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Enhancing heritage and additional language learning in the preschool years: longitudinal implementation of the Little Multilingual Minds program

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Little Multilingual Minds (LMM) partners with universities, communities, and early childhood centers to offer a language exposure program for heritage language (HL) and additional language (AL) speakers in a naturalistic, play-based environment. This paper reports on two program implementations conducted in a Spanish-English bilingual preschool in Sydney, Australia. Implementation 1 focused on HL Spanish children (n = 11; Mage = 4.24) for HL maintenance over 8 months, while Implementation 2 included both HL and AL children (n = 27; Mage = 2.93) with a new cohort over 1 year. Both implementations were quantitatively evaluated in three key areas: HL Spanish linguistic proficiency (vocabulary, listening, speaking, literacy/numeracy), alignment with educational principles (disposition, interaction, interest), and task-related precursors of school readiness (attention, cooperation, engagement), using Bayesian modeling for reliable statistical testing. Results from Implementation 1 showed significant improvements in HL children's linguistic skills from the first to the last assessment, effectively strengthening HL Spanish proficiency while preventing a shift toward English. In Implementation 2, despite challenges, the program was successfully adapted to accommodate both HL and AL children in the same session, yielding encouraging outcomes for both groups. We discuss these findings in terms of their implications for successful HL maintenance and AL learning within preschool classes with mixed language backgrounds.

KEYWORDS

early childhood education, multilingualism, heritage languages, additional languages, play-based language exposure, content and language integrated learning

Introduction

Many children in Australia grow up in multilingual environments, speaking their *heritage language* (HL): "an immigrant, indigenous, or ancestral language that a speaker has a personal relevance and desire to (re) connect with" (He, 2010, p. 66). In 2021, a sizeable 22.3% of people in Australia reported using a language other than English at home, while in the so-called greater capital cities[1], this figure stood at a much higher 29.5%, having

1 Australia is a federation of six states and two territories, each of which has a "capital city", which also has the largest population.

increased by nearly 3% since the 2016 census [Australian Bureau of Statistics (ABS), 2021]. Mandarin, Arabic and Vietnamese are the three most widely spoken home languages (see Supplementary Material A).

The use of HLs and their transmission are known to be crucial to mental health and wellbeing, academic achievement, social inclusion, cultural diversity, community cohesion, economic success, and networking opportunities (e.g., Adesope et al., 2010; Fan et al., 2015). Although migrant parents in Australia can be hesitant about passing their HLs on to their children because they think HL maintenance may hinder their English acquisition (Eisenchlas and Schalley, 2019), they generally display very positive attitudes toward bilingualism (Escudero et al., 2025; Piller and Gerber, 2021). However, due to larger institutional pressures, language shift and attrition are common in Australia, which has been often described as a "graveyard for languages" and as having a strongly "monolingual mindset" (Clyne, 2007; Hajek and Slaughter, 2014).

Such institutional pressures become evident when children are around 4 to 5 years of age, when many shift to speaking English instead of their HL (Verdon et al., 2014; Escudero et al., 2020), coinciding with the time at which they enter school, where English is the dominant language. A reason for this is that although families play a crucial role in HL maintenance (Melo-Pfeifer, 2015; Tran et al., 2022), school-aged children spend most of their time outside of their homes, diminishing the impact of families in countering the shift to English (Curdt-Christiansen, 2022; McLeod et al., 2022). The same predicament has been reported in the US where even when parents want their children to be bilingual and bi-literate, society (school and community practices) acts as a barrier (Li and Renn, 2018).

In a recent, large-scale, Australia-wide survey of multilingual parents, a strong awareness of the importance of maintaining HLs was documented, with 95% of 488 respondents rating the speaking of HLs with their children as very or somewhat important (Escudero et al., 2025). Despite this, parents reported only moderate levels of engagement (37–44%) with community initiatives for HL support and significantly less support was reported for preschool-aged children in comparison with primary school-aged children. However, attendance at HL initiatives during preschool years yielded a significantly higher self-reported success rate in HL maintenance than attendance during primary school years. Furthermore, over 61% of respondents agreed that if more HL initiatives were made available, they would commit to taking part in them on a regular basis. Despite rare initiatives in the Australian state of New South Wales (NSW) that promote children's HL and early bilingualism, significant challenges remain.

To address this lack of support, we introduced and evaluated a program focused on HL maintenance at a Spanish-English bilingual preschool, later expanding it to include additional language learners. Spanish was selected as HL due to its global relevance, the strong interest from the participating bilingual preschool and families, and the presence of a local Spanish-speaking community seeking opportunities to support children's HL development. According to the 2021 Australian Census, Spanish ranks within the top 10–15 home languages spoken in Australia (see Supplementary Material A). While it is not in the top three, it is still one of the most spoken European languages after English, Italian, and Greek [(Australian Bureau of Statistics (ABS), 2021)].

A bilingual preschool's challenge

In 2018, parents, educators, and directors of a Spanish-English bilingual preschool in Sydney approached the first author regarding the prevalence of HL attrition amongst children in their care. The results of an observational study (Escudero et al., 2020) showed that children's refusal to speak HL Spanish was likely connected to a decrease in HL input in the preschool years: children heard more English than Spanish from educators when they transitioned from the toddler (ages 2 to 3) to the pre-school (ages 3 to 5) classroom. In Australia, preparation for primary school involves a focus on pre-literacy and numeracy skills in English, which is the only language of education. The bilingual preschool needs to fulfill this readiness for Australian school requirement at the expense of HL input, as mentioned in Escudero et al. (2020). In a further interview-based study conducted at the same bilingual preschool, educators reported that HL use was restricted primarily to daily routines such as eating, going outside, or washing hands (Jones Diaz et al., 2022).

Considering the demonstrated decrease in HL input and the absence of educational content in the HL, coupled with parents' inability to independently support their children's multilingualism, it was crucial and timely to propose a tailor-made solution with practical implementation. The first author brought together experts in child development, language learning, multilingualism and sociolinguistics as well as educational consultants to help her develop a program aimed at supporting HL maintenance in early childhood settings.

The Little Multilingual Minds program

Little Multilingual Minds (LMM) offers language exposure sessions to encourage children's language proficiency and education, with the goal of enabling sustainable lifespan multilingualism. The program is inspired by the recent call from UNESCO to "foster multilingualism for inclusion in education and society", with a focus on "multilingual education from early childhood, so that for children, their mother tongue is always an asset".[2] LMM is an evidence-based program, designed to deliver educational content in any target language. It is evidence-based because it has been subject to empirical evaluation (Espinosa and Magruder, 2015; Genesee, 2006), including in the present study, demonstrating its feasibility and outcomes. It differs from other providers of language instruction (e.g., language institutes, language teachers) in that it offers education in languages other than English, rather than teaching them directly.

LMM aims to adapt curriculum and co-design delivery to suit children's language proficiency and cognitive development, providing flexibility for different settings. Given the lack of HL and multilingualism support in the early years (cf. Jones Diaz et al., 2022; Escudero et al., 2020, 2025), LMM was designed as a child-centered and child-guided program for early childhood education. Findings from child development, applied linguistics and psycholinguistics are the foundations for its principles, structure, and vision. The program's educational content combines national and international educational curricula, including early years

2 https://news.un.org/en/story/2021/02/1085312

frameworks in the Netherlands (Fukkink, 2017), Europe (European Commission, 2014) and North America (NAEYC/NAESC/SDE, 2002), with a particular emphasis also on the Australian Early Years Framework [(Australian Children's Education Care Quality Authority [ACECQA], 2022)] and the New South Wales Education Standards Authority language framework for years K-10 [NSW Education Standards Authority (NESA), 2018], as outlined in the LMM Principles (see Supplementary Material B).

LMM is a research-based program designed drawing on established research in bilingual development, early childhood education, and language immersion, as reviewed in previous literature (Espinosa, 2015). Our design is also collaborative as it unites community stakeholders with new generations of language learning facilitators to support lifelong multilingualism in Australia and globally (See Figure 1). Many LMM facilitators[3] were educators in their home countries before immigrating to Australia, bringing strong skills in engaging children in the target language[4]. Some have advanced their careers by pursuing postgraduate research within the LMM program, demonstrating the professional development benefits of our training. Figure 1 depicts the multifaceted nature of the LMM program and its collaborative design with educators, families and the educational settings at which the program is delivered.



FIGURE 1
Visualization of the components of the LMM program.

Pedagogical approach: CLIL, immersion, and play-based learning

LMM involves a Content and Language Integrated Learning (CLIL) approach, whereby children are simultaneously exposed to language and meaningful content. Importantly, no explicit language teaching takes place because sessions involve an immersive, play-based learning experience leading to education in and through the target language (i.e., an HL that the program aims to support). For instance, during LMM Spanish sessions, while children could use English, facilitators always responded in Spanish. Lesson structures are designed to ensure age-appropriate exposure to and use of the target language in all its aspects.

CLIL is an increasingly common methodology used in language education in countries around the world, given its many potential benefits (Coyle, 2010). The learning of content allows for cognitive engagement and subject knowledge building, alongside the development of intercultural awareness and community (Hemmi and Banegas, 2021). The CLIL approach is adaptable to any context and is well-suited to a play-based approach in Early Years learning, whether in pre-school or primary school settings (e.g., Brissoni, 2021). It is also an essential element of immersion learning – in which only the target language is used for the teaching and learning of content. Content based instruction (CBI) and CLIL are overlapping approaches, and often used interchangeably. CLIL does not focus on (explicit) language instruction – something which falls explicitly within the remit of CBI as made clear by Zhou (2020). In CLIL, language is learned incidentally as children participate in cognitively engaging, content-rich activities in early years – this often takes the form of exploratory play, storytelling, games, and thematic learning (DeBoer and Leontjev, 2020). Following this line of research, we believe CLIL is particularly compatible with play-based learning in early childhood settings because both approaches emphasize meaningful, contextualized learning and promote natural language acquisition through engagement with content.

LMM participation involves children's attendance at one or more sessions per week as part of the partner center's scheduled activities. These sessions include a range of play-based activities designed to tap into five essential language skills: vocabulary, listening, speaking, literacy and numeracy. The main objective embedded into every session is to foster critical and creative thinking, intercultural understanding, personal and social skills, as well as science, technology, engineering and mathematics (STEM) skills. These contribute to linguistic, cognitive, socio-emotional and motor development, with an emphasis on individual learning.

The sessions were conducted entirely in the target language, without resorting to English, which was achieved through the use of strategies such as gestures, visual supports, repetition and predictable routines, which enabled children to comprehend and engage with the content. This approach aligns with seminal work such as the input hypothesis (Krashen, 1985, 1992), which posits that language acquisition occurs most effectively through exposure to meaningful, context-rich input that is slightly beyond the learners' current level. Using only the target languages also aligns with the interdependence hypothesis (Cummins, 1979, 2000), which suggests that children can transfer knowledge and skills across languages when learning in cognitively engaging

3 We refer to the educators who deliver the LMM program as facilitators, as we consider that their role is to facilitate and support HL input and use in the classroom.

4 In Australia, many professional pre- and primary school educators from overseas are not recognized in their areas of expertise due to their lack of Australian tertiary education qualifications. Our LMM program enables such professionals to gain experience in Australia by following training sessions in the LMM method.

and socially supported contexts. Importantly, language immersion environments are particularly successful in early childhood, as many aspects of language are more easily acquired at an early age (Marsh et al., 2015, p. 48), with language immersion success being more common before the third grade of primary education (Swain and Lapkin, 1981).

Themes, sessions, and alignment with early years education

During LMM sessions, activities relate to a theme because a thematic approach enables knowledge consolidation through repetition and extension (Björklund and Ahlskog-Björkman, 2017; Horst et al., 2011). Each theme includes the content covered in the NSW Department of Education curriculum for early learning and first years of primary school in the key learning areas of English, STEM, and Personal Development and Health (see Supplementary Material C for LMM themes).

A typical LMM session lasts between 45–60 min with a specific outcome connected to one of the essential language skills (see section "Pedagogical approach: CLIL, immersion and play-based learning"). The session begins with an opening routine where children are exposed to common words and everyday expressions, such as "good morning" and saying the date, along with vocabulary that will be used throughout the session. Subsequently, children are presented with an interactive activity, e.g., collaborative retelling of ideas and stories conveyed to them with visual aids, such as flashcards. The next part of the session typically includes drama, play, or arts and crafts-based activities. Children may play *Simon Says* in the target language or make fruit stamps out of real fruit and then use them to illustrate the fruit words they have just learned.

LMM's seven principles (Supplementary Material B) are directly connected to the three Australian Early Years Learning Framework (EYLF) principles of *Being, Becoming,* and *Belonging,* which are encapsulated in our assessments of *disposition*, *interaction* and *interest/engagement,* where we focus on children being at ease in the presence of the other children and facilitator (disposition), connecting with each other (interaction), and enjoying and engaging with the session content (interest/engagement). LMM's principles also emphasize the need to value and respect children's HLs, identity and individual needs, and the role of society, families, and educators in supporting children's language development.

Comparable programs globally

There are some other programs that we are aware of that align with some of the LMM principles and practices, including in particular:

(a) the VietSpeech program at Charles Sturt University in Australia, which supports Vietnamese-Australian children and families to maintain their HL, while also supporting children's acquisition of English (see McLeod et al., 2022; Verdon et al., 2021). Parents are sent Vietnamese language materials and work with children at home, as well as joining facilitators on Zoom for live immersion sessions in Vietnamese and English as part of a weekly hour-long program over 8 weeks (McLeod et al., 2022). Unlike LMM, it does not operate in a physical pre-school setting and relies on encouraging parents' active engagement at home with their child's exposure to and use of Vietnamese (Verdon et al., 2021).

(b) In Spain, the SparkLing program trains language tutors online (via experts in the US) to deliver 45-min daily play sessions in English that take place in early education centers (Ferjan Ramírez and Kuhl, 2017, 2020). This program shows some similarities with LMM, with a shared emphasis on thematic content and language learning as well as a similar research-based approach. They, however, do not conceptualize their program as CLIL, although it potentially could be. Instead, they refer to it as a 'foreign language intervention'. On the other hand, given its focus on English, SparkLing is not specifically formulated to counter HL attrition in the preschool years or lack of educational content in the HL in childhood centers, which is a major focus of LMM.

Both SparkLing and LMM are what can be called incursion models of provision that allow for the release of local center-based educators during language sessions. They are also longitudinal in the sense that researchers can collect data at different time points with the same cohort allowing for the assessment of change over time. We present below a similar type of longitudinal evaluation via two implementations.

Implementation 1: HL maintenance and evaluation

Our first LMM implementation (IMP-1) was designed to increase the bilingual preschool's educational content in the HL, leading to increased HL input and output and countering language shift to English in HL children aged 4 to 5 years. In Escudero et al. (2020), we show that HL input decreases for children in the preschool years attending this bilingual center, which means that their ability to maintain or increase their proficiency is halted, with observations from parents and educators of language shift to English, including reluctance to speak HL Spanish at home. With this in mind, we had two specific research questions:

RQ1: Can a tailor-made LMM program of 8 months prevent the previously-documented language shift from HL Spanish to English among children at their bilingual preschool?

RQ2: Does the LMM program successfully implement the educational principles of the Australian Early Years Framework (EYF)?

The implementation 1 of the LMM Spanish program we offered to the same bilingual center included in Escudero et al. (2020) aimed at providing more frequent HL input with higher quality, with the expectation of both diminishing language shift and maintaining or even increasing children's HL Spanish proficiency. Accordingly, we expected a positive effect of the program in response to RQ1. We also expected a positive response for RQ2, as the program was designed following the Australian EYLF, but

TABLE 1 Participants' demographic information as per parental report.

Participants (*n*)	11
Females (*n*)	7
Mean age (range)	4.24 (3.17–5.15)
Mean English exposure % (range)	36.36 (03–60)
Mean Spanish exposure % (range)	63.64 (40–97)
Mean other language exposure % (range)	18.00 (04–30)
Exposure to Spanish + English (*n*)	8
Main Language: English *n* (%)	4 (36.36%)
Main Language: Spanish *n* (%)	6 (54.55%)
Main Language: Spanish/English *n* (%)	1 (9.10%)
Principal Carer Education (*n*)	University degree+ (10)

this would be the first time our implementation of these national principles was empirically examined.

Method

Participants

Eleven HL children attending the bilingual preschool participated in IMP-1. Table 1 shows children's demographic information collected with a background questionnaire that parents filled out at the same time they signed a consent form for their child's participation. Data collection was approved by Western Sydney Human Research Ethics Committee. All children were acquiring two or three languages simultaneously: HL Spanish plus English as the societal language, with the three other reported languages being Estonian, Dutch and Russian. At home, they were exposed to HL Spanish 40% to 97% of their weekly awake time at home and at the bilingual preschool. Most mothers had a university or higher degree ($n = 10$), indicating high socio-economic status (SES).

Participant recruitment was challenging because the bilingual preschool only has 15 children aged 3-5 enrolled on any given day, with some parents hesitant to sign their children up due to recurrent COVID lockdown restrictions at the time of IMP-1. Absenteeism was not infrequent among the 11 participants due to illness and lockdown measures, sometimes coinciding with assessment days, with some participants moving to a different preschool. This resulted in a small and uneven number of participants per evaluation point, which was addressed using a Bayesian approach to harness the full extent of our results despite data sample shortcomings.

LMM sessions delivery and evaluation

In IMP-1, we report the longitudinal results of LMM sessions delivered across 8 months. Six themes (Supplementary Material C) were covered in approximately a month and a half each, with 3–5 sessions per week. Delivery modality varied across themes as COVID lockdown restrictions changed from week to week in Sydney: Theme 1 was delivered in person at the center, Theme 2 had some sessions delivered online and some in hybrid mode with the educator and some children online and some other children at the center, Theme 3 was delivered mainly online, and Themes 4-6 had hybrid delivery.

For RQ1, we used a *linguistic proficiency form* (see Supplementary Material D and E), which was filled in by the facilitator at the end of each theme to assess children's four language skills, namely vocabulary, listening, speaking, and literacy/numeracy, as well as their level of task-related individual and social early school readiness factors during the session (i.e., attention, cooperation and engagement)[5]. The linguistic proficiency form was developed to reflect key developmental milestones in language acquisition, with a particular focus on comprehension and production at different levels. A customized Likert-scale tool was created for this purpose, following the approach taken in previous studies that have employed similar instruments (see Son, 2017 for a review). The form captures progression across major language domains, namely early phonological development, which enables speech recognition and production, lexical development, which supports vocabulary acquisition and word retrieval, and morphological and syntactic development, which facilitate the construction of grammatically accurate and meaningful sentences. It also includes semantic development for understanding both literal and figurative meanings, while pragmatic development allows for appropriate language use in diverse social and contextual settings. Thus, our form includes the integration of key areas such as phonology, lexicon, morphology, syntax, semantics, and pragmatics that are part of language proficiency and use (Lightbown and Spada, 2020).

Listening and speaking were evaluated at two levels: basic and advanced, with the latter represented with the symbol "+". Attention, cooperation, and engagement are considered early precursors of school readiness, with attention supporting learning and task completion, cooperation fostering positive peer and teacher relationships, and engagement predicting motivation and persistence in academic tasks, all of which contribute to successful transitions into formal schooling (Wenz-Gross et al., 2018).

For RQ2, we used an *educational principles profile form* (see Supplementary Material F and G), which was designed to measure children's *disposition*, *interaction* and *interest* during LMM sessions (see also Supplementary Material B). LMM facilitators filled in both forms with their rating of each child on a series of statements using a 7-point Likert scale (Likert, 1932). We chose this rating scale as it is a straightforward and practical way to measure agreement and it is widely used in behavioral studies (Lai, 2011), educational settings (DeJarnette, 2018; Katz-Buonincontro and Anderson, 2020) and other social and neurological studies in children (Mellor and Moore, 2014; Semrud-Clikeman, 2007).

Both evaluation forms were filled in by a single observer, namely the facilitator who delivered the session. While employing multiple observers can enhance inter-rater reliability, it is not

5 We present linguistic assessment and task-related school readiness factors for themes 2-6 as our first facilitator left the program unexpectedly without filling in the linguistic form for Theme 1 due to COVID restrictions.

always feasible due to resource constraints. Crucially, studies have shown that with proper training and standardized observation protocols, single observers can provide reliable and valid data. For instance, the Measures of Effective Teaching (MET) project found that trained single observers could achieve moderate reliability in classroom observations (Ho and Kane, 2013). A single observer is a common approach in classroom-based research, where the observer is also the facilitator or educator who delivers the program, as it allows for seamless integration of observation into the instructional process (Downer et al., 2012; Howes et al., 2008). Since LMM facilitators were trained before delivering and rating sessions and pilot rating by two facilitators (one observing the session delivery) yielded comparable results, we decided to use single ratings from the facilitator who delivered the session, in line with previous studies.

Results

We present descriptive and inferential results to answer our research questions. Bayesian modeling (Bürkner, 2017, 2018; RStudio Team, 2020) was used to deal with differences in sample size and dataset complexity, following recent studies (e.g., Escudero et al., 2020; Smit et al., 2022). Comparisons between two evaluations were conducted: (1) the second and last themes for each measure of linguistic proficiency (see footnote 4), and (2) the first and last themes for each of the educational principles. We quantified the evidence for the tested hypotheses using probability ratios, assessing whether the effect sizes were greater than zero. Evidence ratios (ERs) close to 1 provide inconclusive evidence, 3–10 moderate evidence, 10-30 strong evidence, above 30 very strong evidence, and above 100 extreme evidence (Kruschke and Liddell, 2018). We exercise caution when interpreting ERs below 19, as ERs greater than 19 yield posterior probabilities (PP) above 0.99, which are roughly equivalent to a frequentist alpha level of 0.05 for rejecting the null hypothesis.

Linguistic proficiency

Table 2 shows the LMM facilitator's ratings for the linguistic skills included in the proficiency form, with basic and advanced skills for listening and speaking. In the table, it can be observed that the higher the rating along the scale, the higher the child's proficiency attainment according to the facilitator's judgement.

We tested whether linguistic performance in the last theme ($n = 5$) was higher than that of Theme 2 ($n = 9$), with approximately 5 months in between. All linguistic skills show evidence of improvement from Theme 2 to Theme 6, with the highest improvement shown in advanced listening, speaking, and especially literacy and numeracy. Table 3 shows the evidence ratios (ERs) for the Bayesian comparison between Theme 6 and Theme 2 for each of the linguistic skills[6].

Alignment with educational principles and early school readiness

Table 4 shows results for the three educational principles of Disposition, Interaction, and Interest, rated at the beginning of each theme, together with the task-related measures of Attention, Cooperation and Engagement measures included in the linguistic proficiency form at the end of each theme.

Table 5 shows the results of Bayesian modeling to test whether the LMM educational principles (i.e., Disposition, Interaction and Interest) differ between Theme 1 and Theme 6 and whether the task-related school readiness measures of Attention, Cooperation and Engagement in the linguistic form differed between Theme 2 and Theme 6. The results confirm that the main difference between Themes 1 and 6 was for Interaction (with a "very strong" effect of improvement, ER = 124), probably because disposition and interest were already high by Theme 1, making further improvement less likely.[7] For Attention, Cooperation and Engagement, scores were lower for the first evaluation (Theme 2), yielding gradual improvement across themes and very strong evidence of a difference between the first and last evaluation for all three measures.

Implementation 1 discussion

We introduced the unique properties of the LMM program and quantitatively evaluated its first implementation, using linguistic and educational principles' assessments conducted over 8 months. As mentioned in the introduction, according to previous research conducted with HL children of the same age who attend the same bilingual center (Escudero et al., 2020), the children should have less Spanish proficiency at the end of their preschool years due to decreasing HL input and shift to speaking English at home. However, our results after LMM implementation 1 clearly show an increase in our participants' Spanish linguistic outcomes from the start to the end of the program, which aligned with the last semester of their final preschool year. Children's basic HL skills (vocabulary, listening and speaking) did not improve much, because they were already high from first assessment, possibly due to high HL exposure at home and their enrolment in an English-Spanish bilingual preschool. In contrast, their HL advanced skills (listening+, speaking+ and literacy and numeracy), more relevant for transition to primary school, showed notable improvement over time (Table 3). Importantly, the baseline for

6 Mean estimate (M) reflects the average size of the difference observed between Theme 6 and Theme 2. The estimate error (EE) gives an idea on how precise this estimate is. The 95% credibility interval (95% CrI) shows the range within which the true value is likely to fall based on the data. The evidence ratio (ER) indicates how much more likely the observed effect is than the alternative (e.g., no difference), and the posterior probability (PP) reflects the degree of certainty in the result (values closer to 1 indicate stronger support). To assist with the interpretation, statistically meaningful results are marked with "*" and an evidence label, i.e., moderate, strong, very strong, or extreme, indicates the level of confidence with which each finding is supported.

7 We also note that improvement across themes was not always linear. For instance, Theme 3 which was about parts of the body and emotions had lower scores than in Theme 2 for Interaction and Interest (see Supplementary Material C), probably because of a higher level of difficulty in Theme 3.

TABLE 2 Average linguistic skills ratings (Likert scale: 1= strongly disagree, 7 = strongly agree) across 5 different themes.

Theme (Participant Number)	Theme	Listen	Listen+	Speak	Speak+	LitNum
Th2 ($n = 9$)	Fruits	6.78 (0.64)	6.06 (0.91)	6.17 (1.70)	6.04 (1.88)	5.25 (2.03)
Th3 ($n = 9$)	Body	6.78 (0.64)	6.11 (1.01)	6.25 (1.63)	6.07 (1.87)	6.25 (1.11)
Th4 ($n = 8$)	Planets	7 (0)	6.56 (0.60)	6.63 (0.36)	6.42 (0.87)	6.57 (1.08)
Th5 ($n = 7$)	Biodiv.	7 (0)	6.64 (0.59)	6.79 (0.21)	6.67 (0.48)	6.71 (0.72)
Th6 ($n = 5$)	School	7 (0)	6.8 (0.25)	6.95 (0.10)	6.73 (0.40)	7 (0)
	Grand mean	6.91	6.43	6.56	6.39	6.36

Mean (standard deviation). The symbol + indicates that a more advanced skill was assessed.

TABLE 3 Bayesian hypothesis testing: comparison of linguistic proficiency between Themes 6 and 2.

Theme 6>Theme 2							
Hypothesis	M	EE	95% CrI	ER	PP	Star	Evidence
Listen	0.81	0.16	[0.56, 1.07]	3.06	0.75		Moderate
Listen+	1.33	0.21	[0.98, 1.66]	73.07	0.99	*	Very strong
Speak	1.21	0.21	[0.86, 1.55]	80.63	0.99	*	Very Strong
Speak+	0.69	0.34	[0.13, 1.25]	49.00	0.98	*	Very Strong
LitNum	1.75	0.38	[1.12, 2.37]	Inf	1	*	Extreme

The "Evidence" column provides the strength level for the evidence. M = mean estimate of the effect's posterior distribution. EE, estimate error; 95% CrI, the two-sided 95% credibility interval of the mean; ER, evidence ratio for the odds that the effect is in the direction specified by the hypothesis; PP, posterior probability of the tested hypothesis; '*', for one-sided hypotheses, the posterior probability exceeds 95%; for two-sided hypotheses, the value tested against lies outside the 95%-CI; "Inf", infinite.

TABLE 4 Educational principles and task-related early school readiness ratings (1= disagree, 7 = agree) across 6 months of LMM sessions and 5–6 different themes.

Theme (Ppt *n*)	Theme	Dispos.	Interaction	Interest	Attention	Co-op.	Engage.
Th1 ($n = 10$)	Animals	6.37 (1.00)	6.10 (0.80)	6.20 (0.83)			
Th2 ($n = 9$)	Fruits	6.52 (0.98)	6.56 (1.50)	6.72 (0.57)	5.55 (1.36)	6.11 (1.61)	5.89 (1.69)
Th3 ($n = 9$)	Body	6.19 (1.47)	5.67 (2.06)	5.61 (1.50)	5.78 (1.57)	6.33 (1.58)	6.22 (1.57)
Th4 ($n = 8$)	Planets	6.50 (0.88)	6.73 (0.59)	6.56 (0.73)	6.25 (0.84)	6.88 (0.33)	6.63 (0.70)
Th5 ($n = 7$)	Biodiv.	6.43 (0.87)	6.84 (0.37)	6.50 (0.65)	6.29 (0.89)	6.71 (0.46)	6.57 (0.50)
Th6 ($n = 6$)	School	6.22 (0.81)	6.88 (0.34)	6.00 (1.21)	6.60 (0.50)	6.80 (0.41)	6.60 (0.50)
	Grand mean	6.37	6.46	6.26	6.09	6.57	6.38

Mean (standard deviation). Attention, cooperation and engagement only include themes 2–6.

TABLE 5 Contrast hypothesis—Bayesian ANOVA model for Likert rating for educational principles comparing the first and last evaluation for the educational principles form (Theme 6 vs. Theme 1) and cognitive measures in the linguistic form (Theme 6 vs. Theme 2).

Hypothesis	M	EE	95% CrI	ER	PP	Star	Evidence
Disposition (Th 6>1)	−0.15	0.32	[−0.67, 0.38]	0.46	0.32		Inconclusive
Interaction (Th 6>1)	0.77	0.33	[0.24, 1.31]	124	0.99	*	Very Strong
Interest (Th 6>1)	−0.20	0.39	[−0.83, 0.46]	0.43	0.30		Inconclusive
Attention (Th 6>2)	1.05	0.25	[0.64, 1.47]	Inf	1	*	Very strong
Cooperat. (Th 6>2)	0.77	0.25	[0.36, 1.17]	3,999	1	*	Very strong
Engagem (Th 6>2)	0.77	0.26	[0.35, 1.19]	665.7	1	*	Very strong

Please see note in Table 3.

our analysis is the first assessment measure because the first aim was to show maintenance of their starting high Spanish proficiency. Since HL children's linguistic performance improved from the first (theme 2) to the last assessment (theme 6) in all areas, we can conclude that the LMM program not only maintained but enhanced HL children's linguistic abilities over time, demonstrating success in blocking HL attrition and shift to English.

As for the LMM program's alignment with educational principles, particularly high ratings in interaction and engagement were observed throughout the 8 months, with many children approaching ceiling (i.e., more than 6.5 out of 7 on the Likert scale, Table 4). Disposition and Interest remained high throughout the program; however, Interaction improved significantly when comparing the first vs. the last evaluation. Measures of Attention, Cooperation and Engagement also showed strong evidence of improvement over time.

These results align with those of Ferjan Ramírez and Kuhl (2020), who showed that children's English language skills improved over 18 months (with better outcomes after 36 months), yet here in only 8 months for LMM IMP-1 and for HL Spanish. Our collaboration with families, center director and educators (see Figure 1) enabled us to balance children's needs with stakeholders' aspirations, likely contributing to the success of the LMM program. By providing structured HL immersion, LMM strengthened children's HL skills, whilst counteracting the shift to the societal language (English) previously reported in children attending the same bilingual preschool (Escudero et al., 2020).

The HL enhancement was corroborated by direct feedback from parents, LMM Spanish facilitator and the center director. The LMM Spanish facilitator was an early learning and primary school teacher in her native Spanish-speaking country before moving to Australia and joining the project. She reported that children were more communicative, happier and used the HL exclusively during LMM sessions, and provided a qualitative comparison between children who participated in LMM and the monolingual Spanish speakers she had taught in her country of origin, indicating that half of the LMM Spanish children performed like the monolingual children she had taught. The facilitator and parents mentioned by personal communication that they had observed children's enthusiasm for LMM sessions, both at the center and online. The center director, in email communications, expressed satisfaction with the LMM partnership, citing the numerous benefits for the children. Parents and the director also expressed interest in extending the partnership and requested more inclusive practices for children from diverse backgrounds, paving the way for a new implementation.

We acknowledge that variability in individual HL exposure at home may contribute to individual outcomes, which is being further explored in follow-up studies. For instance, the same bilingual children's Spanish story retelling and comprehension and their grammatical development were compared to monolingual speakers, in both English and Spanish (Hernandez Gallego et al., 2025; Pino Escobar and Escudero, 2024), demonstrating how the total input contributes to language proficiency and HL grammatical use.

Implementation 2: including additional language (AL) learners

The preschool where the LMM program was implemented is inclusive, and accommodates alongside Spanish HL speakers children who speak English or other HLs, and therefore learning Spanish as an additional language (AL). Not surprisingly, AL children's exposure to Spanish was limited to the childcare setting, which was minimal for some children due to the center's policy of respecting children and families' language preference. IMP-1 described above also included six AL learners who attended some sessions, with only four AL children completing the program. Results for these four children where very different to those reported for HL children above, as their linguistic skills ratings showed a decline (listening from 5.67 to 4.00 and literacy/numeracy from 5.00 to 3.33), demonstrating that IMP-1 success only applied to HL children. However, results in educational principles and task-related early school readiness measures showed improvement in cooperation (from 5.25 to 6.25) and engagement (from 3.67 to 4.25), while attention remained stable at 5.00 (For details on AL ratings, see Supplementary Material H). These findings suggest that despite AL learners' engagement with the program, the linguistic content was too challenging, likely because it was designed for HL children, resulting in less progress in Spanish linguistic skills for AL children than their HL peers.

In response, our partner requested a second implementation (IMP-2) that could better accommodate both HL and AL children, aiming to involve all children aged two and older in the LMM program. Drawing on the challenges observed during IMP-1, the program was adjusted to make the content more accessible for AL learners and younger children. In IMP-2 the frequency of sessions was reduced to twice per week to accommodate a larger cohort of children and two age groups (2–3 years and 3–5 years). A total of 111 sessions and four themes were covered over the course of a second year of LMM Spanish at the same bilingual preschool.

Research questions

IMP-2 investigated the linguistic development of HL and AL learners in the same Spanish immersion program, addressing the following questions:

RQ1: Do HL Spanish children differ from AL children in linguistic proficiency (listening, advanced listening, speaking, advanced speaking, literacy/numeracy), educational principles (disposition, interaction, interest), and school readiness factors (attention, cooperation, engagement)?

RQ2: Do children improve in these areas over the course of the program (first vs. last assessment)?

RQ3: Are older children (>3.5 years) more likely to show improvement than younger children?

We hypothesized that HL Spanish children would outperform AL children in linguistic skills but not in educational principles and early school readiness. Additionally, we hypothesized that all children would improve by the final assessment, with older children showing greater improvement over time than younger children due to maturational constrains (Ferjan Ramírez and Kuhl, 2017; Kuhl, 2004).

Method

Participants

Table 6 shows demographic information of the 27 preschool children in IMP-22 (M_{age} = 2.93 years at the start of year 2; 13

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TABLE 6 Participants' age, linguistic background and % of weekly language(s) input as per parental report.

	Groups	
	Spanish HL	Spanish AL
N	19	8
Females (*n*)	9	4
Mean age (range)	2.80 (1.7–3.98)	3.26 (2.1–4.6)
Mean English exposure % (range)	49.68 (10–85)	79.13 (20–100)
Mean Spanish exposure % (range)	47.63 (15–90)	6.25 (0–15)
Main language: English (*n*)	11 (57.9%)	6 (75%)
Main language: Spanish (*n*)	5 (26.3%)	0 (0%)
Main language: other language (*n*)	0 (0%)	2 (25%)
Main lang: English and Spanish (*n*)	3 (15.8%)	0 (0%)
Exposed to 3 or more languages (*n*)	3 (15.8%)	1 (12.5%)
Median principal carer relation	Mother ($n = 18$, 94.7%)	Mother ($n = 8$, 100%)
Median principal carer education	University degree + ($n = 16$, 84.2%)	University degree + ($n = 6$, 75.0%)

females)[8]. Data collection was approved by the Western Sydney University Human Research Ethics Committee.

This cohort includes children younger than 3.5 (HL = 15, AL = 4) and children aged 3.5 or older who were due to start primary school the following year (HL = 4, AL = 4). Absenteeism was still frequent in 2022, with many families and their children contracting mild COVID infections and other illnesses, resulting in only two assessments throughout their whole period of participation for some children. To address these limitations, we chose to analyse the children's first assessment vs. their last assessment, using the same probabilistic Bayesian analyses described in the previous section, to provide a longitudinal component to our analysis.

Previous research on teaching practices for ALs in preschool settings

Nikolov and Mihaljević Djigunović's (2023) review of 74 empirical studies revealed that most AL programs are conducted in English, driven more by parental enthusiasm than by evidence of long-term AL benefits. The predominant focus is on measurable outcomes rather than child development, including first language (L1), emotional, cognitive, and social development (Nikolov and Mihaljević Djigunović, 2023). Another systematic review (Thieme et al., 2022) suggests that AL programs in preschools support foreign language development with no negative effects on children's majority or first language skills, while also achieving positive wellbeing, particularly when programs are play-based and the language policy is flexible. Crucially, input quantity, language policy, and teacher strategies influence language development and wellbeing (Thieme et al., 2022).

Younger children develop AL skills more slowly than older children or adults, relying heavily on implicit learning, which aligns with L1 acquisition (Nikolov and Mihaljević Djigunović, 2023; Oliver and Nguyen, 2018). Preschool AL programs often face challenges like limited amount and quality of the input, affecting program success (Thieme et al., 2022) and children's attitudes and motivation to learn (Brumen, 2011). Indeed, mismatches between children's proficiency and classroom expectations can lead to long-term demotivation (Krevelj and Djigunović, 2021). Thus, it is vital to recognize the role of context, input quality, and realistic expectations, advocating for an integrative approach that supports children's holistic development and bridges the gap between early childhood education and AL expertise (Nikolov and Mihaljević Djigunović, 2023).

AL and HL learners exhibit large differences in their language development process (Whiting and Marshall, 2023). For AL learners, instruction time may be their only source of AL input, while for HL learners, it is an additional environment outside of home that can facilitate HL acquisition as a first language (Nikolov and Mihaljević Djigunović, 2023). Unlike AL children, HL children have many opportunities to be exposed to the HL from family members, including a variety of cultural experiences in their HL, which can provide a more natural and richer environment for their HL learning (Escudero et al., 2025, 2020; McLeod et al., 2022; Muñoz, 2011; Tran et al., 2022). However, HL learners might encounter limited formal educational resources tailored to their specific linguistic needs, resulting in gaps in their HL proficiency (Escudero et al., 2025).

There are also commonalities across child HL and AL learners. For both, active engagement, rather than passive listening, is essential for effective language learning, as it enhances children's ability to grasp and use languages proficiently, as shown by successful studies in infants' AL acquisition (Ferjan Ramírez and Kuhl, 2016, 2017, 2020). This aligns with theories of "play to learn" connected to language development and socio-emotional growth in both monolingual and multilingual children (Blinkoff et al., 2024; De Houwer, 2020; Hassinger-Das et al., 2017; Nesbitt et al., 2023; Weisberg et al., 2016). Age is also crucial as very young children are still acquiring verbal proficiency, and maturational constraints may limit linguistic production (Ferjan Ramírez and Kuhl, 2017; Kuhl, 2004).

Results

Our Bayesian modeling (Bürkner, 2017, 2018; RStudio Team, 2020) considered variables of Time (first assessment vs. last assessment), language group (AL vs. HL), and age group (younger <3.5 vs. older >3.5) as predictors of the outcome (i.e. the assessment measures, e.g., listening skills were a dependent variable). For all of the analyses, the automatic reference terms were: First assessment time, AL group, and Older age group. We used probability ratios to quantify the evidence for the tested hypothesis (i.e., that the effect is greater than zero).

8 Four additional AL children started with year 2 cohort, but changed preschools and therefore left the program without having any assessment conducted, so they are not represented in this table.

TABLE 7 Average linguistic skills ratings (Likert scale: 1= strongly disagree, 7 = strongly agree) at first and last assessment time.

Group	HL		AL	
M_{age} (age range) in years skills	First assessment	Last assessment	First assessment	Last assessment
	M_{age} 3.36 (2.3–4.5)	M_{age} 3.57 (2.5–4.8)	M_{age} 3.78 (2.7–5.2)	M_{age} 4.02 (2.9–5.4)
Listen	5.74 (1.69)	5.84 (1.46)	4.25 (0.46)	5.12 (1.13)
Listen+	3.79 (1.47)	3.87 (1.37)	2.38 (0.35)	3.31 (1.03)
Speak	4.43 (1.99)	4.12 (1.95)	2.21 (0.77)	2.47 (1.21)
Speak+	2.93 (2.04)	2.91 (1.96)	1.00 (0.00)	1.45 (0.62)
LitNum	1.83 (1.25)	3.11 (1.94)	2.00 (1.83)	4.63 (3.11)

Mean (Standard Deviation). The symbol + indicates that a more advanced skill was assessed.

Linguistic proficiency

Table 7 shows the LMM facilitators' rating for linguistic skills, with 2.5 months as the average time between first and last assessment for HL and 3 months for AL. Overall assessment ratings were lower and more variable than for IMP-1, likely because IMP-2 includes younger children and AL children (Table 6).

Some but not all linguistic skills showed improvement from the first to the last assessment, with the highest improvement shown in listening, advanced listening, and literacy and numeracy. Analysis using Bayesian linear mixed models yielded the following results for Linguistic proficiency (see detailed results for IMP-2 Linguistic Proficiency in Supplementary Material I):

Listening: We found moderate evidence that all children performed better at the last assessment compared to the first (ER = 10.87, PP = 0.92). However, there was inconclusive evidence for differences between HL and AL children (ER = 3.57, PP = 0.78), and no strong evidence that younger children performed worse than older children (ER = 2.07, PP = 0.67).

Advanced Listening: Very strong evidence indicated that HL children outperformed AL children in advanced listening skills (ER = 46.06, PP = 0.98). There was strong evidence that scores improved at the last assessment for all children (ER = 17.52, PP = 0.95). However, both age effects and the interaction between age and language status were inconclusive (ER = 2.32, PP = 0.70 for age; ER = 3.51, PP = 0.78 for interaction).

Speaking: We observed very strong evidence that HL children performed significantly better than AL children in speaking skills (ER = 32.90, PP = 0.97). However, time effects (ER = 0.39, PP = 0.28) and age differences (ER = 1.31, PP = 0.57) were inconclusive. The interaction effect between age and language status was also inconclusive (ER = 2.26, PP = 0.69).

Advanced Speaking: Extreme evidence indicated that HL children outperformed AL children in advanced speaking (ER = 284.71, PP = 1.00). However, time effects were inconclusive (ER = 2.89, PP = 0.74), and age effects were similarly inconclusive (ER = 1.07, PP = 0.52). We found strong evidence for the interaction between younger age and HL status, confirming that younger HL children had lower advanced speaking scores compared to older HL children (ER = 14.33, PP = 0.93).

Literacy and Numeracy: We found no compelling evidence that HL children performed better than AL children in literacy/numeracy (ER = 0.65, PP = 0.39). However, we observed extreme evidence that children performed better at the last assessment compared to the first (ER = Inf, PP = 1.00), and that older children outperformed younger ones (ER = 132.33, PP = 0.99). The interaction between age and language status remained inconclusive (ER = 1.12, PP = 0.53).

Educational principles and task-related early school readiness factors

Table 8 shows results for the three educational principles of Disposition, Interaction, and Interest, together with task-related early school readiness ratings of Attention, Cooperation and Engagement. Ratings were particularly high for the educational principles from the beginning, and for both sets of measures improvement is apparent, particularly for Attention and Engagement.

Ratings were similarly high across language groups and ages, with time being the most relevant effect, as last assessment ratings were higher than first assessment in almost all areas. Bayesian linear mixed models; for each of the educational principles and the task-related early school readiness factors assessments yielded the following results (see detailed results for IMP-2 Educational Principles in Supplementary Material J):

Disposition: A strong probability was found for disposition improvement over time, with higher ratings in the last evaluation compared to the first (ER = 13.81, PP = 0.93). This suggests that both HL and AL children became more aligned with the educational principle of disposition over the course of the program. The evidence was inconclusive for differences between HL and AL learners (ER = 0.69, PP = 0.41). Furthermore, inconclusive evidence was found for differences between younger and older children (ER = 1.46, PP = 0.59) and the interaction between language status and age (ER = 0.76, PP = 0.43) in disposition ratings.

Interaction: There was extreme evidence of improvement over time in interaction ratings (ER = ∞, PP = 1.00), indicating that children, irrespective of HL or AL status, showed higher interaction ratings in the last evaluation. Moderate evidence favored HL learners having higher interaction ratings than AL learners (ER = 6.37, PP = 0.86), suggesting that HL learners may engage more

TABLE 8 Average educational principles and task-related early school readiness ratings (Likert scale: 1= strongly disagree, 7 = strongly agree) at first and last profile time.

Group	HL		AL	
Skills	First assessment	Last assessment	First assessment	Last assessment
Disposition	5.70 (0.69)	5.94 (0.72)	5.75 (0.43)	6.00 (0.50)
Interaction	4.26 (1.93)	5.25 (1.08)	3.58 (1.58)	5.29 (1.09)
Interest	5.66 (1.34)	6.63 (0.72)	5.69 (1.62)	6.44 (1.59)
Attention	5.42 (1.17)	5.89 (0.88)	4.75 (0.70)	5.38 (1.10)
Cooperation	6.00 (1.11)	6.26 (0.99)	5.25 (1.04)	6.38 (1.19)
Engagement	5.84 (1.16)	6.00 (1.00)	4.75 (1.39)	5.50 (0.76)

Mean (standard deviation).

effectively in social interactions in Spanish. Inconclusive evidence for age differences was found in interaction ratings (ER = 1.29, PP = 0.56) for the interaction between language status and age (ER = 3.01, PP = 0.75).

Interest: Extreme evidence supported a time-related improvement in interest ratings (ER = 399.00, PP = 1.00), indicating that all children became more engaged in the program's content as time progressed. Inconclusive evidence was found for differences between HL and AL learners in interest (ER = 0.23, PP = 0.19). Extreme evidence showed that younger children had lower ratings of interest compared to older children (ER = 147.15, PP = 0.99). The interaction between language status and age was inconclusive (ER = 0.05, PP = 0.05).

Attention: Extremely strong evidence was found for improvement in attention ratings over time (*ER* = 113.29, *PP* = 0.99), indicating that all children's attention (regardless of language status) improved as they progressed through the program. Inconclusive evidence was found for HL learners having better attention ratings than AL learners (*ER* = 0.36, *PP* = 0.27). Strong evidence indicated that younger children had lower attention ratings than older children (*ER* = 11.35, *PP* = 0.92). Finally, there was inconclusive evidence for the interaction between language status and age (*ER* = 0.03, *PP* = 0.03).

Cooperation: Very strong evidence was found for improvement in cooperation ratings over time (*ER* = 46.62, *PP* = 0.98), suggesting that all children became more cooperative as they spent more time in the program. Inconclusive evidence was found for HL learners having higher cooperation ratings (*ER* = 0.52, *PP* = 0.34). Moderate evidence showed that younger children had lower cooperation ratings than older children (*ER* = 5.33, *PP* = 0.84). Finally, inconclusive evidence was found for the interaction between language status and age (*ER* = 0.13, *PP* = 0.12).

Engagement: Moderate evidence was found for improvement in engagement ratings over time (*ER* = 9.15, *PP* = 0.90), suggesting children were more engaged in the program in later evaluations. Moderate evidence supported that HL learners had higher engagement ratings than AL learners (*ER* = 4.83, *PP* = 0.83). Inconclusive evidence was found for age-related differences (*ER* = 3.34, *PP* = 0.77) and for the interaction between language status and age (*ER* = 0.49, *PP* = 0.33).

Implementation 2 discussion

IMP-2 aimed to address limitations identified in the first implementation by including AL learners alongside HL learners, as well as younger cohorts. Adjustments, such as reducing the frequency of sessions and adapting content, were made to foster a more inclusive environment, while maintaining the core CLIL play-based approach. The results for this program implementation in a second year, though varied across different learner groups, were overall encouraging.

In line with findings from IMP-1, HL learners consistently exhibited higher linguistic proficiency than their AL counterparts, particularly in advanced listening and both basic and advanced speaking. Given the increased complexity of language content over the year (as detailed in "Themes, Session Structure, and Alignment with Early Years Education" in IMP-1), and considering that the children in IMP-2 were younger, the fact that HL learners maintained or even improved their performance over time strongly suggests both successful HL maintenance and incremental AL improvement. Importantly, although HL children had an input advantage over AL children, probably because they received Spanish at home and entered the program with higher levels of Spanish, AL children also showed sustained improvement in Spanish. This reinforces the notion that HL learners benefit from enhanced Spanish immersion, supported by exposure both at home and in the preschool environment (Nikolov and Mihaljević Djigunović, 2023). Previous research has shown that as children grow older, they tend to use the majority language (i.e., English) more frequently, often at the expense of their HL (De Houwer, 2009; Montrul, 2008), which was the case for children in this specific bilingual center, as reported in Escudero et al. (2020). This means that incorporating the HL into educational settings can help mitigate the shift from HL to English in HL children and support continued HL development, which was the motivation underlying the development of the LMM program.

Nonetheless, the introduction of AL learners presented some challenges. Our findings revealed that while AL learners made gains in listening and literacy/numeracy, their progress in speaking skills was limited, with their proficiency remaining significantly below that of HL learners. The weak evidence for substantial improvement in speaking suggests that, despite program adjustments, AL learners may require more time and

additional input to develop productive language skills. This outcome aligns with previous findings regarding the challenges faced by AL programs when the quantity of input is insufficient and classroom expectations do not match students' proficiency levels (Whiting and Marshall, 2023). All younger children (HL and AL) struggled with advanced speaking skills and literacy/numeracy, in line with developmental constraints on productive language acquisition (Ferjan Ramírez and Kuhl, 2016, 2017; Kuhl, 2004). However, the inclusive nature of the program posed additional challenges, especially for AL learners, given their limited exposure to Spanish and their early stage of language development. Increasing the number of sessions would enhance input opportunity and create more chances for meaningful language output, especially for young AL learners.

A key objective of the program was to adopt a holistic approach that assessed not only linguistic outcomes but also cognitive and social development. Children's disposition, interaction, and interest, as well as individual and social task-related early school readiness factors such as attention, cooperation, and engagement, were integrated into our program. These domains were consistently strong from the initial assessment and, importantly, were maintained or improved over time. This aligns with research advocating for the integration of emotional, cognitive, and social domains to foster children's overall wellbeing in language learning programs (Thieme et al., 2022).

General discussion

The two successive implementations of the LMM program have yielded promising results for both HL and AL learners. HL children showed significant improvements in advanced listening, speaking, and literacy/numeracy skills, confirming the program's effectiveness in maintaining their HL and preventing a shift to English. The results confirmed that IMP-1 was clearly targeted to HL children with advanced, near-native or native Spanish skills, as a small group of AL learners who took part did not improve in Spanish linguistic proficiency. During a second year, IMP-2 expanded the program and made important adjustments and adaptations to support HL and AL mixed cohorts, demonstrating that while AL children made gains in linguistic skills, they may require more time and input to reach higher levels of fluency. Importantly, both implementations were found to enhance educational principles in HL and AL children, including disposition, interaction and interest and promoted key precursors to early school readiness (attention, cooperation and engagement).

Our focus was on children's outcomes within the LMM program, based on the assumption that home exposure alone was insufficient to maintain HL proficiency at and beyond preschool. This was grounded in previous findings of reduced HL input in the classroom, and a noticeable shift toward English use within the same bilingual center (Escudero et al., 2020), as well as in other settings (De Houwer, 2009; Montrul, 2008). The present results support this observation. While HL children benefitted from structured support, AL children, despite their lack of Spanish input at home, also showed gains, reflecting the program's ability to foster both HL maintenance and language learning through immersion. However, we acknowledge that variability in individual HL exposure at home may contribute to variable outcomes, which has been further explored in follow-up studies. For instance, the same bilingual children's Spanish story retelling and comprehension and their grammatical development were compared to monolingual peers, in both English and Spanish (Hernandez Gallego et al., 2024, 2025).

Our findings highlight HL children's need for continuous support to maintain their HL, achieving balanced multilingualism and preventing language shift to English, together with benefits for AL learners drawn from CLIL and increased opportunities to use their new language. As an evidence-based program, LMM has the potential to become an effective model for fostering language learning and multilingualism in diverse educational contexts. Future initiatives will further evaluate the program's effectiveness across different languages, educational levels, and learning environments.

Data availability statement

Datasets are available on request. The unidentifiable data supporting the conclusions of this article will be made available by the main author under mediated access.

Ethics statement

The studies involving humans were approved by Western Sydney University Human Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

PE: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. GPE: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. CD-H: Conceptualization, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing. JH: Conceptualization, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/flang.2025.1604196/full#supplementary-material

References

Adesope, O. O., Lavin, T., Thompson, T., and Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Rev. Educ. Res.* 80, 207–245. doi: 10.3102/0034654310368803

Australian Bureau of Statistics (ABS). (2021). *Cultural Diversity: Census Information on Country of Birth, Year of Arrival, Ancestry, Language and Religion*. Australian Bureau of Statistics, Australian Capital Territory.

Australian Children's Education Care Quality Authority [ACECQA]. (2022). *Belonging, Being and Becoming: The Early Years Learning Framework for Australia (EYLF) V2.0 2022*. ACECQA.

Björklund, C., and Ahlskog-Björkman, E. (2017). Approaches to teaching in thematic work: early childhood teachers' integration of mathematics and art. *Int. J. Early Years Educ.* 25, 98–111. doi: 10.1080/09669760.2017.1287061

Blinkoff, E., Nesbitt, K. T., Golinkoff, R. M., and Hirsh-Pasek, K. (2024). Observation of student and teacher behaviors during a preliminary active playful learning intervention in kindergarten classrooms. *Educ. Sci.* 14:648. doi: 10.3390/educsci14060648

Brissoni, S. (2021). "Teaching Italian through the CLIL approach at a bilingual primary school in Australia: the use of songs," in *L'italiano in Australia. Prospettive e tendenze nell'insegnamento della lingua e della cultura/Italian in Australia. Perspectives and Trends in the Teaching of Language and Culture*, eds. A. Rubino, A. R. Tamponi, and J. Hajek (Florence: Franco Cesati), 81–92.

Brumen, M. (2011). The perception of and motivation for foreign language learning in pre-school. *Early Child Dev. Care* 181, 717–732. doi: 10.1080/03004430.2010.485313

Bürkner, P.-C. (2017). brms: An R package for Bayesian multilevel models using Stan. *J. Stat. Softw.* 80, 1–28. doi: 10.18637/jss.v080.i01

Bürkner, P.-C. (2018). Advanced Bayesian multilevel modeling with the R package brms. *R J.* 10, 395–411. doi: 10.32614/RJ-2018-017

Clyne, M. (2007). Are we making a difference? On the social responsibility and impact of the linguist/applied linguist in Australia. *Austr. Rev. Appl. Ling.* 30, 3.1–3, 14. doi: 10.2104/aral0703

Coyle, D. "Evaluating the impact of CLIL programmes," in *Content and Language Integrated Learning*. Cambridge English (2010).

Cummins, J. (1979). Linguistic Interdependence and the Educational Development of Bilingual Children. *Rev. Educ. Res.* 49, 222–251. doi: 10.3102/00346543049002222

Cummins, J. (2000). *Language, Power, and Pedagogy: Bilingual Children in the Crossfire, Vol. 23*. Clevedon: Multilingual Matters. doi: 10.21832/9781853596773

Curdt-Christiansen, X. L. (2022). Family language policy and school language policy: can the twain meet? *Int. J. Multiling.* 19, 466–475. doi: 10.1080/14790718.2022.2050242

De Houwer, A. (2009). *Bilingual First Language Acquisition*. Multilingual Matters. doi: 10.21832/9781847691507

De Houwer, A. (2020). "Harmonious bilingualism: well-being for families in bilingual settings," in *Handbook of Home Language Maintenance and Development* (De Gruyter Mouton), 63–83. doi: 10.1515/9781501510175-004

DeBoer, M., and Leontjev, D. (2020). *Assessment and Learning in Content and Language Integrated Learning (CLIL) Classrooms, Vol. 10* (Springer). doi: 10.1007/978-3-030-54128-6

DeJarnette, N. K. (2018). Implementing STEAM in the early childhood classroom. *Eur. J. STEM Educ.* 3:18. doi: 10.20897/ejsteme/3878

Downer, J. T., López, M. L., Grimm, K. J., Hamagami, A., Pianta, R. C., Howes, C., et al. (2012). Observations of teacher-child interactions in classrooms serving Latinos and dual language learners: applicability of the classroom assessment scoring system in diverse settings. *Early Childhood Res. Q.* 27, 21–32. doi: 10.1016/j.ecresq.2011.07.005

Eisenchlas, S. A., and Schalley, A. C. (2019). Reaching out to migrant and refugee communities to support home language maintenance. *Int. J. Biling. Educ. Biling.* 2, 564–575. doi: 10.1080/13670050.2017.1281218

Escudero, P., Diskin-Holdaway, C., Pino Escobar, G., and Hajek, J. (2025). Needs and demands for heritage language support in Australia: results from a nationwide survey. *J. Multiling. Multicult. Dev.* 46, 437–454. doi: 10.1080/01434632.2023.2189261

Escudero, P., Jones Diaz, C., Hajek, J., Wigglesworth, G., and Smit, E. A. (2020). Probability of heritage language use at a supportive early childhood setting in Australia. *Front. Educ.* 5:93. doi: 10.3389/feduc.2020.00093

Espinosa, L. M. (2015). *Getting it RIGHT for Young Children from Diverse Backgrounds: Applying Research to Improve Practice with a Focus on Dual Language Learners, 2nd Edn*. Pearson.

Espinosa, L. M., and Magruder, E. S. (2015). "Practical and proven strategies for teaching young dual language learners," in *Getting it RIGHT for Young Children from Diverse Backgrounds: Applying Research to Improve Practice With a Focus on Dual Language Learners, Vol. 2* (Pearson Education), 76–113.

European Commission (2014). *Proposal for Key Principles of a Quality Framework for Early Childhood Education and Care: Report of the Working Group on Early Childhood Education and Care Under the Auspices of the European Commission*. European Commission.

Fan, S. P., Liberman, Z., Keysar, B., and Kinzler, K. D. (2015). The exposure advantage: early exposure to a multilingual environment promotes effective communication. *Psychol. Sci.* 26, 1090–1097. doi: 10.1177/0956797615574699

Ferjan Ramírez, N., and Kuhl, P. K. (2016). *Bilingual Language Learning in Children*. Institute for Learning and Brain Sciences.

Ferjan Ramírez, N. F., and Kuhl, P. (2017). Bilingual baby: foreign language intervention in Madrid's infant education centers. *Mind, Brain, Educ.* 11, 133–143. doi: 10.1111/mbe.12144

Ferjan Ramírez, N. F., and Kuhl, P. K. (2020). Early second language learning through SparkLing^{TM}: scaling up a language intervention in infant education centers. *Mind, Brain, Educ.* 14, 94–103. doi: 10.1111/mbe.12232

Fukkink, R. (2017). *Pedagogisch curriculum voor het jonge kind in de kinderopvang*. Utrecht: Bureau Kwaliteit Kinderopvang.

Genesee, F. (2006). *Educating English Language Learners: A Synthesis of Research Evidence*. Cambridge University Press. doi: 10.1017/CBO9780511499913

Hajek, J., and Slaughter, Y. (Eds.). (2014). *Challenging the Monolingual Mindset, Vol. 156*. Multilingual Matters.

Hassinger-Das, B., Toub, T. S., Zosh, J. M., Michnick, J., Golinkoff, R., Hirsh-Pasek, K., et al. (2017). More than just fun: a place for games in playful learning/Más que diversión: el lugar de los juegos reglados en el aprendizaje lúdico. *Infancia y Aprendizaje* 40, 191–218. doi: 10.1080/02103702.2017.1292684

He, A. W. (2010). The heart of heritage: sociocultural dimensions of heritage language learning. *Annu. Rev. Appl. Ling.* 30, 66–82. doi: 10.1017/S0267190510000073

Hemmi, C., and Banegas, D. L. (2021). "CLIL: an overview," in *International Perspectives on CLIL, International Perspectives on English Language Teaching*, eds. C. Hemmi, and D. L. Benegas (Cham: Palgrave Macmillan), 1–2. doi: 10.1007/978-3-030-70095-9_1

Hernandez Gallego, M., Escudero, P., Mailhammer, R., and Li, W. (2025). "Bilingual grammatical gender agreement in Spanish: data from a spontaneous semi-elicited retelling task," in *International Symposium of Bilingualism (ISB15) Donostia-San Sebastián, Spain* (San Sebastian).

Hernandez Gallego, M., Pino Escobar, G., Li, W., and Escudero, P. (2024). "English lexical productivity and diversity in Spanish-English bilingual children in Australia," in *Proceedings of the 19th Australasian International Conference on Speech Science and Technology*. Melbourne, Australia: SST.

Ho, A. D., and Kane, T. J. (2013). *The Reliability of Classroom Observations by School Personnel. Research Paper. MET Project*. Bill Melinda Gates Foundation.

Horst, J. S., Parsons, K. L., and Bryan, N. M. (2011). Get the story straight: contextual repetition promotes word learning from storybooks. *Front. Psychol.* 2:17. doi: 10.3389/fpsyg.2011.00017

Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., et al. (2008). Ready to learn? Children's pre-academic achievement in pre-Kindergarten programs. *Early Childhood Res. Q.* 23, 27–50. doi: 10.1016/j.ecresq.2007.05.002

Jones Diaz, C., Cardona, B., and Escudero, P. (2022). Exploring the perceptions of early childhood educators on the delivery of multilingual education in Australia: challenges and opportunities. *Contemp. Issues Early Childhood* 25, 1–15. doi: 10.1177/14639491221137900

Katz-Buonincontro, J., and Anderson, R. C. (2020). A review of articles using observation methods to study creativity in education (1980–2018). *J. Creative Behav.* 54, 508–524. doi: 10.1002/jocb.385

Krashen, S. (1985). *The Input Hypothesis: Issues and Implications*. Longman.

Krashen, S. (1992). "The input hypothesis: an update," in *Georgetown University Round Table on Languages and Linguistics (GURT) 1991: Linguistics and Language Pedagogy: The State of the Art*, ed. J. E. Alatis (Georgetown University Press), 409–431.

Krevelj, S. L., and Djigunović, J. M. (2021). Transition from pre-primary to primary level: a neglected variable in EFL learning. *Eur. J. Appl. Ling. TEFL* 10, 79–101. Available online at: https://www.proquest.com/scholarly-journals/transition-pre-primary-level-neglected-variable/docview/2596629199/se-2?accountid=36155

Kruschke, J. K., and Liddell, T. M. (2018). Bayesian data analysis for newcomers. *Psychon. Bull. Rev.* 25, 155–177. doi: 10.3758/s13423-017-1272-1

Kuhl, P. K. (2004). Early language acquisition: cracking the speech code. *Nat. Rev. Neurosci.* 5:831. doi: 10.1038/nrn1533

Lai, E. R. (2011). *Metacognition: A Literature Review*. Pearson.

Li, H., and Renn, J. (2018). Nurturing Spanish-speaking English learners to be bilinguals in the rural midwest: challenges and possible solutions. *INTESOL J.* 15, 5–28. Available online at: https://journals.indianapolis.iu.edu/index.php/intesol/article/view/22617/22182

Lightbown, P. M., and Spada, N. (2020). Teaching and learning L2 in the classroom: it's about time. *Lang. Teach.* 53, 422–432. doi: 10.1017/S0261444819000454

Likert, R. (1932). A technique for the measurement of attitudes. *Arch. Psychol.* 22, 5–55. Available online at: https://psycnet.apa.org/record/1933-01885-001

Marsh, D., Cañado, M. L. P., and Padilla, J. R. (2015). *CLIL in Action: Voices from the Classroom*. Cambridge Scholars Publishing.

McLeod, S., Verdon, S., Tran, V. H., Margetson, K., and Wang, C. (2022). SuperSpeech: multilingual speech and language maintenance intervention for Vietnamese-Australian children and families via telepractice. *Lang. Speech Hear. Serv. Sch.* 53, 675–697. doi: 10.1044/2021_LSHSS-21-00146

Mellor, D., and Moore, K. A. (2014). The use of Likert scales with children. *J. Pediatr. Psychol.* 39, 369–379. doi: 10.1093/jpepsy/jst079

Melo-Pfeifer, S. (2015). The role of the family in heritage language use and learning: impact on heritage language policies. *Int. J. Biling. Educ. Biling.* 18, 26–44. doi: 10.1080/13670050.2013.868400

Montrul, S. (2008). *Incomplete Acquisition in Bilingualism Re-Examining the Age Factor*. John Benjamins Pub. Co. doi: 10.1075/sibil.39

Muñoz, C. (2011). Input and long-term effects of starting age in foreign language learning. *Int. Rev. Appl. Ling. Lang. Teach.* 49, 113–133. doi: 10.1515/iral.2011.006

NAEYC/NAESC/SDE (2002). *Early Learning Standards: Creating the Conditions for Success*. Washington, DC: National Association for the Education of Young Children.

Nesbitt, K. T., Blinkoff, E., Golinkoff, R. M., and Hirsh-Pasek, K. (2023). Making schools work: an equation for active playful learning. *Theory Into Pract.* 62, 141–154. doi: 10.1080/00405841.2023.2202136

Nikolov, M., and Mihaljević Djigunović, J. (2023). Studies on pre-primary learners of foreign languages, their teachers, and parents: a critical overview of publications between 2000 and 2022. *Lang. Teach.* 56, 451–477. doi: 10.1017/S0261444823000095

NSW Education Standards Authority (NESA). (2018). *Language K-10 Framework*. NSW Education Standards Authority.

Oliver, R., and Nguyen, B. (2018). "Teaching young second language learners: practices in different classroom contexts," in *Teaching Young Second Language Learners* (Routledge), 1–28. doi: 10.4324/9781315149813

Piller, I., and Gerber, L. (2021). Family language policy between the bilingual advantage and the monolingual mindset. *Int. J. Biling. Educ. Biling.* 24, 622–635. doi: 10.1080/13670050.2018.1503227

Pino Escobar, G., and Escudero, P. (2024). Vocabulary, comprehension and retelling in multilingual children: age and input tell the whole story. doi: 10.31219/osf.io/8e4nf

RStudio Team (2020). *RStudio: Integrated Development Environment for R*. Available online at: http://www.rstudio.com/

Semrud-Clikeman, M. (2007). "Assessment of social competence in children," in *Social Competence in Children* (Boston, MA: Springer), 39–49. doi: 10.1007/978-0-387-71366-3_3

Smit, E. A., Milne, A. J., and Escudero, P. (2022). Music perception abilities and ambiguous word learning: is there cross-domain transfer in nonmusicians? *Front. Psychol.* 13:801263. doi: 10.3389/fpsyg.2022.801263

Son, Y-. A. (2017). Toward useful assessment and evaluation of heritage language learning. *Foreign Lang. Ann.* 50, 367–386. doi: 10.1111/flan.12273

Swain, M., and Lapkin, S. (1981). *Bilingual Education in Ontario: A Decade of Research*. Toronto, ON: Ontario Institute for Studies in Education.

Thieme, A-. M. M. M., Hanekamp, K., Andringa, S., Verhagen, J., and Kuiken, F. (2022). The effects of foreign language programmes in early childhood education and care: a systematic review. *Lang. Cult. Curriculum* 35, 334–351. doi: 10.1080/07908318.2021.1984498

Tran, V. H., Verdon, S., McLeod, S., and Wang, C. (2022). Family language policies of Vietnamese-Australian families. *J. Child Sci.* 12, e67–e78. doi: 10.1055/s-0042-1743490

Verdon, S., McLeod, S., Tran, V. H., Margetson, K., Phạm, B., Wang, C., et al. (2021). *VietSpeech multilingual children/Trẻ em Đa ngữ*. Charles Sturt University.

Verdon, S., McLeod, S., and Winsler, A. (2014). Language maintenance and loss in a population study of young Australian children. *Early Childhood Res. Q.* 29, 168–181. doi: 10.1016/j.ecresq.2013.12.003

Weisberg, D. S., Hirsh-Pasek, K., Golinkoff, R. M., Kittredge, A. K., and Klahr, D. (2016). Guided play: principles and practices. *Curr. Directions Psychol. Sci.* 25, 177–182. doi: 10.1177/0963721416645512

Wenz-Gross, M., Yoo, Y., Upshur, C. C., and Gambino, A. J. (2018). Pathways to kindergarten readiness: the roles of second step early learning curriculum and social emotional, executive functioning, preschool academic and task behavior skills. *Front. Psychol.* 9:1886. doi: 10.3389/fpsyg.2018.01886

Whiting, S. B., and Marshall, C. R. (2023). Foreign language provision in English primary schools: making evidence-based pedagogical choices. *Front. Educ.* 8:1063863. doi: 10.3389/feduc.2023.1063863

Zhou, W. (2020). "Integrating content and language instruction in a Chinese immersion classroom," in *Chinese as a Second or Foreign Language* (Palgrave Macmillan), 97–111. doi: 10.5040/9781978730472.ch-007