Short versions of the Basque MacArthur-Bates Communicative Development Inventories (children aged 8–50 months)

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This study provides a brief review of the adaptation of the short MacArthur-Bates Communicative Development Inventories (CDI) instruments into Basque. The study aims to provide the scientific community with several standardized instruments designed to measure the vocabulary size of young children (aged 8–50 months) who are learning Basque, a language spoken in Spain and France. Data from over 2,400 children, obtained using the Basque adaptations of the short CDI parental questionnaires, the BCDI-1s(hort), BCDI-2s, and BCDI-3, revealed the capacity of these instruments to identify the effect of age on the language development of preschool-age children exposed to this language, as has been attested in other (minority and non-minority) languages. The study also examined the effect size of age, sex, and language input. The results showed that sex had a null or very small effect on both lexical development and the rest of the scales, whereas the effect of language input increased as children grew older and was even stronger than the effect of age from 30 months onwards. These findings provide solid ground for discussing the relevance of various factors that affect young children's language acquisition.

KEYWORDS

short CDI, Basque, child language, input, sex, 8–50 months

Introduction

Parents (and caregivers) are considered a relevant source of information on children's communicative and language skills and have positively contributed to early child language research. Similar to medical consultations, where parents report on their children's behavior, capacities, and feelings, they can also provide information on language development. Parents' impressions and knowledge of their child's capacities are based on hours of observation of spontaneous behavior in varied interactions, situations, and contexts. Noticeably, parental questionnaires allow researchers to compile valuable information ecologically, and consequently, this information is less likely to be affected by contextual factors in other observational spaces (e.g., a laboratory or clinic), which may affect the child's skills.

The MacArthur-Bates Communicative Development Inventories, commonly known as CDI instruments, are a set of parental questionnaires originally designed to measure lexical skills and gestural or grammatical skills in English for preschool-age children living in the USA. The first set of questionnaires were the Words and Gestures or CDI-1 instrument (8–15/18 months, depending on the versions) and the Words and Sentences or

CDI-2 (16–30 months). Based on these original questionnaires, which included a vocabulary checklist of over 350 items among other sections, shorter versions were developed, with fewer subsections and a checklist of approximately 100 words (Fenson et al., 2000, 2007): the CDI-1 short or CDI-1s (8–18 months), the CDI-2 short or CDI-2s (16–30 months), and the CDI-3 (30–48 months). Depending on the language, all or some of these five instruments have been adapted to over 100 oral and sign languages, which provides interesting ground for inter-/intra-individual and cross-linguistic comparison (Dale and Penfold, 2011; Ezeizabarrena and Kovacevic, 2023, a.o). More specifically, research into how variables such as age, sex, and/or prematurity, and/or language exposure affect lexical development has facilitated cross-linguistic comparisons using instruments suitable for clinical use. Notable among these are recent adaptations of short CDIs for several languages, including Arabic (Abdelwahab et al., 2021), Australian English (Jones et al., 2022), Basque (Garcia et al., 2011, 2014), Croatian (Šmit Brleković and Kuvač Kraljević, 2023; Kuvač Kraljević et al., 2024), Estonian (Tulviste and Schults, 2020; Urm and Tulviste, 2021), Finnish (Stolt, 2023), Galician (Perez-Pereira and Resches, 2007), Hungarian (Kas et al., 2022), Italian (Rinaldi et al., 2019), Korean (Pae et al., 2008), Mexican Spanish (Jackson-Maldonado et al., 2013), European Portuguese (Frota et al., 2016), Mandarin (Soli et al., 2012), Norwegian (Holm et al., 2023), and Swedish (Eriksson, 2017).

Basque is a European language spoken by approximately 800,000 adult speakers in the western part of the Pyrenean Mountains on the Spanish–French border. It is a minority language currently undergoing a revitalisation process. According to data from 2011 and 2021, Basque is the home language of 21% and 25% of families living in the Basque Autonomous Community (BAC). Moreover, the educational system, in which over 99% of 3-year-old children are involved (ISEI/IVEI, 2021), promotes the use of Basque in kindergartens and schools in this region, where Basque has a co-official status with Spanish. Recent census data gathered in the BAC indicate that the knowledge of Basque (active and passive knowledge combined) among 2- to 4-year-olds has reached 97% in the last few years (Eustat, 2021). In other words, the youngest age group currently has the highest rate of Basque speakers. In this context, in which the minority language, Basque, is in constant contact with Spanish and/or French and, to a lesser extent, with other languages, the variation in the relative amount of exposure becomes relevant to the assessment of young and older children's linguistic skills (Hurtado et al., 2014; Thordardottir, 2019).

The five CDI instruments mentioned above, two long forms and three short forms, have been adapted into Basque. However, the current article focuses on the vocabulary scales of the three short Basque CDI questionnaires, namely, BCDI-1s, BCDI-2s, and BCDI-3, with a two-fold aim. First, this study aims to demonstrate these instruments' reliability (internal consistency) and concurrent validity for measuring lexical development in early Basque among children aged 8–50 months. Second, it highlights the need to include the variable of relative exposure, in addition to age and sex, in the research and use of CDI instruments within bilingual populations, especially if minority languages are involved.

Three short Basque CDI instruments

Following the criteria established by Fenson et al. (2000, 2007), the short Basque CDIs have retained the original scales for receptive vocabulary (BCDI-1s), expressive vocabulary (BCDI-1s,−2s, and−3), mean length of utterance (MLU) (BCDI-2s and BCDI-3), and language use (BCDI-3). The vocabulary checklists were based on the long forms of BCDI-1 and BCDI-2 (Barreña et al., 2008; Garcia et al., 2011, 2014). Data were collected from across various Basque-speaking areas of Spain and France, with the majority of data gathered from the Basque Autonomous Community (BAC), which has the highest concentrations of Basque speakers.

The BCDI-1s and BCDI-2s were standardized using data from 468 children aged 8–15 months, including 221 girls and 247 boys and with additional 926 children aged 16–30 months, comprising 427 girls and 499 boys (Garcia et al., 2011). The BCDI-3 was normed with a sample of 1,024 children aged between 30 and 50 months, which included 526 girls and 498 boys (Garcia et al., 2014).

Subsequently, the participants were divided into three input groups according to their relative exposure to Basque (and Spanish/French): Basque-dominant children (over 60% Basque input), balanced (40–60% Basque input), and Spanish/French-dominant children (below 40% Basque input). In all three BCDI samples, i.e., BCDI-1, BCDI-2, and BCDI-3, the Basque-dominant group was the largest ($N = 334/678/814$, respectively), followed by the balanced groups (N=41/125/105) and, finally, the Spanish/French-dominant group ($N = 81/74/93$).

Figure 1 shows the results of receptive and expressive vocabulary obtained by Garcia et al. (2011) using the BCDI-1s and BCDI-2s instruments and by Garcia et al. (2014) using the BCDI-3. For uniformity, vocabulary size is plotted as mean percentages of the total vocabulary checklist included in each instrument (90 words for BCDI-1, 100 words for BCDI-2, and 120 words for BCDI-3) rather than the mean numbers of words selected from each list. The uninterrupted increase in the four curves for expressive vocabulary in Figure 1 illustrates these three instruments' sensitivity to age variations. The two upper curves plot the means of the sample in receptive (words understood) and expressive vocabulary (words produced). The two bottom curves represent the P10 values, which are the percentages of words known by 10% of the participants with the lowest scores in receptive and expressive vocabulary. Values below P10 are traditionally used as benchmarks in CDI studies to identify children who have or are at risk of language delay.

Table 1 displays the means of the number of words and standard deviations for receptive vocabulary (ages 8–15 months) and overall vocabulary (ages 8–50 months), segmented by age, sex, and language input across the three instruments. These statistics are based on the data from Garcia et al. (2011) for the BCDI-1s.

Table 2 displays the means of the number of words and standard deviations for expressive vocabulary (8–50 months), categorized by age, sex, and language input across the three instruments. These data are derived from the study by Garcia et al. (2011) for the BCDI-1s and the BCDI-2s and from Garcia et al. (2014) for the BCDI-3.
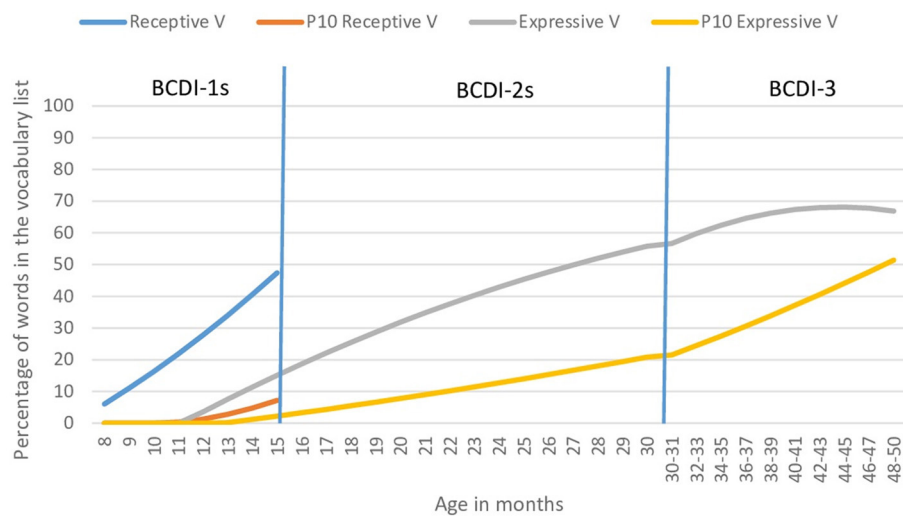
FIGURE 1
Adjusted mean rates and P10 scores of receptive and expressive vocabulary scales between 8 and 50 months in 3 short BCDI instruments.

The means of receptive vocabulary measured with the BCDI-1s increased steadily during the 8–15-month period (a total increase of 40 words, five words/month mean increase), as shown in Table 1. In contrast, the growth rate in expressive vocabulary displayed in Table 2 varied during the studied period: there was a 1–2 word increase by month during the period of 12–18 months in the BCDI-1, a five-word/month increase over the next 10 months, and a slowdown to a 1–2 word/month increase in the 28–50 month period, with a decrease in word production observed in the last age group of 49–50 months. Only a low percentage of children reached the maximum score of 120 (below 12% in the oldest age groups), eliminating any potential ceiling effect in BCDI-3. The ANOVA statistical analyses revealed a significant and strong effect of age on receptive vocabulary in the BCDI-1s instrument [$F_{(7,460)}$ = 36,10, $p < 0.001$, $\eta_p^2 = 0.353$], as well as on expressive vocabulary in the BCDI-1s [$F_{(7,460)}$ = 14,10, $p < 0.001$, $\eta_p^2 = 0.176$], BCDI-2s [$F_{(14,913)}$ = 48.69, $p < 0.001$, $\eta_p^2 = 0.427$], and BCDI-3 instruments [$F_{(9,1004)}$ = 17,08; $p < 0.001$; $\eta_p^2 = 0.133$]. The effect size of the children's age indicates the sensitivity of these three instruments for detecting developmental changes in both receptive and expressive vocabulary. Interestingly, age also significantly affected the rest of the BCDI-2s and BCD-3 scales, showing a strong impact on morphology, grammatical complexity, language use scales, and medium-sized effects in the MLU scales (Garcia et al., 2011, 2014).

Mean vocabulary scores differed for boys and girls across most age groups (Table 1). Differences ranged from 0 to 8 words in receptive vocabulary and from 0 to 10 in expressive vocabulary, favoring boys in some age groups and girls in others. Specifically, the total mean number of words understood was 1.5 words higher for boys in receptive vocabulary and 0.2 words higher for girls in expressive vocabulary in the BCDI-1s sample. However, the ANOVA statistical analysis revealed that these sex differences did not reach statistical significance in either receptive [$F_{(7,452)}$ = 0.12, $p = 0.728$, $\eta_p^2 = 0.000$] or expressive vocabulary scales [$F_{(7,452)}$ = 0.53, $p = 0.469$, $\eta_p^2 = 0.001$]. Among older children, girls outscored boys in 19 out of the 25 age groups in expressive vocabulary by

a range of 0 to 21 words, although boys outscored the girls in six age groups by 0 to 10 words. Further ANOVA analyses conducted with BCDI-2s [$F_{(14,896)}$ = 7.20, $p = 0.007$, $\eta_p^2 = 0.008$] and BCDI-3 samples [$F_{(9,1004)}$ = 4.43, $p = 0.036$, $\eta_p^2 = 0.004$] revealed that the differences in total mean scores, which were higher for girls by 0.4 and 2.5 words, respectively, reached statistical significance. However, the effect of sex was very weak, explaining <0.1% of the variance. Interestingly, this effect size was similar to those found in the MLU scales in BCDI-2s and in morphology in BCDI-3, while sex differences did not reach statistical significance in the rest of the BCDI-2s and BCDI-3 scales.

The highest total mean scores in receptive (28 words) and expressive vocabulary across the three instruments (2/42/92 words, respectively) were observed in the Basque-dominant group (>60% input), followed by the balanced bilingual group (24 and 2/37/84 words) and the Spanish/French dominant group (19 and 1/35/62 words), as displayed in Table 1. This pattern may indicate that vocabulary scores decrease with the relative amount of exposure. However, this ranking is consistently observed only in age groups older than 13 months for both receptive and expressive vocabulary. The ANOVA analyses showed that the effect of the amount of exposure to Basque was not significant in either receptive or expressive vocabulary in the youngest age range (8–15 months). In contrast, language input significantly affected expressive vocabulary in the 16–30 month age range, where children with Basque input >60% scored higher than those in the <40% input group. This effect was weak, accounting for less than 3% of the variance [$F_{(2,834)}$ =8.00, $p < 0.001$, $\eta_p^2 =0.019$]. In the 30- to 50-month age range, the effect of language input on expressive vocabulary was strong [$F_{(2,947)}$ = 124.80, $p < 0.001$, $\eta_p^2 =0.209$], as well as on other scales, with the Basque-dominant group achieving the highest scores (Garcia et al., 2011). In the 30- to 50-month age range, language input accounted for over 20% of the variance (high effect size) for expressive vocabulary and the rest of the BCDI-3 scales, except for MLU, where its effect was medium (Garcia et al., 2014).

TABLE 1 Means and standard deviations for receptive vocabulary (8–15 months).

	Receptive vocabulary (8–15 months)											
	Receptive vocabulary N of words		Sex				Input					
			Girls		Boys		>60		40–60		<40	
Age Months	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BCDI-1s (90 lexical items)												
8	6.72	9.14	6.72	10.23	6.72	8.28	6.06	7.95	5.00	7.44	8.16	11.31
9	11.18	11.02	10.06	10.13	12.90	12.36	12.09	11.71	3.50	2.52	11.83	10.44
10	14.97	13.70	13.07	12.03	16.73	15.09	14.91	12.67	12.20	18.69	15.75	14.73
11	20.57	14.37	21.70	16.54	19.44	12.03	20.20	13.99	21.00	21.21	18.00	13.02
12	28.08	23.79	26.53	22.94	29.83	25.00	29.00	23.08	17.75	23.60	35.40	32.64
13	36.52	22.51	40.66	23.49	32.26	20.96	36.76	22.71	35.30	21.08	47.67	30.86
14	40.24	21.71	39.79	24.10	40.92	17.90	46.32	21.33	29.14	19.56	29.92	18.94
15	46.62	19.86	49.00	19.82	43.96	19.94	47.49	19.78	46.20	15.21	43.75	28.45
Total	26.34	22.51	25.51	21.22	27.08	23.63	28.44	23.01	24.29	21.70	19.43	19.92

All three short instruments presented accurate psychometric features, as shown by the reliability and validity analyses. Regarding reliability, all the scales presented high internal consistency, as determined using Cronbach's α coefficient, with α > 0.90 values for all BCDI-1s, BCDI-2s (Garcia et al., 2011), and BCDI-3 scales (Garcia et al., 2014), except for the language use scale in the BCDI-3 (α = 0.74). Moreover, score stability was analyzed using the test-retest procedure in the BCDI-3, with a small sample of 30 participants tested twice with an interval of 2 weeks. Significant and strong correlations were found between all the lexical, grammatical, and language use scales ($r > 0.92$).

The concurrent validity of the instruments has been confirmed. For the short and long BCDI-1 and BCDI-2 forms, some parents completed each form 2 weeks apart, with the order counterbalanced so that half the sample completed each form first (Garcia et al., 2011). The relationship between the short and long forms was statistically significant and strong, with the Pearson coefficient value (r) > 0.75 for the BCDI-1s ($N = 48$) and $r > 0.81$ for the BCDI-2s ($N = 98$). In the case of the BCDI-3, 19 participants completed both the BCDI-3 and the Peabody (Dunn et al., 2006) tests. The correlations across all the scales were statistically significant and strong, with some variation across scales, as shown by the Pearson coefficient values of $r > 0.60$ for vocabulary and language use scales and $r = 0.40$ for vocabulary and grammatical scales. The test-retest procedure was used to measure the BCDI-3 instrument's predictive validity. A group of 21 participants completed the BCDI-3 twice, with a 5-month interval between sessions. All between-scale correlations were significant and strong ($r > 0.52$). The validity of the three short instruments was also supported by high total and partial correlations between scales. Total r values ranged from 0.50 (between vocabulary scales in BCDI-1s) to >0.63 (all scales in BDCI-3) and, finally, to 0.80 (vocabulary and both MLU scales in BCDI-2s). Partial correlations controlling for age were slightly lower but remained high, with r values ranging from 0.32 (between vocabulary scales in BCDI-1s) to >0.58 (all scales in BDCI-3) and, finally, to >0.70 (vocabulary and both MLU scales in BCDI-2s).

Discussion

All short BCDI instruments appear to have been accurate for measuring communicative development between children aged 8 and 50 months since the effect of age was significant in the lexical scales of the three instruments and the rest of the scales of the BCDI-2s and BCDI-3. More specifically, age significantly affected both receptive and expressive vocabulary scales, and it was strong in the BCDI-1s (8–15 months), the only short instrument containing that scale, and in expressive vocabulary for the 16–30-month-old children. The effect of age was, however, weaker in the youngest (8–15 months) and the oldest children (30–50 months).

Interestingly, the magnitude of age effects found in the BCDI-1s and BCDI-2s samples up to 30 months of age was similar to those reported with the long Basque questionnaires, BCDI-1 and BCDI-2 (Barreña et al., 2008). It was also in line with previous studies conducted using short CDI-1 and CDI-2 instruments developed in Galician (Perez-Pereira and Resches, 2007), European Portuguese (Frota et al., 2016), and Mexican Spanish (Jackson-Maldonado

TABLE 2 Means and standard deviations for expressive vocabulary (8–50 months).

		Expressive vocabulary (8–50 months)											
	Age	Expressive vocabulary		Sex				Amount of exposure to basque					
	Months	N of words		Girls		Boys		>60%		40–60%		<40%	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BCDI-1s (90 lexical items)	8	0.07	0.26	0.10	0.31	0.04	0.20	0.10	0.30	0.00	0.00	0.05	0.23
	9	0.14	0.45	0.10	0.31	0.16	0.52	0.18	0.52	0.25	0.50	0.00	0.00
	10	0.74	2.71	1.13	3.68	0.32	0.77	1.18	3.53	0.00	0.00	0.20	0.52
	11	0.65	1.35	0.63	1.31	0.67	1.41	0.69	1.36	0.00	0.00	0.67	1.63
	12	1.33	2.81	1.10	1.84	1.53	3.46	1.31	3.04	1.50	1.29	1.80	2.49
	13	4.13	8.63	4.79	11.22	3.49	5.08	4.24	9.56	4.30	4.27	4.00	3.61
	14	3.25	3.93	3.88	4.52	2.84	3.48	3.51	4.37	3.43	1.90	2.42	3.58
	15	6.71	7.83	6.65	6.28	6.76	9.11	7.29	8.47	4.60	3.29	4.00	2.71
	Total	2.20	5.18	2.63	5.77	2.06	4.60	2.53	5.89	2.36	3.11	0.92	2.13
BCDI-2s (100 lexical items)	16	12.43	17.32	11.71	10.83	12.89	20.58	12.32s	19.35	15.20	12.37	3.00	0.00
	17	9.53	8.90	11.81	10.51	5.90	4.69	9.70	9.00	11.40	8.91	7.00	10.44
	18	15.44	21.24	10.33	10.75	20.03	26.86	14.20	16.87	12.90	22.69	3.33	1.53
	19	20.93	17.61	18.42	12.63	23.10	20.99	23.26	18.32	12.80	10.45	7.60	3.78
	20	21.53	18.69	20.94	17.27	21.74	19.38	22.40	19.00	19.63	19.57	12.50	17.68
	21	29.13	22.10	29.80	22.52	28.66	22.11	32.18	24.54	24.82	15.87	19.88	14.92
	22	31.42	24.50	34.29	23.48	29.24	25.34	31.18	24.09	32.88	32.11	22.50	17.56
	23	39.32	22.97	44.76	21.14	33.57	23.72	40.26	24.23	34.63	19.28	35.20	20.27
	24	46.70	27.00	47.47	28.55	45.78	25.47	45.71	27.93	43.17	19.14	23.50	9.26
	25	52.87	26.09	58.06	29.76	48.98	22.54	51.97	27.14	65.33	23.86	54.00	20.20
	26	54.86	28.57	58.44	28.76	50.89	28.23	57.02	29.81	46.89	28.27	52.50	25.33
	27	67.37	25.79	72.26	23.56	61.41	27.47	72.15	25.16	55.15	22.02	56.50	40.52
	28	66.05	27.02	66.43	28.33	65.71	26.26	69.00	27.58	58.75	13.50	46.14	27.15
	29	67.45	22.75	70.64	19.57	65.19	24.83	68.91	24.86	67.18	21.51	55.40	15.85
	30	69.61	28.36	82.43	22.13	60.67	29.07	75.68	27.24	45.80	32.17	50.25	19.70
	Total	41.92	31.00	45.03	31.86	39.36	30.04	42.55	31.92	36.99	27.52	35.70	26.35

(Continued)

TABLE 2 (Continued)

	Age	Expressive vocabulary		Sex				Amount of exposure to basque					
		Expressive vocabulary (8–50 months)											
	Months	N of words		Girls		Boys		>60%		40–60%		<40%	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BCDI-3 (120 lexical items)	30-31	68.95	29.62	74.41	24.87	62.83	33.42	71.38	28.62	57.75	33.67	37.33	28.43
	32-33	70.48	29.17	73.10	27.48	67.98	30.81	74.06	26.24	72.33	23.81	23.71	21.34
	34-35	70.80	28.25	76.28	26.25	64.88	29.38	77.79	22.86	50.21	31.73	37.67	30.40
	36-37	78.26	28.25	75.63	29.71	80.58	26.97	84.62	25.59	69.36	20.01	50.30	32.52
	38-39	84.98	30.20	87.00	29.89	83.53	30.60	91.82	24.61	58.40	37.20	46.13	28.45
	40-41	88.77	26.88	91.38	25.68	86.78	27.81	91.47	24.76	97.30	27.33	59.45	27.38
	42-43	95.42	25.65	98.73	18.50	91.92	31.32	101.72	17.35	75.08	40.17	66.30	33.16
	44-45	94.27	24.75	92.24	24.06	96.15	25.45	101.33	17.73	89.00	22.48	44.67	25.54
	46-47	98.82	23.13	98.65	23.06	98.96	23.42	105.09	16.70	83.88	18.87	63.80	32.29
	48-50	92.55	27.67	93.78	28.99	91.16	26.24	101.28	20.22	74.14	33.77	54.80	20.14
	Total	84.79	29.47	86.09	27.90	83.55	30.86	92.41	25.02	84.24	25.84	62.76	32.65

et al., 2013). From 30–50 months, age had a medium-large effect on the expressive vocabulary scale and the grammatical scales of BCDI-3, with a slightly higher effect observed on the language-use scale. These effect sizes of age on the Basque BCDI-3 scales were very similar to those reported for vocabulary in the original CDI-3 (Fenson et al., 2007), as well as in the Swedish (Eriksson, 2017) and the European Portuguese adaptations (Cadime et al., 2021).

Sex did not show any effects in the 8–15-month age range tested with both the short and the long BCDI-1 instruments (Barreña et al., 2008). This finding is in line with the null (Jackson-Maldonado et al., 2013) or very small effects found in the short English, CDI-1s (Fenson et al., 2000; Perez-Pereira and Resches, 2007; Frota et al., 2016). However, the effects of sex were significant, albeit very weak, in favor of girls in the expressive vocabulary scales of both short and long BCDI-2 instruments (Barreña et al., 2008). Similar minor effects were noted in long CDIs tested in 10 languages other than Basque (Eriksson et al., 2012) and in other short CDI-2s (Fenson et al., 2000; Perez-Pereira and Resches, 2007; Jackson-Maldonado et al., 2013). The effect of sex also remained weak in the oldest 30–50-month age range tested with the BCDI-3, which was similar to the findings observed in English, Swedish and Estonian studies (Fenson et al., 2007; Eriksson, 2017; Urm and Tulviste, 2021). Collectively, these findings indicate that the minimal impact of sex on CDI results is not unique to the Basque language. Moreover, considering the variation observed within both sex groups, these findings question the usefulness of maintaining separated percentile tables for boys and girls (Garcia et al., 2024).

The effect of the amount of exposure on vocabulary size increased with age, developing from null in the youngest age range tested with short (and long) BCDI-1 instruments to significant but very small in the 16- to 30-month age range tested with the BCDI-2s and to medium-large in the 30- to 50-month age group tested with the BCDI-3 (Ezeizabarrena and Garcia, 2023). The findings from the Basque data are not very different from those of Galician studies, where no input effects were found among children aged 8–30 months tested with the short CDI-1s and CDI-2s (Perez-Pereira and Resches, 2007). However, the lack of studies examining the effects of this variable on CDI-3 scales for older bilinguals over 30 months limits the ability to compare these results broadly. It is not surprising that greater exposure to the target language provides bilingual children with more linguistic experience over time, which can lead to a greater lexical repertoire in that language. The increase in the input effect with age is compatible with models of lexical development, which propose that the accumulation of linguistic experience, rather than other variables such as chronological age or the age of initial exposure, may accelerate word learning (McMurray, 2007). The lower scores of the groups with less exposure to Basque are compatible with an acceleration that may have occurred among the Basque-dominant children earlier than in the other two groups. The differences in vocabulary development across the input groups in the current study are also in line with studies conducted with older children, which explained the significant differences between age-matched bilinguals with similar ages of initial exposure, which was largely attributable to the varying amounts of exposure they had received in each language (Thordardottir, 2019). This finding highlights the critical role of language exposure in shaping the bilingual lexical development of children.

Additionally, short BCDI instruments showed high reliability and validity. First, Cronbach's alpha values in short BCDI instruments were as high as in other short CDI instruments (Fenson et al., 2000; Perez-Pereira and Resches, 2007; Frota et al., 2016; Urm and Tulviste, 2021). As for concurrent validity, short and long BCDI instruments showed high correlation values, in line with Fenson et al. (2000), Frota et al. (2016), Jackson-Maldonado et al. (2013), Perez-Pereira and Resches (2007), and Urm and Tulviste (2021). Moreover, the BCDI-3 showed a significant and high correlation with the Peabody test, as in the original CDI-3 (Fenson et al., 2007). Additionally, significant and strong between-scale correlations were found in the three BCDIs. A high correlation between receptive and expressive vocabulary in the BCDI-1s resembles the Galician data (Perez-Pereira and Resches, 2007), which was slightly slower than other versions (Frota et al., 2016). Between-scale correlations were higher in the BCDI-2s, similar or even higher than those reported for other languages (Fenson et al., 2000; Perez-Pereira and Resches, 2007; Frota et al., 2016), and they were also high in the BCDI-3, in line with Portuguese, Swedish, and Estonian adaptations (Eriksson, 2017; Cadime et al., 2021; Urm and Tulviste, 2021).

In summary, the similarities found in the factors affecting vocabulary size as measured by both the short (BCDI-1s, BCDI-2s, and BCDI-3) and long (BCDI-1 and BCDI-2) instruments, in addition to the similarly high reliability and validity of the three short instruments relative to the original short CDIs and their posterior adaptations to other languages, confirm the robustness of the findings and the usefulness of the short Basque instruments for assessing language development in the age range of 8 to 50 months. Those tools containing a short vocabulary checklist will facilitate professionals in assessing and identifying young Basque children at risk of developmental delays. Moreover, the availability of these assessment tools, which consider not only age and sex but also the amount of exposure, will help address the current lack of assessment tools for identifying (a)typical development, a need emphasized by professionals in language intervention within bilingual settings that involve minority languages.

Author contributions

M-JE: Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing—original draft, Writing—review & editing. IGF: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing—original draft. AM: Data curation, Investigation, Methodology, Writing—original draft.

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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.

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