 November 2022; Accepted 17 March 2023
Available online 20 March 2023

Bialystok, 2008; Robertson et al., 1997). Finally, for cognitive flexibility, tests like the Dimensional Change Card Sort (DCCS) or the Opposite Worlds task, where participants have to switch their attention focus to different cues depending on the trial, have also resulted in conflicting findings. Advantages have been found for some bilinguals (Bialystok, 1999; Bialystok and Shapero, 2005; Prior and MacWhinney, 2010) but not for others (Costa et al., 2009; Green and Abutalebi, 2013; Prior and Gollan, 2011).

Researchers that have not replicated a bilingual effect (e.g. Antón et al., 2014, 2019; Duñabeitia et al., 2014; Gathercole et al., 2014; Lehtonen et al., 2018; Paap, 2014; Paap and Greenberg, 2013; Paap et al., 2014, 2015, 2016; Paap and Sawi, 2014; Samuel et al., 2018) have questioned the methodological designs of those that have. Numerous variables are argued to not have been adequately controlled for: socio-economic or immigrant status, culture, age of onset of second language (L2) acquisition, type or amount of L2 exposure, and L2 proficiency. Sample size has also been highlighted as problematic, as well as publication bias, with studies revealing positive or statistically significant results in favour of an advantage being more likely to be published than those revealing non-significant or null results (de Bruin et al., 2015). In addition, conflicting interpretation of results could be further complicated by researchers' definitions of bilingualism, the types of tasks used, or the populations under investigation (Cox et al., 2016).

Most of the aforementioned studies have focused on speakers raised with more than one language at home or in the community. Only a few studies have examined children whose exposure to an L2 is limited to their bilingual or immersion education. This is an interesting population where some of the previously mentioned variables can be more easily controlled, as children who enrol in this type of education usually start without prior L2 knowledge, receive the same type and amount of L2 input, and are exposed to similar L2 learning contexts (Barbu et al., 2019). It is within this group of studies that our own sits. This paper will focus on the relationship between educational bilingualism and children's cognitive and linguistic development, and more specifically attention and vocabulary skills, which are the aspects addressed in this study. In Section 2, we summarise some of the most recent literature on educational bilingualism, concentrating first on attention and then on vocabulary, before sketching the main points of our two-year project in Section 3 (reported fully in Chamorro and Janke, 2020, 2021). Section 4 integrates our results with the literature we have discussed and proposes how future work on this population might progress.

2. Educational bilingualism

One of the first investigations on educational bilingualism was that of Bialystok and Barac (2012), which presented two studies: one with children enrolled on a Hebrew L2 immersion programme in Grades 2 and 3 and another with children enrolled on a French L2 immersion programme in Grades 2 and 5. The children had different language backgrounds and proficiency levels. In study one, two thirds of the children spoke English at home, with the remaining third speaking Hebrew or Russian. In study two, two thirds of them spoke English at home whilst the other third reported access to different L2s. These varied greatly (e.g. Chinese, Urdu, Estonian) but parents judged their children's proficiency as only poor or fair. The children were assessed on metalinguistic awareness and executive control (interference inhibition and task switching) using different tasks. With regard to metalinguistic awareness skills, it was English vocabulary skills that made the most significant contribution to children's performance in both studies (see also Bialystok et al., 2014). However, for executive control, it was length of time in the immersion programme that was associated with better performance in both studies. These results led the authors to propose a distinction between the way in which bilingualism influenced these skills: whereas access to bilingualism per se might provide an initial boost to a child's developing linguistic representations, there is a cumulative effect for cognitive advantages, achieved through increased periods of immersion, which leads to the better performance witnessed in bilingual children.

At a similar time, Nicolay and Poncelet (2013) tested 53 8-year-olds attending an English-immersion school in France from 5 years of age, where the L2 was used to teach between 50 and 75% of the curriculum (depending on the school year), and compared these children with a group of 51 8-year-olds attending a monolingual 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) using the Test for Attentional Performance in Children (Zimmermann et al., 2002) and the Attentional Network Test (ANT; Fan et al., 2002). After three 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 their discussion, the authors accounted for this spread of results by suggesting that, compared to fluent bilinguals, who continuously inhibit one of their activated languages when they select the other, immersed children are not fluent in their L2 and are less exposed to L2 production situations in which inhibition is trained.

In a follow-up longitudinal study, Nicolay and Poncelet (2015) excluded the possibility of their previous findings being the product of greater cognitive development in the immersion group at the time of their enrolment. They achieved this by observing children from their baseline, testing 51 5-year-olds at the start of the same type of English-immersion programme in France and 50 5-year-olds at the start of their monolingual French programme. Children were matched for age, verbal and nonverbal reasoning, and socio-economic status. They were tested on the same attentional and executive measures as Nicolay and Poncelet (2013), except for response inhibition and interference inhibition, as these had not revealed positive results. The children were retested three years later, at age 8. At the start of year one, there were no differences on any experimental measures. However, by year three, the immersion group was significantly faster than the monolingual group on all tasks. These findings supported an argument such that after three years in an immersion setting, cognitive benefits emerged due to the intensity with which the children focused their attention when learning academic subjects in a language in which they were not fluent.

A related study by Barbu et al. (2019) explored whether the same results would surface after just one year of exposure to immersion education. To ascertain this, they assessed children attending the same type of immersion programme, using the same tasks as Nicolay and Poncelet (2013, 2015). This study included 59 8-year-old French children enrolled in an English L2 immersion programme for one year and 57 8-year-old French children attending a monolingual French programme. Again, they were matched for age, gender, verbal and non-verbal reasoning, and socio-economic status. What they found was that the immersion group performed significantly better on the selective auditory attention task but not on tasks measuring alerting, divided attention, and cognitive flexibility. The authors concluded that one year of exposure to an L2 may not suffice to achieve superiority in most skills. The differences found in auditory attention, however, may have been due to children in the immersion programme being faced with the constant challenge of processing complex academic subjects in a language they were not fluent in, which may have honed these auditory skills. This learning experience differs from that of monolinguals, who learn their subjects in a 'highly automatized and fluent' language, enabling them to focus solely on the content, rather than the language as well.

Other studies within this area of educational bilingualism have looked at bilingual programmes that focus on minority languages, that is, languages spoken by less than half of the population in a region or country (Grenoble and Roth Singerman, 2014). This population is slightly different from those in the aforementioned studies, as most of

these children have had some exposure to the minority language either at home or in the community prior to entering the immersion programme. This is the case for Kalashnikova and Mattock's (2014) study, which tested 33 3–6-year-old English-speaking monolingual children and 33 3–6-year-old children in a Welsh L2 immersion programme, where 75% of the curriculum was taught in Welsh. The immersion group had had prior exposure to Welsh through their families or the community. Groups were matched for age and English vocabulary and tested on attentional control with the DCCS task, as well as for metalinguistic awareness and metarepresentation. Contrasts were found only in the DCCS task, with the bilingual group outperforming the monolingual one.

A few studies have also been conducted on Gaelic-medium education. Cape et al. (2018) compared executive function abilities in 29 monolingually-raised English children in Gaelic-medium education with 30 in English-medium education. They were in Year 5 (age 9–10) and all but one had been exposed to English from birth. Children were tested using three tasks from the Test of Everyday Attention for Children (Manly et al., 1999). Those attending Gaelic-medium education demonstrated an advantage for the response inhibition task but not for task switching. These results support the proposal put forward in 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. Instead, as Cape et al. (2018) suggest, inhibition of a habitual response reflects more closely the experience of these bilinguals, who have a dominant language that they have to suppress.

As with the work presented on simultaneous bilingualism in Section 1, there is also work on educational bilingualism that has reported no cognitive advantage on tasks assessing executive functions (Carlson and Meltzoff, 2008; Poarch and van Hell, 2012; Simonis et al., 2020). Others have found a positive effect of bilingualism on skills other than executive control. Woumans et al. (2016), for example, tested 27 5-year-old French-speaking children at the start of a Dutch immersion program, where 50% of the curriculum was taught in the L2, and compared them with 27 control peers on a French monolingual programme, matched for age and socio-economic status. Children were assessed at the start and again one year later on French verbal fluency, non-verbal intelligence, and the Simon task. After one year, verbal fluency was similar for both groups, indicating that L2 exposure did not affect L1 development negatively. Of further interest was that immersed children outperformed monolinguals on non-verbal reasoning but not on the Simon task. The authors consider several possible explanations for the absence of an advantage on the interference inhibition task. First, they had a more controlled methodological design as they matched the groups on cognitive control and intelligence at the onset of immersion. Second, the Simon task's reliability might be questioned, unlike the non-verbal reasoning test (Progressive Coloured Matrices; Raven et al., 1998), which is standardised. Third, the children's bilingual experience did not incorporate frequent L2 production or language switching. In contrast to this study, Trebits et al. (2021) found no lead for non-verbal reasoning, but did so for phonological awareness and working memory (see also Kaushanskaya et al., 2014; Hansen et al., 2016). Their study tested 39 primary-school children enrolled in a monolingual German programme or a bilingual German-English programme (with 75% of the curriculum in English), at two points in time: at the end of Grade 3 (age 9–10) and at the end of Grade 4 (age 10–11). Children in the immersion programme outperformed the control group on L2 grammar and vocabulary measures, phonological awareness, and working memory tasks in Grade 4, but not on non-verbal reasoning. Importantly, these observed benefits were independent of socio-economic status, which suggests that immersion programmes could be used to level the playing field for children from low socio-economic backgrounds, who could be disadvantaged with respect to linguistic and cognitive development (see also Lindholm-Leary, 2014).

Turning more specifically to L1 language development, there is a growing consensus that participation in immersion programmes does not impact negatively on the child's L1 majority language (namely the one spoken in the community at large and at home) even if there might be an initial lag on entering such a programme. Swain and Lapkin (1982), for example, conducted a large-scale longitudinal study of children in Canada, who came from English-speaking homes and most of whom began their French immersion programmes as monolinguals. Some children attended partial immersion programmes and others were enrolled on complete immersion programmes. The children also differed in terms of when they began, namely early (Kindergarten age) or late (Grade 1 onwards). Tracking children across five years, the authors reported that from Kindergarten to Grade 3, pupils in immersion settings scored lower than their monolingual peers on tests of word knowledge, word discrimination, and reading in English - the language in which they received no formal instruction. However, by Grade 5, these children had caught up or surpassed their monolingual peers on "all aspects of English skills measured by standardised tests" (p. 36). They also reported that children in immersion programmes performed no differently to monolingual children on a cloze test, and cited qualitative results that suggested greater creativity exhibited by the children enrolled on immersion programmes on a storytelling task. Agreeing with the central tenets of these results, Genesee's (2004) report updated the situation for majority language development, concluding that, in most cases, pupils in bilingual programmes achieved proficiency levels in their L1s that were comparable to those children whose programmes were conducted entirely in their L1. Interestingly, this conclusion generalised to pupils categorised as below average in terms of their intellectual ability. More encouragingly still, their L2 competence was higher than that of children with comparably low intellectual ability who learned French in the regular way as an L2.

The question of whether the same positive prognosis extends to cases in which the language at school is a minority language was addressed more recently in Garraffa et al. (2020), which focused on Gaelic as the minority language through which classes were taught. The authors concentrated on grammatical ability in the majority language, namely English, asking if immersion in a minority language such as Gaelic impacted negatively on comprehension of relative clauses, taken from the Test for the Reception of Grammar 2 (Bishop, 2003). They compared 23 16-18-year-old students in English-medium secondary education with 25 same-aged individuals who attended Gaelic-medium secondary education. Fifteen of these individuals had experienced no Gaelic at home and were introduced to the language at nursery school. The remaining 10 had had access to Gaelic from birth. The authors reported that the bilinguals outperformed the monolinguals and that, in addition, the 15 whose access to Gaelic had been limited to school surpassed those who had had access to the language from birth. Thus, we see an example of complex grammar which, far from being compromised, actually fares better in bilinguals even if their L2 has not been further bolstered by input from home. The authors also tested students' attention using the Test of Everyday Attention (Robertson et al., 1994) and the same results were revealed: bilinguals performed better than monolinguals on more complex cognitive tasks, particularly those with no L2 exposure at home.

An interesting question addressed in Hermanto et al. (2012) was whether children in immersion programmes whose access to L2 had been limited to formal instruction at school demonstrated a monolingual or bilingual path of development. The telling evidence would come from their performance on linguistic versus metalinguistic tasks because it was in the latter that bilingual children consistently demonstrated a lead over their monolingual peers (Bialystok, 1986, 1988). If immersion children were progressing as monolinguals learning an L2 in a regular way, they should show no advantage with respect to metalinguistic tasks. If, however, they were approximating the developmental path of bilinguals, a superiority for metalinguistic tasks should emerge. Formal linguistic knowledge (of both L1 English and L2 French) was tested via vocabulary comprehension, verbal category fluency, and grammaticality judgements of un/grammatical sentences. Metalinguistic

knowledge was tested via verbal letter fluency and grammaticality judgements of semantically anomalous sentences. 50 children with L1 English, attending a French immersion programme, were tested at Grade 2 (mean age 7.7 years) and 33 children were tested at Grade 5 (mean age 10.6 years). At both grade levels, children fared better in the English version of tests than in the French ones, despite the Grade 5 children's extra three years of French instruction, and in both languages, their vocabulary continued to develop at a typical rate. Results for category fluency indicated greater gains in English than in French. Although children in Grade 5 produced a greater number of words than did children in Grade 2, the difference between the years was larger for English than for French, indicating greater gains in the language not in receipt of any formal instruction. In terms of detecting grammatical errors, this too, was higher for both groups in English than in French so it seemed that intensive French immersion had no negative repercussions on their English language development. With respect to their metalinguistic development, the results pointed towards a bilingual path of development: at Grades 2 and 5, children performed comparably on ungrammatical English sentences and semantically anomalous English sentences, demonstrating early success with the latter metalinguistic skill. Performance of the letter fluency task - the other probe of metalinguistic knowledge - increased sharply with age, although a cross-sectional study such as this cannot be used safely to draw generalisations about development.

From this overview of educational bilingualism, we can see that the picture emerging for this population is also somewhat mixed, although the language studies paint a less confusing, and positive, picture. What is clear is that the amount of time in an immersion programme, the intensity of the bilingual experience, and the proficiency achieved in both languages are factors that cannot be ignored when considering whether or not cognitive and linguistic advantages materialise (Carlson and Meltzoff, 2008; Trebits and Kersten, 2019). To that end, further and longer longitudinal studies, which employ a broader range of tests and control for a greater number of variables, should help clarify the developmental path followed by children who come to bilingualism via this increasingly popular immersion route.

3. Our study

The present paper contributes to the above discussion by reporting on the cognitive and linguistic development of children educated – but not raised – bilingually, and comparing them with children both educated and raised monolingually.[1] In particular, we tested attention (selective attention, sustained attention, and attention switching) and L1 and L2 receptive vocabulary skills. We employed a longitudinal design, incorporated different levels of L2 exposure, and controlled for variables left unchecked in previous research by including a range of background measures.

The study took place in Spain and followed children enrolled in fee-paying primary schools whose L1 was Spanish and L2 was English. The children belonged to three different groups, based on the amount of L2 exposure they had at school. Those in the higher exposure group (HiEx) received 40% of the curriculum in English (Natural Sciences, English Language, Arts and Crafts, Performing Arts) and 60% in Spanish (Social Sciences, Maths, Spanish Language, Religion, Physical Education). Those in the lower exposure group (LoEx) received 30% in English (Social Sciences, Natural Sciences, English Language) and 70% in Spanish (Maths, Spanish Language, Religion, Physical Education, Arts and Crafts, Music). The children attending the monolingual school (MON) followed a Spanish curriculum with 3 h of English Language instruction per week.

Children were tested at the end of Year 1 of primary education and retested at the end of Year2[2] so as to track children's development with respect to two main questions:

(1) Do the bilingually-educated children outperform the MON on receptive vocabulary? Do the HiEx outperform the LoEx?
(2) Do the bilingually-educated children outperform the MON on the attention skills measures? Do the HiEx outperform the LoEx?

Our prediction based on previous studies and the population under investigation was that bilingually-educated children, particularly the HiEx group, due to the higher L2 exposure they received at school, would outperform the MON group on English receptive vocabulary and attention measures, but that they would not do so on Spanish receptive vocabulary.

3.1. Participants

As mentioned above, participants were all native speakers of Spanish and belonged to three different groups based on the amount of L2 English they were exposed to at their respective schools. They were tested at the end of Year 1 of primary education (ages 6–7) and at the end of Year 2 (ages 7–8). In the first testing phase, we had a pool of 59 children. In Year 2, we retested 51 of the original children (see Table 1 for participant numbers and age means per group in each year). The eight children that were not tested in Year 2 had either left the school or were absent at the time of testing.

3.2. Materials

3.2.1. Background measures

A background questionnaire was used to collect information on socio-economic status, immigrant status, families' educational background, and children's L2 exposure outside of school. This questionnaire was adapted from the Utrecht Bilingual Language Exposure Calculator (UBiLEC; Unsworth, 2011) and, since it was aimed at parents, was presented in Spanish in written form. The answers confirmed that all the children, those attending the monolingual school and those attending the bilingual schools, came from parents who had been born in Spain and only used Spanish at home.

We also tested children's non-verbal reasoning and working memory. For the former, we administered the Progressive Coloured Matrices (Raven et al., 1998), where participants must identify the missing piece that completes a given pattern from four options provided. The children's scores on this task showed that, except for four, all children performed similarly on non-verbal reasoning ($F = 0.29$, $df = 2$, $p = 0.75$). The four children who performed below the standardised score for their age were excluded. For working memory, we used the Digit Span task (Wechsler Intelligence Scales for Children-Revised; Wechsler, 1974), where participants are read strings of digits and have to repeat

Table 1
Number of participants and age means (SDs) of each group in Years 1 and 2.

	Year 1		Year 2	
	N	Age	N	Age
HiEx	26 (17 girls)	6.83 (3.31)	21 (13 girls)	7.83 (3.26)
LoEx	17 (7 girls)	6.92 (4.25)	16 (6 girls)	7.83 (4.25)
MON	16 (6 girls)	6.75 (3.38)	14 (6 girls)	7.71 (2.98)

[1] The original study also incorporated social development but, for reasons of space, we restrict this paper to the cognitive and linguistic aspects of this investigation. The interested reader can find our discussion of social skills in Chamorro and Janke (2020, 2021).

[2] Initially, this was designed as a 4-year longitudinal study, but due to COVID-19, the testing of Years 3 and 4 could not take place.

them back to the experimenter in the same order. Results from this task indicated a similar picture: except for a further four that were excluded for obtaining a lower score than expected, all children obtained the minimum span of 4 for this task.

3.2.2. Experimental measures

With regard to experimental measures, L1 and L2 vocabulary and attention skills were tested. To explore Spanish receptive vocabulary, we implemented the *Test de Vocabulario en Imágenes Peabody* (PPVT-III; Dunn et al., 2006), and for English receptive vocabulary, we used the British Picture Vocabulary Scales (BPVS3; Dunn et al., 2009). For both of these tasks, participants must select the picture that corresponds with the word spoken by the experimenter from four options provided.

To examine attention skills, we used the Test of Everyday Attention for Children (TEA-Ch2; Manly et al., 2016). Unlike previous studies (e.g. Bak et al., 2016; Garraffa et al., 2015; Vega-Mendoza et al., 2015), we administered the complete battery of the TEA-Ch2. This test includes seven tasks assessing selective attention (i.e. the ability to focus on a specific cue while inhibiting distractors) and sustained attention (i.e. the ability to focus over a long period of time) for children aged 6–7, and nine tasks assessing selective attention, sustained attention, and attention switching (i.e. the ability to switch between different instructions) for children aged 7–8. Even though most of the tasks in the two versions are the same, the task titles in the Year 1 and Year 2 version differ. More information on the materials and the methodology can be found in Chamorro and Janke (2020, 2021).

3.3. Procedure

After obtaining the consent form and background questionnaire from the parents, children were tested individually in a quiet room in their respective schools. The tests were administered in two 45-min sessions, each taking place on different days. During Session 1, children undertook the Raven's, the Digit Span, and the BPVS tests, in that order, with one of the researchers. During Session 2, they first completed the TEA-Ch2 and then the PPVT with the other researcher. Except for the BPVS, all tasks were conducted in Spanish, as this was the children's L1.

3.4. Results

Attending to English vocabulary first, this was significantly different between the groups in Year 1 ($X^2 = 102.2$, $df = 2$, $p < 0.001$), with the HiEx children outperforming the LoEx ($p < 0.001$) and the MON (HiEx mean = 60.11, LoEx mean = 27.24, MON mean = 18.56), and the LoEx outscoring the MON ($p = 0.02$). These group differences were maintained in Year 2 ($F = 55.88$, $df = 2$, $p < 0.001$): the HiEx performed better than the LoEx ($p < 0.001$) and the MON ($p < 0.001$; HiEx mean = 68.95; LoEx mean = 38.50; MON mean = 28.64), and the LoEx performed marginally better than the MON ($p = 0.08$). There was no Group-by-Year interaction ($F = 0.39$, $df = 2$, $p = 0.681$), which indicated that the increase in vocabulary scores over the year was comparable for all groups.

In contrast to L2 English vocabulary, the groups performed similarly (and within the standard for their age) on L1 Spanish vocabulary in Year 1 ($X^2 = 0.55$, $df = 2$, $p = 0.76$; HiEx mean = 87.91, LoEx mean = 90.41, MON mean = 87.55), and this was also the case in Year 2 ($F = 0.95$, $df = 2$, $p = 0.40$; HiEx mean = 99.05, LoEx mean = 104.06, MON mean = 102.36). In addition, the children showed a significant improvement from Year 1 to Year 2 ($F = 50.17$, $df = 1, 48$, $p < 0.001$). Table 2 presents the means and SDs for English and Spanish vocabulary across groups and years.

With regard to attention, results from Year 1 showed significant group differences for two of the seven measures: *Balloons 5* ($F = 11.82$, $df = 2$, $p < 0.001$), which tests selective attention with interference suppression and where both bilingual groups outperformed the MON (HiEx vs. MON: $p < 0.001$; LoEx vs. MON: $p < 0.001$), and *SART* ($F = 3.145$, $df = 2$, $p = 0.05$), which tests sustained attention with response inhibition and where only the HiEx outperformed the MON ($p = 0.02$). Results from Year 2 showed no significant differences between the groups on any of the measures, although numerically, the bilingual groups, and particularly the HiEx, scored higher than the MON on all measures but one. However, a notable result was observed for 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* ($t = 2.64$, $df = 49$, $p = 0.01$), which tests divided attention/switching with interference suppression, and *Cerberus* ($t = 2.90$, $df = 49$, $p = 0.006$), which tests selective auditory attention with interference suppression. More detailed information about the results from Year 1 are reported in Chamorro and Janke (2020) and those from Year 2 in Chamorro and Janke (2021).

Table 2
Score means (SDs) of each group for English and Spanish vocabulary in Years 1 and 2.

	English vocabulary		Spanish vocabulary	
	Year 1	Year 2	Year 1	Year 2
HiEx	60.11 (13.63)	68.95 (11.81)	87.91 (9.98)	99.05 (13.14)
LoEx	27.24 (12.09)	38.50 (14.75)	90.41 (13.65)	104.06 (10.33)
MON	18.56 (8.34)	28.64 (7.71)	87.55 (15.48)	102.36 (9.09)

4. Discussion

After two annual rounds of testing, our study produced mixed results. Firstly, with respect to L1 and L2 vocabulary, the data were in line with our predictions and with previous literature discussed in the introduction (Garraffa et al., 2020; Genesee, 2004; Hermanto et al., 2012; Swain and Lapkin, 1982; Woumans et al., 2016). In short, a greater amount of exposure to English led to a higher performance in L2 vocabulary comprehension in the bilingual groups, and L1 vocabulary development proceeded similarly in all groups, regardless of whether children were exposed to 'monolingual' or bilingual education. With respect to the attention tests, in the first round of testing, we observed some positive effects of bilingualism for two of the seven tasks but in year two, one year later, there were no differences that reached significance. In this second round of testing, however, we did find that children who were exposed to English outside of the school setting performed significantly better on two tasks which tapped into interference suppression. In the remainder of this section, we unpack these findings, with a view to situating them against the more recent literature on educational bilingualism and to specifying how future studies can continue to move the 'bilingual advantage' discussion forward.

4.1. Vocabulary skills

Starting with L2 vocabulary comprehension, it is perhaps of no surprise that over two consecutive years, children immersed in their L2 environment more intensively fared best in their performance. But it is worth noting that the proportion of class time executed in English differed only moderately between the two bilingual groups: HiEx translated into 40% of classes conducted in English and LoEx into 30%. It is interesting, therefore, that after one year, this 10% contrast in exposure coincided with such a vast difference, where the mean score for HiEx was 60 and for LoEx was 27. Before we conclude prematurely that this extra 10% of exposure is responsible for the difference between the groups, it is worth recalling that the children did not overlap entirely in terms of the subjects that were taught in English. For both groups, English was used as the medium of instruction for Natural Sciences and English Language but for the remaining percentages, they diverged: HiEx were taught Arts and Crafts and Performing Arts in English, whereas LoEx studied Social Sciences. It is possible that having two vocational subjects taught in English provides a better opportunity for

English language to flourish than does another academic subject, or that the vocabulary test had a higher overlap with the content of these subjects. Our study cannot rule this out with regards to vocabulary but measures on attention are less likely to be affected by this difference in L2 content.

Of further note is that although the initial boost we found for HiEx was maintained after a second year, it had not become more marked at this point. Both groups' scores increased at a similar rate, with HiEx achieving a mean score of 69 and LoEx of 38, so HiEx did not surge further ahead but nor did LoEx show signs of catching up. To be certain that these results were due to level of exposure and not to contrasts in delivery or other practices between the two schools, a follow-up study would need to disperse itself across a greater number of schools. Inclusion of schools with greater disparities in terms of exposure would also be helpful. With a larger number of schools, it would then be fruitful to track L2 development from onset of exposure, when children have just started their programme, to the end of primary-school age. This would enable us to see how different intensities of L2 exposure play out over time. In addition, since we only tested fee-paying schools, we cannot exclude the possibility that students' performance may have been due to their mid to high socio-economic status and may not necessarily apply to students with lower socio-economic status. Therefore, to ascertain if our generalisations extend to populations not attending fee-paying schools, public schools should be incorporated in future studies.

With respect to L1 vocabulary comprehension, a positive picture for the bilingual groups emerged. The narrative regarding the bilingual child and their L1 has been uneven over the years, starting with early fears that L2 language development was achieved at the cost of a less-developed and fractionated L1. Interpretation of these early studies, however, was hampered by the presence of other factors, such as socio-economic status and uneven access to bilingualism, which would have fed into the data without their contribution to the overall result being monitored (see Woumans et al., 2016, for discussion). Other studies have addressed these problematic aspects of design and reported that L1 development, whether the L2 is a majority or minority language, is not impeded by L2 immersion schooling (Garraffa et al., 2020; Genesee, 1983, 2004; Hermanto et al., 2012; Swain and Lapkin, 1982). Our findings fit in with these later studies - over two years, bilingually-educated children's L1 vocabulary did not diverge from that of monolingually-educated children. Woumans et al. (2016), which looked at L1 vocabulary development in particular, drew the same conclusions as regards L1 vocabulary development. However, vocabulary development was measured using a test of semantic verbal fluency rather than the standardised comprehension test we relied on. It is encouraging that a different test, tapping into a comparable skill, resulted in their groups scoring similarly at the outset and developing at an equal rate over time, just like ours. As with our earlier suggestions for the further examination of the L2, the next step would be to continue to monitor this L1 development over a longer period in a greater number of bilingual and monolingual schools. Extending testing to the development of other language areas, for example, morphology, syntax, semantics, and pragmatics, would also enable a more rounded investigation of linguistic progress in this sub-group of bilinguals, whose access to L2 is limited to school.

4.2. Attention skills

We turn now to the results that paint a less clear picture, that is, executive functioning tests that tap into attention skills. From our first round of testing - conducted after one year of bilingual education -, a bilingual advantage was found for two of the seven tasks, namely *Balloons 5* and *SART*. This superiority held for both bilingual groups for *Balloons 5* but was restricted to HiEx for *SART*. The object of the former task is to assess the child's ability to attend to material selectively by inhibiting interference. The fact that the results on this task favoured the bilingual groups is one that maps with other studies investigating selective attention with similar tests (e.g. Bialystok, 1992; Costa et al., 2008; Kapa, 2010; Nicolay and Poncelet, 2013, 2015; Yang and Lust, 2004), but it might be asked why the effect in the current study only appeared for one of the three tasks assessing this skill – *Balloon Hunt* and *Hide & Seek Visual* did not show a bilingual advantage. One difference between the former task and these ones is that they included a time limit, making them a more demanding task, a contrast that might be relevant to a proposal made in Bialystok and Barac (2012). Here, a distinction was drawn between the development of linguistic representational knowledge, as measured by metalinguistic tasks, on the one hand, and development of executive control, as measured by tests of attention, on the other. The former skill was argued to coincide with a categorical level of L2 proficiency, whereas the latter was viewed as a complex of more general cognitive skills which improved as a function of time spent in a bilingual environment. On this basis, we would expect indicators of advancement in attention skills in this type of bilinguals to increase over time, with differences on more demanding tasks predicted to emerge later (but see Engel de Abreu et al., 2012; Barac et al., 2016, for different results on early bilinguals fluent in both languages). This is in line with Garraffa et al.'s (2020) results on secondary education students, who had a longer exposure to immersion education, which revealed that bilinguals tended to perform better on more complex cognitive tasks in comparison with monolinguals. Put into this context, the moderate result for selective attention found after this first year makes sense. Recall that of a whole suite of attention tests, Barbu et al. (2019) found that children immersed for one year in bilingual education only scored better than monolinguals on one test, namely, selective auditory attention. In addition, no bilingual benefits were reported in Woumans et al. (2016) on the Simon task or by Poarch and van Hell (2012) on the Simon task or ANT for children who had experienced 1 and 1.3 years of immersion, respectively.

The second attention task in which the HiEx bilinguals did better was *SART*, which measured the child's ability to sustain attention and inhibit a response tendency. Success on this task might be expected of bilingually-educated children because it reflects more closely their bilingual experience, as children in this environment are required to constantly suppress their dominant language, which resembles the inhibition of a habitual response (see Cape et al., 2018). Note that the advantage did not stretch to the other three assessments of sustained attention (*Barking, Hide & Seek Auditory, Simple Reaction Time*), despite numerically revealing a better performance for the bilinguals. However, these three tasks did not include an element of response inhibition. If we expect these skills to improve with time, as per Bialystok and Barac (2012), then a longer period than the COVID-curbed study reported here needs to be conducted.

The results of the second testing phase suggest that a period of longer than two years is indeed necessary – at this stage, no group differences were found. It could be that for immersion settings, the three-year point marks the 'sweet spot' where more changes in attentional skills start to appear. Recall from Section 2 that Nicolay and Poncelet (2013, 2015) reported an advantage for attention and mental flexibility measures after three years of such education. However, one co-variate did have an influence in this second round of trials, namely exposure to English outside of school. These children outperformed those without this exposure on two tasks: *Troy Dual Task* and *Cerberus*. In our study, we can only speculate over the relative importance of a higher or more intensive exposure on the one hand and the increased language-switching that would have incurred within this co-variate on the other. Both of the tasks include interference suppression and the *Troy Dual Task* incorporates a switching component, so the better performance we found on these tasks in this sub-group of children could be related to their bilingual experience outside of school, which leads to more frequent switching between their two languages and suppression of the unwanted language (not necessarily just the dominant one). This may have given these children an advantage on these tasks. Unfortunately, the attention test in Year 1 did not include a switching task so we could not track the

effect of time on this skill. But the moral of this story is now familiar – a more expansive longitudinal study could help us shed some light on these results. This would involve a study that measures children from their baseline, compares them according to different proportions of exposure, and tests them over a number of years. Such a design could also contribute to the question of whether a bilingual lead is a temporary phenomenon, surfacing during a point in linguistic development where cognitive resources are exploited more intensively, as the child learns to manage their languages, and subsiding once these skills become second nature (see Simonis et al., 2020; Paap, 2018, for discussion).

References

Antón, E., Carreiras, M., Duñabeitia, J.A., 2019. The impact of bilingualism on executive functions and working memory in young adults. PLoS One 14 (2). https://doi.org/10.1371/journal.pone.0206770.

Antón, E., Duñabeitia, J.A., Estévez, A., Hernández, J.A., Castillo, A., Fuentes, L.J., Davidson, D.J., Carreiras, M., 2014. Is there a bilingual advantage in the ANT task? Evidence from children. Front. Psychol. 5, 398. https://doi.org/10.3389/fpsyg.2014.00398.

Bak, T.H., Long, M.R., Vega-Mendoza, M., Sorace, A., 2016. Novelty, challenge, and practice: the impact of intensive language learning on attentional functions. PLoS One 11 (4). https://doi.org/10.1371/journal.pone.0153485.

Barac, R., Moreno, S., Bialystok, E., 2016. Behavioral and electrophysiological differences in executive control between monolingual and bilingual children. Child Dev. 87 (4), 1277–1290. https://doi.org/10.1111/cdev.12538.

Barbu, C., Gonzalez, A., Gillet, S., Poncelet, M., 2019. Cognitive advantage in children enrolled in a second-language immersion elementary school program for one year. Psychol. Belg. 59 (1), 416–435. https://doi.org/10.5334/pb.469.

Bialystok, E., 1986. Factors in the growth of linguistic awareness. Child Development 57 (2), 498–510. https://doi.org/10.2307/1130604.

Bialystok, E., 1988. Levels of bilingualism and levels of linguistic awareness. Developmental Psychology 24 (4), 560–567. https://doi.org/10.1037/0012-1649.24.4.560.

Bialystok, E., 1992. Attentional control in children's metalinguistic performance and measures of field independence. Dev. Psychol. 28 (4), 654–664. https://doi.org/10.1037/0012-1649.28.4.654.

Bialystok, E., 1999. Cognitive complexity and attentional control in the bilingual mind. Child Dev. 70, 636–644. https://doi.org/10.1111/1467-8624.00046.

Bialystok, E., 2006. Effect of bilingualism and computer video game experience on the Simon task. Can. J. Exp. Psychol. 60, 68–79. https://doi.org/10.1037/cjep2006008.

Bialystok, E., Barac, R., 2012. Emerging bilingualism: dissociating advantages for metalinguistic awareness and executive control. Cognition 122, 67–73. https://doi.org/10.1016/j.cognition.2011.08.003.

Bialystok, E., Craik, F.I.M., Klein, R., Viswanathan, M., 2004. Bilingualism, aging, and cognitive control: evidence from the Simon task. Psychol. Aging 19, 290–303. https://doi.org/10.1037/0882-7974.19.2.290.

Bialystok, E., Craik, F.I.M., Luk, G., 2008. Cognitive control and lexical access in younger and older bilinguals. J. Exp. Psychol. Learn. Mem. Cognit. 34, 859–873. https://doi.org/10.1037/0278-7393.34.4.859.

Bialystok, E., Craik, F.I.M., Luk, G., 2012. Bilingualism: consequences for mind and brain. Trends Cognit. Sci. 16 (4), 240–250. https://doi.org/10.1016/j.tics.2012.03.001.

Bialystok, E., Craik, F.I.M., Ryan, J., 2006. Executive control in a modified antisaccade task: effects of aging and bilingualism. J. Exp. Psychol. Learn. Mem. Cognit. 32, 1341–1354. https://doi.org/10.1037/0278-7393.32.6.1341.

Bialystok, E., Martin, M.M., 2004. Attention and inhibition in bilingual children: evidence from the dimensional change card sort task. Dev. Sci. 7, 325–339. https://doi.org/10.1111/j.1467-7687.2004.00351.x.

Bialystok, E., Martin, M.M., Viswanathan, M., 2005. Bilingualism across the lifespan: the rise and fall of inhibitory control. Int. J. BiLing. 9, 103–119. https://doi.org/10.1177/13670069050090010701.

Bialystok, E., Peets, K., Moreno, S., 2014. Producing bilinguals through immersion education: development of metalinguistic awareness. Appl. Psycholinguist. 35 (1), 177–191. https://doi.org/10.1017/S0142716412000288.

Bialystok, E., Shapero, D., 2005. Ambiguous benefits: the effect of bilingualism on reversing ambiguous figures. Dev. Sci. 8 (6), 595–604. https://doi.org/10.1111/j.1467-7687.2005.00451.x.

Bishop, D., 2003. Test for the Reception of Grammar – Version 2 (TROG-2). Pearson, London.

Blumenfeld, H.K., Marian, V., 2013. Parallel language activation and cognitive control during spoken word recognition in bilinguals. J. Cognit. Psychol. 25 (5), 547–567. https://doi.org/10.1080/20445911.2013.812093.

Cape, R., Vega-Mendoza, M., Bak, T.H., Sorace, A., 2018. Cognitive effects of Gaelic medium education on primary school children in Scotland. Int. J. Biling. Educ. BiLing. https://doi.org/10.1080/13670050.2018.1543648.

Carlson, S.M., Meltzoff, A.N., 2008. Bilingual experience and executive functioning in young children. Dev. Sci. 11, 282–298. https://doi.org/10.1111/j.1467-7687.2008.00675.x.

Chamorro, G., Janke, V., 2020. Investigating the bilingual advantage: the impact of L2 exposure on the social and cognitive skills of monolingually-raised children in bilingual education. Int. J. Biling. Educ. BiLing. https://doi.org/10.1080/13670050.2020.1799323.

Chamorro, G., Janke, V., 2021. Does bilingual education benefit the social and cognitive development of monolingually-raised children? Evidence from a longitudinal study. In: Dionne, D., Vidal Covas, L.-A. (Eds.), Proceedings of the 45th Annual Boston University Conference on Language Development. Cascadilla Press, Somerville, MA, pp. 108–119.

Costa, A., Hernández, M., Costa-Faidella, J., Sebastián-Gallés, N., 2009. On the bilingual advantage in conflict processing: now you see it, now you don't. Cognition 113, 135–149. https://doi.org/10.1016/j.cognition.2009.08.001.

Costa, A., Hernández, M., Sebastián-Gallés, N., 2008. Bilingualism aids conflict resolution: evidence from the ANT task. Cognition 106, 59–86. https://doi.org/10.1016/j.cognition.2006.12.013.

Costa, A., Sebastián-Gallés, N., 2014. How does the bilingual experience sculpt the brain? Nat. Rev. Neurosci. 15, 336–345. https://doi.org/10.1038/nrn3709.

Cox, S.R., Bak, T.H., Allerhand, M., Redmond, P., Starr, J.M., Deary, I.J., MacPherson, S.E., 2016. Bilingualism, social cognition and executive functions: a tale of chickens and eggs. Neuropsychologia 91, 299–306. https://doi.org/10.1016/j.neuropsychologia.2016.08.029.

Craik, F., Bialystok, E., 2006. Cognition through the lifespan: mechanisms of change. Trends Cognit. Sci. 10, 131–138. https://doi.org/10.1016/j.tics.2006.01.007.

de Bruin, A., Treccani, B., Della Sala, S., 2015. Cognitive advantage in bilingualism: an example of publication bias? Psychol. Sci. 26 (1), 99–107. https://doi.org/10.1177/0956797614557866.

Dunn, L.M., Dunn, L.M., Arribas, D., 2006. PPVT-III PEABODY: Test de Vocabulario en Imágenes. TEA Ediciones, Madrid, Spain.

Dunn, L.M., Dunn, D.M., Styles, B., 2009. The British Picture Vocabulary Scale, third ed. Brentford, UK: GL Assessment. *(BPVS 3)*.

Duñabeitia, J.A., Hernández, J.A., Antón, E., Macizo, P., Estévez, A., Fuentes, L.J., Carreiras, M., 2014. The inhibitory advantage in bilingual children revisited: myth or reality? Exp. Psychol. 61 (3), 234–251. https://doi.org/10.1027/1618-3169/a000243.

Engel de Abreu, P.M.J., Cruz-Santos, A., Tourinho, C.J., Martin, R., Bialystok, E., 2012. Bilingualism enriches the poor: enhanced cognitive control in low-income minority children. Psychol. Sci. 23 (11), 1364–1371. https://doi.org/10.1177/0956797612443836.

Fan, J., McCandliss, B.D., Sommer, T., Raz, A., Posner, M.I., 2002. Testing the efficiency and independence of attentional networks. J. Cognit. Neurosci. 14, 340–347. https://doi.org/10.1162/089892902317361886.

Garraffa, M., Beveridge, M., Sorace, A., 2015. Linguistic and cognitive skills in Sardinian–Italian bilingual children. Front. Psychol. 6, 1–15. https://doi.org/10.3389/fpsyg.2015.01898.

Garraffa, M., Obregon, M., O'Rourke, B., Sorace, A., 2020. Language and cognition in gaelic-English young adult bilingual speakers: a positive effect of school immersion program on attentional and grammatical skills. Front. Psychol. 11, 570587 https://doi.org/10.3389/fpsyg.2020.570587.

Gathercole, V.C.M., Thomas, E.M., Kennedy, I., Prys, C., Young, N., Viñas Guasch, N., Roberts, E.J., Hughes, E.K., Jones, L., 2014. Does language dominance affect cognitive performance in bilinguals? Lifespan evidence from preschoolers through older adults on card sorting, Simon, and metalinguistic tasks. Front. Psychol. 5, 11. https://doi.org/10.3389/fpsyg.2014.00011.

Genesee, F., 1983. Bilingual education of majority-language children: the immersion experiments in review. Appl. Psycholinguist. 4 (1), 1–46. https://doi.org/10.1017/S0142716400001739.

Genesee, F., 2004. What do we know about bilingual education for majority language students? In: Bhatia, T.K., Ritchie, W. (Eds.), Handbook of Bilingualism and Multiculturalism. Blackwell, Malden, MA, pp. 547–576.

Green, D.W., Abutalebi, J., 2013. Language control in bilinguals: the adaptive control hypothesis. J. Cognit. Psychol. 25 (5), 515–530. https://doi.org/10.1080/20445911.2013.796377.

Grenoble, L., Roth Singerman, A., 2014. Minority languages obo in Linguistics. . https://doi.org/10.1093/obo/9780199772810-0176.

Hansen, L., Macizo, P., Duñabeitia, J.A., Saldaña, D., Carreiras, M., Fuentes, L., Bajo, M., 2016. Emergent bilingualism and working memory development in school aged children: working memory in emergent bilinguals. Lang. Learn. 66, 51–75. https://doi.org/10.1111/lang.12170.

Hermanto, N., Moreno, S., Bialystok, E., 2012. Linguistic and metalinguistic outcomes of intense immersion education: how bilingual? Int. J. Biling. Educ. BiLing. 15 (2), 131–145. https://doi.org/10.1080/13670050.2011.652591.

Hernández, M., Martin, C.D., Barceló, F., Costa, A., 2013. Where is the bilingual advantage in task-switching? J. Mem. Lang. 69, 257–276. https://doi.org/10.1016/j.jml.2013.06.004.

Kalashnikova, M., Mattock, K., 2014. Maturation of executive functioning skills in early sequential bilingualism. Int. J. Biling. Educ. BiLing. 17, 111–123. https://doi.org/10.1080/13670050.2012.746284.

Kapa, L.L., 2010. Executive Function in Simultaneous and Sequential Bilingual Children. Unpublished MA thesis. University of Kansas, Lawrence, KS.

Kaushanskaya, M., Gross, M., Buac, M., 2014. Effects of classroom bilingualism on task shifting, verbal memory, and word learning in children. Dev. Sci. 17, 564–583. https://doi.org/10.1111/desc.12142.

Lagrou, E., Hartsuiker, R., Duyck, W., 2013. The influence of sentence context and accented speech on lexical access in second-language auditory word recognition. Biling. Lang. Cognit. 16 (3), 508–517. https://doi.org/10.1017/S1366728912000508.

Lehtonen, M., Soveri, A., Laine, A., Järvenpää, J., de Bruin, A., Antfolk, J., 2018. Is bilingualism associated with enhanced executive functioning in adults? A meta-analytic review. Psychol. Bull. 144 (4), 394–425. https://doi.org/10.1037/bul0000142.

Lindholm-Leary, K., 2014. Bilingual and biliteracy skills in young Spanish-speaking low-SES children: impact of instructional language and primary language proficiency.

Int. J. Biling. Educ. BiLing. 17 (2), 144–159. https://doi.org/10.1080/13670050.2013.866625.
Luk, G., de Sa, E., Bialystok, E., 2011. Is there a relation between onset age of bilingualism and enhancement of cognitive control? Biling. Lang. Cognit. 14 (4), 588–595. https://doi.org/10.1017/S1366728911000010.
Manly, T., Anderson, V., Crawford, J., George, M., Underbjerg, M., Robertson, I., 2016. In: Test of Everyday Attention for Children, second ed. (TEA-Ch2), London, UK: Pearson.
Manly, T., Robertson, I., Anderson, V., Nimmo-Smith, I., 1999. The test of everyday attention for children (TEA-Ch). Bury St. Edmunds: Thames Valley Test Company.
Martin-Rhee, M.M., Bialystok, E., 2008. The development of two types of inhibitory control in monolingual and bilingual children. Biling. Lang. Cognit. 11, 81–93. https://doi.org/10.1017/S1366728907003227.
Miyake, A., Friedman, N.P., 2012. The nature and organization of individual differences in executive functions: four general conclusions. Curr. Dir. Psychol. Sci. 21, 8–14. https://doi.org/10.1177/0963721411429458.
Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., Howerter, A., Wager, T.D., 2000. The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: a latent variable analysis. Cognit. Psychol. 41, 49–100. https://doi.org/10.1006/cogp.1999.0734.
Nicolay, A.C., Poncelet, M., 2013. Cognitive advantage in children enrolled in a second-language immersion elementary school program for 3 years. Biling. Lang. Cognit. 16 (3), 597–607. https://doi.org/10.1017/S1366728912000375.
Nicolay, A.C., Poncelet, M., 2015. Cognitive benefits in children enrolled in an early bilingual immersion school: a follow up study. Biling. Lang. Cognit. 18 (4), 789–795. https://doi.org/10.1017/S1366728914000868.
Paap, K.R., 2014. The role of componential analysis, categorical hypothesizing, replicability and confirmation bias in testing for bilingual advantages in executive functioning. J. Cognit. Psychol. 26, 242–255. https://doi.org/10.1080/20445911.2014.891597.
Paap, K.R., 2018. Bilingualism in cognitive science: the characteristics and consequences of Bilingual Language control. In: De Houwer, A., Ortega, L. (Eds.), The Cambridge Handbook of Bilingualism. Cambridge University Press, Cambridge, pp. 435–465. https://doi.org/10.1017/9781316831922.023.
Paap, K.R., Greenberg, Z.I., 2013. There is no coherent evidence for a bilingual advantage in executive processing. Cognit. Psychol. 66, 232–258. https://doi.org/10.1016/j.cogpsych.2012.12.002.
Paap, K.R., Johnson, H.A., Sawi, O., 2014. Are bilingual advantages dependent upon specific tasks or specific bilingual experiences? J. Cognit. Psychol. 26, 615–639. https://doi.org/10.1080/20445911.2014.944914.
Paap, K.R., Johnson, H.A., Sawi, O., 2015. Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. Cortex 69, 265–278. https://doi.org/10.1016/j.cortex.2015.04.014.
Paap, K.R., Johnson, H.A., Sawi, O., 2016. Should the search for bilingual advantages in executive functioning continue? Cortex 74, 305–314. https://doi.org/10.1016/j.cortex.2015.09.010.
Paap, K.R., Sawi, O., 2014. Bilingual advantages in executive functioning: problems in convergent validity, discriminant validity, and the identification of the theoretical constructs. Front. Psychol. 5, 962. https://doi.org/10.3389/fpsyg.2014.00962.
Poarch, G.J., van Hell, J.G., 2012. Executive functions and inhibitory control in multilingual children: evidence from second-language learners, bilinguals, and trilinguals. J. Exp. Child Psychol. 113 (4), 535–551. https://doi.org/10.1016/j.jecp.2012.06.013.
Prior, A., Gollan, T.H., 2011. Good language-switchers are good task-switchers: evidence from Spanish-English and Mandarin-English bilinguals. J. Int. Neuropsychol. Soc. 17, 682–691. https://doi.org/10.1017/S1355617711000580.
Prior, A., MacWhinney, B., 2010. A bilingual advantage in task switching. Biling. Lang. Cognit. 13 (2), 253–262. https://doi.org/10.1017/S1366728909990526.
Raven, J.C., Court, J.H., Raven, J., 1998. Progressive Coloured Matrices. Oxford Psychologists Press, Oxford.
Robertson, I.H., Manly, T., Andrade, J., Baddeley, B.T., Yiend, J., 1997. "Oops!": performance correlates of everyday attentional failures in traumatic brain injured and normal subjects. Neuropsychologia 35 (6), 747–758. https://doi.org/10.1016/S0028-3932(97)00015-8.
Robertson, I.H., Ward, T., Ridgeway, V., Nimmo-Smith, I., 1994. The test of everyday attention: TEA. Bury St. Edmunds: Thames Valley Test Company.
Ryan, J.D., Bialystok, E., Craik, F., Logan, J., 2004. Bilingual Advantages in Attentional Control. Poster presented at the Meeting of the Cognitive Neuroscience Society, San Francisco, CA.
Samuel, S., Roehr-Brackin, K., Pak, H., Kim, H., 2018. Cultural effects rather than a bilingual advantage in cognition: a review and an empirical study. Cognit. Sci. 42 (7), 2313–2341. https://doi.org/10.1111/cogs.12672.
Simonis, M., Van der Linden, L., Galand, B., Hiligsmann, P., Szmalec, A., 2020. Executive control performance and foreign-language proficiency associated with immersion education in French-speaking Belgium. Biling. Lang. Cognit. 23 (2), 355–370. https://doi.org/10.1017/S136672891900021X.
Swain, M., Lapkin, S., 1982. Evaluating Bilingual Education: A Canadian Case Study. Clevedon: Multilingual Matters.
Tao, L., Marzecová, A., Taft, M., Asanowicz, D., Wodniecka, Z., 2011. The efficiency of attentional networks in early and late bilinguals: the role of age of acquisition. Front. Psychol. 2, 123. https://doi.org/10.3389/fpsyg.2011.00123.
Thierry, G., Sanoudaki, E., 2012. Activation syntaxique non-sélective à la langue chez le bilingue précoce. Rev. Fr. Ling. Appl. 17, 33–48.
Trebits, A., Koch, M.J., Ponto, K., Bruhn, A., Adler, M., Kersten, K., 2021. Cognitive gains and socioeconomic status in early second language acquisition in immersion and EFL learning settings. Int. J. Biling. Educ. BiLing. https://doi.org/10.1080/13670050.2021.1943307.
Trebits, A., Kersten, K., 2019. Bilingual Education Trumps Socioeconomic Status: L1 and L2 Development in Primary School EFL Learners. EUROSLA Conference, Lund, Sweden.
Unsworth, S., 2011. Utrecht Bilingual Language Exposure Calculator (UBiLEC) (Unpublished material).
Vega-Mendoza, M., West, H., Sorace, A., Bak, T.H., 2015. The impact of late, non-balanced bilingualism on cognitive performance. Cognition 137, 40–46. https://doi.org/10.1016/j.cognition.2014.12.008.
Wechsler, D., 1974. Wechsler Intelligence Scale for Children-Revised. Psychological Corporation, New York.
Woumans, E., Surmont, J., Struys, E., Duyck, W., 2016. The longitudinal effect of bilingual immersion schooling on cognitive control and intelligence. Lang. Learn. 66, 76–91. https://doi.org/10.1111/lang.12171.
Yang, S., Lust, B., 2004. Testing effects of bilingualism on executive attention: comparison of cognitive performance on two non-verbal tests. In: Paper Presented at the Boston University Conference on Language Development. Boston University, Boston, MA.
Zimmermann, P., Gondan, M., Fimm, B., 2002. KiTAP: Test for Attentional Performance in Children. Psytest, Herzogenrath.