

## Article

# Cross-Cultural Comparisons of Home Numeracy and Literacy Environments: Canada, Mexico, and Chile

María Inés Susperreguy<sup>1,2,\*</sup> , Carolina Jiménez Lira<sup>3,\*</sup>  and Jo-Anne LeFevre<sup>4,5</sup> <sup>1</sup> Facultad de Educación, Pontificia Universidad Católica de Chile, Santiago 4860, Chile<sup>2</sup> Millennium Nucleus for the Study of the Development of Early Math Skills (MEMAT), Santiago 4860, Chile<sup>3</sup> Facultad de Ciencias de la Cultura Física, Universidad Autónoma de Chihuahua, Chihuahua 31125, Mexico<sup>4</sup> Department of Cognitive Science, Carleton University, Ottawa, ON K1S 5B6, Canada;

jo-anne.lefevre@carleton.ca

<sup>5</sup> Department of Psychology, Carleton University, Ottawa, ON K1S 5B6, Canada

\* Correspondence: misusper@uc.cl (M.I.S.); cajimenez@uach.mx (C.J.L.)

**Abstract:** Home numeracy and literacy environments are related to the development of children's early academic skills. However, the home learning environments of preschool children have been mainly explored with children from North America, Europe, and Asia. In this study we assessed the home numeracy and literacy environments of three-to-five-year-old children from Mexico ( $n = 54$ ) and Chile ( $n = 41$ ) and compared the patterns of results to those of children from Canada ( $n = 42$ ). Parents completed a questionnaire about their expectations for children's academic performance prior to Grade 1 and the home numeracy and literacy activities they provide for their children. To analyze differences among countries in the home learning environments, we performed mixed and one-way ANOVAs (Analysis of Variance), followed-up by post-hoc comparisons. Mexican parents had higher expectations for children's early skills than Chileans or Canadians. The frequency with which Mexican, Canadian, and Chilean parents reported home numeracy and literacy activities showed both similarities and differences. Our findings speak to the importance of developing culturally sensitive models of early home learning environments and illustrate the complexities of comparing home learning environments across countries.

**Keywords:** home numeracy environment; home literacy environment; children; home activities; academic expectations; cross-cultural comparisons; parent's reports; Mexico; Chile; Canada



**Citation:** Susperreguy, M.I.; Jiménez Lira, C.; LeFevre, J.-A. Cross-Cultural Comparisons of Home Numeracy and Literacy Environments: Canada, Mexico, and Chile. *Educ. Sci.* **2022**, *12*, 62. <https://doi.org/10.3390/educsci12020062>

Academic Editors: Michele Stites and Susan Sonnenschein

Received: 4 December 2021

Accepted: 13 January 2022

Published: 18 January 2022

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## 1. Introduction

Parents provide their children at home with math and literacy learning resources and experiences prior to formal schooling (i.e., home learning environments). The quality of these home learning environments has been linked to children's cognitive and socio-emotional outcomes [1,2]. However, most studies have been carried out in North America, Europe, or Asia [3]. Moreover, although the role of the home learning environment in fostering children's early literacy skills is well established in the wider literature [4–6], fewer researchers have explored the links between home numeracy activities and children's numeracy performance [7,8]. In this paper, we addressed the issue of whether the home literacy and numeracy environments of children in Latin American countries are similar to those in other countries. We focused on parental academic expectations and literacy and numeracy activities, as central aspects of the home learning environments of children. Few studies on the home numeracy environment for children in Latin American countries have been conducted and so this work is important in extending the findings more broadly [9–12]. Under the umbrella of socio-cultural theories [13], there might be differences in the home learning environments in families from different cultures and regions of origin [14]. Specifically, cultural values and traditions regarding academic expectations

and literacy and numeracy practices for young children in Latin American countries may be different from those of other countries [15–17].

Accordingly, we compared parents' reports of academic expectations and home literacy and numeracy environments across three countries: Mexico, Chile, and Canada. Mexico and Chile share a language and might have similar cultural values and traditions regarding academic expectations for young children. However, the cultural beliefs regarding the responsibilities of parents and schools in children's early learning might be different between these Latin American countries [18–20] and Canada. Research has shown that Latino immigrant parents in the U.S. have views regarding their children's abilities to understand academic concepts before starting school that are different from those of non-Latino American parents [19]. Latino immigrant parents in the U.S. [21] and Latino parents living in Latin America [22] both engage in less frequent shared-reading with their children than parents from the U.S., and Latinos from low-socioeconomic backgrounds in the U.S. report engaging more frequently in somewhat different math activities at home (e.g., answering or asking questions about quantities) compared with African-American low-income parents [23]. Given these findings, parents from Latin America could have different expectations for their children's early numeracy and literacy skills and may engage differently in home learning activities than those from Canada.

### *1.1. Home Numeracy Environment*

Activities at home have been proposed as a potential source of the extensive variability that occurs in children's numeracy skills [24–26]. In accord with this view, parents' reports of home numeracy activities are correlated with children's performance [7,8] and mediate the longitudinal associations between parental socioeconomic status (SES) and children's academic performance [27]. However, most of the studies have been conducted in United States, Canada, and Europe. Few studies have included Latino families, and the findings across these studies are mixed compared with the more consistent results from other countries. For example, Missall et al. [28] examined the relation between the home numeracy environment and children's performance in a U.S. sample of mainly low-income White and Hispanic families. Although Missall et al. did not find differences in the frequency with which these groups reported home numeracy activities, parents' reports of numeracy activities were not correlated with children's early numeracy performance for either group. In contrast, in a low-income U.S. Latino immigrant sample, the majority from Mexico, Sonnenschein, Metzger, and Thompson [23] found that parents' engagement and enjoyment of math was related to their preschoolers' math skills. These findings highlight the differences between families from the U.S. and Latino countries. Moreover, more recent studies with families living in Latin America indicate potential differences within groups, depending on factors such as socioeconomic status [11].

These differences could be driven by the home numeracy activities parents choose to engage in with their children. Home numeracy activities have been classified in several ways, depending on whether the activities are focused on teaching specific skills (i.e., teaching the number words) or on activities that include math in less formal settings (i.e., number board games [26]). Among the activities that intentionally promote mathematics, some target more complex skills (i.e., mental arithmetic), whereas others focus on less advanced knowledge (i.e., reciting the number sequence). Research indicates that parents' reports of the frequency of more advanced formal numeracy activities are more strongly related to mathematics among children than reports of less advanced activities [8]. Thus, it is interesting to explore and compare patterns of engagement in home numeracy activities of different types with parents from Latin American countries.

Parents' reports of numeracy activities are related to other parent characteristics, such as their attitudes and beliefs toward math or their academic expectations for their children [29–32]. Skwarchuk, Sowinski, and LeFevre [26] found that the importance that parents ascribed to specific numeracy and literacy benchmarks for their children before starting Grade 1 was related to the frequency with which parents engaged with their

children in shared activities focused on developing numeracy skills. Consistent with those findings, Sonnenschein and colleagues [23] found that the extent to which Latino parents in the U.S. served as models of engagement in math was correlated with their children's engagement with numeracy activities and with their children's numeracy performance. However, parental expectations for children's mathematics in Latino families living in the U.S. might be different from those of Latino families living in their country of origin.

The socioeconomic status (SES) of the parents is another variable that relates to the home numeracy environment. Interestingly, in a recent study with low- and high-SES Mexican families, all parents reported engaging in home numeracy activities with their preschool children [11]. However, numeracy expectations were higher for Mexican low-SES parents compared with their high-SES counterparts [11]. These results are consistent with data from Flemish parents, where the researchers found that low-SES parents reported more positive attitudes and higher expectations than above average and high-SES parents [33]. However, a Chilean study with pre-kindergarten children found that parents with higher educational attainment reported higher frequencies of operational activities (i.e., more advanced formal math activities, for example, mental calculations) and informal math activities than those with lower education [10].

In summary, there is variability in the home numeracy environment of Latin American children, as reflected in parental beliefs, expectations and activities, and these differences are associated with sociodemographic characteristics. However, the specific aspects of the home numeracy environment that vary among countries with different cultural backgrounds remain unexamined.

### *1.2. Home Literacy Environment*

The home literacy environment is related to children's oral and written language skills [4,34,35]. Home literacy activities are classified as basic/code-based or advanced/meaning-related, depending on their focus. Code-based are those activities that emphasize the written characteristics of the letters and words, whereas meaning-related literacy activities concentrate on the underlying meaning of words and text that are conveyed during interactions around print [5,36,37]. These activities are differentially related to children's early outcomes. For example, code-based literacy activities relate to children's word reading in Grade 1, whereas meaning-related literacy activities predict vocabulary skills in the same grade [4].

Researchers have explored the home literacy environments of Latin American immigrant families to the U.S. [38]. Within Latino samples, there is considerable variability in home literacy activities, beliefs, and resources [39,40]. For example, Schick and Melzi [40] found that Latino families reported wide variability in the number of children's books at home. Similarly, Davis and colleagues [39] assessed different beliefs, attitudes, values, and knowledge about home literacy practices. They found three profiles of parents. One group was named "low literacy beliefs and low literacy practices," and included parents who reported low facilitative reading beliefs (e.g., low positive affect, low teaching efficacy) and little knowledge about home reading practices. Most of these parents were at the lowest income and education levels. In addition, these parents reported reading two or fewer times per week to their children and having 10 or fewer books at home. The second group was named "moderate beliefs and moderate practices" and included parents who reported moderate levels of shared reading beliefs and reading instruction practices. These parents had low income and educational attainment. In this group, parents reported reading to their children once or twice per week and having a similar number of children's books compared to the first group. The third group reported engaging in more family shared-reading practices and sustained higher shared-reading beliefs than the other two groups. Parents in this group were highly educated, reported higher income than the other two groups, read more frequently to their children, and had a greater number of children's books at home. Thus, other factors, such as parental beliefs, educational and socioeconomic

backgrounds, and availability of resources may underlie differences in literacy activities among families [41] from similar cultural origins [39].

Similarly, researchers have found diversity in the home literacy practices and beliefs among Latino families living in Latin America [42,43]. For example, almost half of the parents of Chilean kindergarteners did not read to them and this pattern was found across SES [17]. Similar results were found in a study with 30 low-SES Mexican children [44]. Although these mothers mentioned having access to diverse resources to support their children's literacy skills, including children's books, only a few of them reported engaging in shared-book reading or written activities with their children at home. In an observational study with Mexican parents, using a variety of materials, code-based activities were not observed as frequently as meaning-related activities [45]. These researchers found that parents use a direct approach during shared reading (i.e., ask few questions and direct the child's attention to what they consider important). However, this study [45] did not examine other contextual factors that could provide additional insight into the nature of the differences among families. Research with low- and high-SES Mexican families of preschoolers found that high-SES parents reported a higher frequency of both code-based and meaning-related literacy activities than low-SES parents [11], whereas no SES differences were found for literacy expectations. In summary, the available research highlights nuances in the literacy activities that parents engage in with their children at home and suggest that families of Latino backgrounds in different countries may vary in their home literacy activities and expectations [46].

### 1.3. Current Research

In the current research, parents from three countries, Canada, Chile, and Mexico, answered questions about the home learning environments of their families. We compared parents from these countries to better understand the learning experiences children are exposed to at home in diverse and international contexts. Chile and Mexico share a language and cultural values and traditions but have different rankings on the Human Development Index (HDI). The HDI is a measure of the development of a country that considers three dimensions—life expectancy, education, and gross national income per capita. In 2020, among 189 countries, Canada was ranked 16th, Chile was ranked 43rd, and Mexico was ranked 74th on the HDI [47]. Life expectancy was highest in Canada and lowest in Mexico (82, 80, and 75 years, respectively), Canadians attained more schooling (mean of 13.4 years, compared with 10.6 and 8.8 for Chile and Mexico, respectively), and they had more than twice the gross national income per capita (\$48,527) compared with both Chileans (\$23,261) and Mexicans (\$19,160).

We analyzed parents' reports of the importance of children obtaining literacy and numeracy benchmarks before formal schooling (i.e., expectations), as well as the frequency of home numeracy and literacy activities, to build a comprehensive picture of differences and similarities in the home learning environments. Two questions were addressed. First, do parents' reports of literacy and numeracy expectations vary across countries? Second, do parents' reports of home numeracy and literacy activities vary across countries?

## 2. Materials and Methods

### 2.1. Participants

Parents were recruited from preschools/schools in Mexico and Chile and from day-cares in Canada. In all three countries, children start elementary school at age 6. In Canada and Chile, children start preschool/pre-kindergarten at age 4 and attend for two years. Mexican children start preschool/kindergarten at age 3 and attend for three years. The Mexican parents were recruited when their children were in their first year of preschool and had been attending for approximately eight months. The Canadian parents were recruited two to three months before their children were scheduled to start preschool. The Chilean parents were recruited when their children were in pre-kindergarten and had been

attending for approximately four months. All the daycares/preschools/schools were in large urban areas.

Forty-two Canadian parents, 54 Mexican parents, and 41 Chilean parents completed the questionnaire. Most respondents were mothers: 30, 42, and 38 for Canada, Mexico, and Chile, respectively. The number of mothers (vs. fathers or other caregivers) who responded to the questionnaire was significantly different across countries,  $\chi^2(2, N = 137) = 6.28$ ,  $p = 0.043$ , Cramer's  $V = 0.21$ ; this difference was mainly driven by the lower number ( $n = 3$ ) of Chilean fathers (7%, vs. 28% and 22% in Canada and Mexico, respectively). The same parental questionnaire was used in the three countries (see description below).

Parents' education varied across groups. Only 18.6% of Mexican mothers and 13.1% of Chilean mothers were educated beyond community college, compared with 92.8% of Canadian mothers. All the Canadian parents had at least a high school education. Similarly, 94.8% of Chilean mothers had at least a high school education compared with 74.1% and 66.0% of Mexican mothers and fathers, respectively. Thus, on average, education levels were highest for Canadians, moderate for Chileans, and lowest for Mexicans (see Table 1).

**Table 1.** Highest level of education completed by parents (percentage of individuals per column).

Level of Education Completed	Mexico <sup>a</sup>		Canada <sup>b</sup>		Chile <sup>c</sup>
	Mother	Father	Mother	Father	Mother
Less than high school	25.9	34.0	0	0	5.2
High school	29.6	24.5	2.4	5.3	28.9
Community college	25.9	11.3	4.8	10.5	52.7
University	13.0	26.4	35.7	31.6	10.5
Post graduate	5.6	3.8	57.1	52.6	2.6

**Note.** Community college provides for specific vocational or skill-based training. Post graduate indicates Master's or Ph.D. degrees, or professional degrees such as Law or Medicine. <sup>a</sup>  $n = 54$  mothers and  $n = 53$  fathers. <sup>b</sup>  $n = 42$  mothers and  $n = 38$  fathers. <sup>c</sup>  $n = 38$  mothers; education level in Chile was only collected for the respondent parent (i.e., 38 mothers and three fathers whose education levels were: community college [ $n = 2$ ] and university [ $n = 1$ ]).

## 2.2. Parent Questionnaire

The questionnaire was a Spanish-language version of the English-language one used by Skwarchuk, Sowinski, and LeFevre [26], although it did not include parents' storybook or number game knowledge. The second author translated the questionnaire into Spanish. The first author discussed the translation with the second author and a few modifications were made. The questionnaire was then back-translated into English by a native Spanish speaker and revised by an English speaker to ensure validity. In addition, a few items in the Spanish version were modified to account for variability in language across countries (e.g., Spanish has 27 letters whereas English has 26). Parents responded to questions about their academic expectations for children entering Grade 1 (see Table 2) and provided ratings of how frequently they engaged the child in numeracy (see Table 3) and literacy activities (see Table 4).

## 2.3. Procedure

Permission to conduct the research was obtained from the Carleton University Research Ethics Board and from the Ethics Committee of the Faculty of Education at the Pontificia Universidad Católica de Chile. Preschool/school or daycare directors were provided a written description of the project. In Canada, the consent forms and parent questionnaires were sent home and subsequently returned to the children's daycare. In Mexico, primary caregivers (usually mothers) were asked to attend a meeting during which the experimenter explained the purpose and nature of the study. Parents completed the consent form and questionnaires during that meeting. In Chile, primary caregivers (38 mothers and 3 fathers) answered the questionnaires and completed the consent forms at their child's school during the first part of a parent-teacher group conference.

**Table 2.** Academic expectations by country.

	Mexico <sup>1</sup>		Canada <sup>2</sup>		Chile <sup>3</sup>		F	p
	M	SD	M	SD	M	SD		
<b>Numeracy</b>								
Count to 10	3.23	0.75	3.55	0.74	3.46	0.71	2.48	0.088
Count to 100	2.57 <sup>b</sup>	1.14	2.02 <sup>a</sup>	1.08	2.63 <sup>b</sup>	0.83	4.42	0.014
Read numbers to 100	2.59 <sup>b</sup>	1.14	1.95 <sup>a</sup>	0.95	2.22 <sup>a,b</sup>	0.99	4.55	0.012
Know simple sums (e.g., 2 + 2)	2.85	0.93	2.37	1.09	2.76	0.97	2.94	0.056
Count to 1000	2.14 <sup>b</sup>	1.27	0.95 <sup>a</sup>	0.86	1.61 <sup>b</sup>	1.00	13.88	<0.001
Know multiplying (e.g., 2 × 6)	2.19 <sup>c</sup>	1.29	0.85 <sup>a</sup>	0.94	1.44 <sup>b</sup>	0.81	18.82	<0.001
Cronbach's alpha	0.896		0.824		0.859			
<b>Literacy</b>								
Know some alphabet letters	3.24 <sup>a</sup>	0.89	3.67 <sup>b</sup>	0.69	3.20 <sup>a</sup>	0.78	4.56	0.012
Print his/her name	3.43	0.79	3.26	0.89	3.54	0.64	1.31	0.274
Know all 26/27 letters <sup>4</sup>	2.89 <sup>a</sup>	0.95	3.40 <sup>b</sup>	0.86	3.00 <sup>a</sup>	0.92	4.01	0.020
Print all the 26/27 letters <sup>4</sup>	2.81	1.13	2.79	1.32	2.76	1.04	0.03	0.974
Read a few words	2.94	0.94	2.66	1.22	2.54	0.92	2.00	0.139
Read simple picture books	2.85 <sup>b</sup>	0.95	2.34 <sup>a,b</sup>	1.35	1.85 <sup>a</sup>	0.95	9.68	<0.001
Read chapter books	2.49 <sup>b</sup>	1.14	0.90 <sup>a</sup>	1.07	1.22 <sup>a</sup>	0.85	31.56	<0.001
Cronbach's alpha	0.923		0.886		0.889			

**Notes.** Parents responded on a five-point scale (0 to 4) to the question: In your opinion, how important is it for your child to achieve the following benchmarks before starting Grade 1? Response options were 0—unimportant, 1—neither important nor unimportant, 2—important, 3—very important, and 4—extremely important. <sup>a,b,c</sup> Means which share a letter as superscripts were not significantly different according to Tukey HSD (honestly significant difference) post hoc comparisons with  $\alpha = 0.05$ . Comparisons are based on harmonic means because sample sizes were unequal. <sup>1</sup> Ns = 51–54; <sup>2</sup> Ns = 40–42; <sup>3</sup> Ns = 40–41. <sup>4</sup> Spanish has the additional letter ñ.

**Table 3.** Home numeracy activities by country.

	Mexico		Canada		Chile		F	p
	M	SD	M	SD	M	SD		
I help my child learn simple sums	1.60	1.40	1.59	1.28	2.20	1.29	2.92	0.058
I encourage my child to do math in his or her head	2.15 <sup>b</sup>	1.35	1.15 <sup>a</sup>	1.31	2.50 <sup>b</sup>	1.13	12.50	<0.001
We talk about time with clocks and calendars	1.85	1.29	1.78	1.44	2.29	1.38	1.75	0.178
I help my child weigh, measure, and compare quantities	1.65	1.34	1.23	1.03	1.88	1.36	2.81	0.064
We play games that involve counting, adding or subtracting	2.44 <sup>a,b</sup>	1.13	2.00 <sup>a</sup>	1.26	2.76 <sup>b</sup>	1.22	4.12	0.018
I teach my child to recognize printed numbers	2.83 <sup>a,b</sup>	1.08	2.60 <sup>a</sup>	1.13	3.32 <sup>b</sup>	0.79	5.34	0.006
We sort and classify by color, shape, and size	2.67	1.26	2.48	1.18	2.77	0.84	0.59	0.557
I ask about quantities (e.g., how many spoons)	2.92	1.10	3.00	1.08	3.27	1.45	1.30	0.276
We play board games or cards	2.08	1.37	1.60	1.40	1.44	1.38	3.04	0.051
I encourage collecting (e.g., cards, stamps, rocks)	1.88	1.53	1.44	1.11	1.56	0.75	1.17	0.313
I help my child to recite numbers in order	3.08 <sup>a,b</sup>	1.12	2.88 <sup>a</sup>	1.38	3.49 <sup>b</sup>	1.34	3.86	0.023
We sing counting songs	2.52	1.49	2.52	1.07	2.39	0.94	0.12	0.884
I encourage the use of fingers to indicate how many	3.17	1.04	3.03	1.26	3.24	1.22	0.48	0.617
Cronbach's alpha	0.896		0.884		0.855			

**Notes.** Parents responded on a five-point scale to the question: How often do you do the following activities with your child? Response options were 0—rarely or never, 1—monthly, 2—weekly, 3—several days a week, and 4—most days per week. <sup>a,b</sup> Means which share a letter as superscripts were not significantly different according to Tukey HSD post hoc comparisons with  $\alpha = 0.05$ . Comparisons are based on harmonic means because sample sizes were unequal. Sample sizes: Mexico  $n = 52$  (collecting  $n = 51$ ); Canada  $n = 40$ –41; Chile  $n = 41$  (calculate  $n = 40$ ; classify  $n = 39$ ).

**Table 4.** Home literacy activities by country.

	Mexico		Canada		Chile		F	p
	M	SD	M	SD	M	SD		
I help my child read words	2.04 <sup>a</sup>	1.34	2.41 <sup>a,b</sup>	1.43	2.88 <sup>b</sup>	1.19	4.55	0.012
I ask my child to point to letters/words when we read	2.06 <sup>a</sup>	1.48	2.34 <sup>a</sup>	1.44	3.22 <sup>b</sup>	0.91	9.23	<0.001
I teach my child to recognize printed letters	3.02 <sup>a</sup>	1.02	3.10 <sup>a</sup>	1.08	3.63 <sup>b</sup>	0.54	5.75	0.004
I help my child print words	2.19 <sup>a</sup>	1.39	2.17 <sup>a</sup>	1.32	3.15 <sup>b</sup>	0.76	9.06	<0.001
We identify words on signs	2.50	1.43	2.32	1.44	3.00	1.22	2.74	0.068
I teach my child the sounds of the letters	2.67 <sup>a</sup>	1.20	2.76 <sup>a</sup>	1.22	3.44 <sup>b</sup>	0.67	6.63	0.002
I introduce new words and their definitions to my child	2.58	1.35	2.69	1.41	3.00	1.09	1.25	0.290
I help my child sing/recite the alphabet	1.73 <sup>a</sup>	1.36	2.85 <sup>b</sup>	1.11	3.12 <sup>b</sup>	0.90	19.29	<0.001
We make up rhymes in songs (e.g., down by the bay)	2.23	1.45	2.12	1.42	2.27	1.43	0.12	0.890
I ask questions when we read together	2.33 <sup>a</sup>	1.35	2.93 <sup>b</sup>	1.13	3.10 <sup>b</sup>	0.86	5.86	0.004
We visit the library for children's books	0.58 <sup>a</sup>	1.11	1.48 <sup>b</sup>	1.02	0.46 <sup>a</sup>	0.98	12.14	<0.001
Cronbach's alpha	0.926		0.861		0.815			

**Notes.** Parents responded on a five-point scale to the question: How often do you do the following activities with your child? Response options were 0—rarely or never, 1—monthly, 2—weekly, 3—several days a week, and 4—most days per week. <sup>a,b</sup> Means which share a letter as superscripts were not significantly different according to Tukey HSD post hoc comparisons with  $\alpha = 0.05$ . Comparisons are based on harmonic means because sample sizes were unequal. Sample Sizes: Mexico  $n = 52$  (read words  $n = 51$ ; point to words  $n = 50$ ); Canada  $n = 40$ –42, Chile  $n = 41$  (new words and definitions  $n = 40$ ).

#### 2.4. Analytic Plan

To analyze differences across countries in the parental academic expectations (Research Question 1) and reports of home numeracy and literacy activities (Research Question 2), we performed mixed ANOVAs. Mixed ANOVAs allowed us to compare the means in academic expectations and home learning activities across the three countries to see if there are any statistically significant differences among them and test whether there is an interaction effect between the home environment factor and country [48,49]. Then, we conducted separate one-way ANOVAs for each item by country, followed-up by post-hoc tests when the F-test was significant, using Tukey HSD corrections ( $\alpha = 0.05$ ) to control for Type I error rates.

### 3. Results

#### 3.1. Are There Differences across Countries in the Parental Academic Expectations?

Parents' ratings of the importance of children achieving each numeracy and literacy expectation are shown in Table 2. These ratings were analyzed in separate country by expectation-mixed ANOVAs. Next, each expectation was analyzed in a one-way ANOVA to compare across the three countries.

For numeracy expectations, there was a main effect of country,  $F(2, 130) = 8.02$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.110$ . Canadian parents rated the expectations as less important than Mexican parents (1.95 vs. 2.60,  $p < 0.001$ ). Chilean parents' ratings were not significantly different from those of the other two groups (2.35,  $ps = 0.058$  and  $0.409$ , respectively). There were also significant main effects for expectations,  $F(5, 650) = 66.33$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.520$ , and for the interaction between expectation and country,  $F(10, 650) = 9.66$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.129$ . To explore these patterns, each numeracy expectation was analyzed in a one-way ANOVA by country.

For numeracy expectations, parents in all three countries rated "count to 10" as very important and "know simple sums" as somewhat important. For the more advanced numeracy expectations, Mexican parents rated the expectations as significantly more important than Canadian parents (i.e., count to 100, count to 1000, read numbers to 100, and multiply). Chilean parents rated these benchmarks as more important than the Canadians

(significantly for count to 100, count to 1000, and multiply) and lower than the Mexicans, although differences between Chilean and Mexican parents were significant for only one item (i.e., multiply). In essence, Mexican and Chilean parents showed higher numeracy expectations than Canadian parents for the more advanced items, whereas Mexican and Chilean parents did not differ in their numeracy expectations, with the exception of the most complex benchmark (i.e., multiply).

For literacy expectations, in the overall analysis there was a main effect of country,  $F(2, 131) = 3.09, p = 0.049, \eta_p^2 = 0.045$ . However, Bonferroni post-hoc comparisons indicated that average ratings were similar across countries: Chilean parents had lower ratings than Canadian parents, but the difference was not significant (2.57 vs. 2.71). Mexican parents' ratings were higher (2.96) but not significantly different from those of the other two groups ( $p$ s = 0.051 and 0.354). There were significant main effects for expectation,  $F(6, 786) = 137.41, p < 0.001, \eta_p^2 = 0.512$ , and for the interaction between expectation and country,  $F(12, 786) = 16.84, p < 0.001, \eta_p^2 = 0.205$ , indicating considerable variability across specific items.

To explore these patterns, each literacy expectation was analyzed in a one-way ANOVA by country, with Tukey HSD used to control Type I errors on post-hoc comparisons. For the literacy expectations, importance ratings were similar across the three countries for the basic skills (e.g., print name, print all letters, read a few words), except that Canadian parents rated "know some alphabet letters" and "know all alphabet letters" as significantly more important than Chilean and Mexican parents, who did not differ from each other. In contrast, Mexican parents rated "read simple picture books" as significantly more important than Chilean parents, whereas Canadian parents were not significantly different from either other group. Finally, on the most complex skill, "read chapter books", Mexican parents indicated higher importance ratings than either Canadian or Chilean parents, who indicated that this skill was not important to achieve before children started Grade 1. Thus, literacy expectations were overall quite similar across the three countries, except for the most complex skill, which Mexican parents rated as more important than the other two groups of parents, and the importance given to knowing alphabet letters, which was the only skill that Canadian parents rated as more important than the parents from Mexico and Chile.

### 3.2. Are There Differences across Countries in the Frequency with Which Parents Reported Engaging in Numeracy and Literacy Activities?

Parents rated how frequently they engaged in numeracy (Table 3) and literacy activities (Table 4). Two separate country-by-activity mixed ANOVAs were carried out, then separate one-way ANOVAs were carried out for each country. Follow-up post-hoc comparisons used the Tukey HSD correction with alpha of 0.05.

For numeracy activities, there was a main effect of country,  $F(2, 124) = 3.16, p = 0.046, \eta_p^2 = 0.049$ . Canadian parents reported less frequent activities than Chilean parents (2.09 vs. 2.54,  $p = 0.040$ ), but these ratings were not different than those of Mexican parents (2.35,  $p = 0.289$ ) and Mexican parents were not different from Chilean parents ( $p = 0.747$ ). There were also significant main effects for type of activity,  $F(12, 1488) = 44.95, p < 0.001, \eta_p^2 = 0.266$ , and for the interaction between numeracy activity and country,  $F(24, 1488) = 2.69, p < 0.001, \eta_p^2 = 0.042$ . For just over half of the numeracy activities, including "help learning simple sums", "talking about time with clocks and calendars", "weighing, measuring, and comparing quantities", "classifying by color, shape, and size", "asking about quantities", "playing board games or cards", "collecting", "singing counting songs", and "encouraging the use of fingers to indicate how many", frequencies that were not significantly different across the three groups were reported. Chilean and Mexican parents reported engaging more frequently in activities involving mental calculations than Canadian parents. For the other activities, including "playing games involving counting, addition, and subtraction", "teaching to recognize printed numbers", and "reciting numbers in order", Canadian parents reported engaging significantly less frequently than

Chilean parents, whereas Mexican parents did not differ from the other two groups in these activities. In summary, there were similar ratings on most of the numeracy activities across countries. The few differences found between Chilean and Canadian parents were for activities focusing on the number symbols.

For literacy activities, in the overall analysis there was a main effect of country,  $F(2, 123) = 7.72, p = 0.001, \eta_p^2 = 0.112$ . Chilean parents reported more frequent literacy activities than Mexican parents (2.83 vs. 2.13,  $p < 0.001$ ), whereas Canadian parents did not differ from the other two groups (2.43,  $ps = 0.115$  and  $0.304$ , respectively). There were also significant main effects for type of activity,  $F(10, 1230) = 55.50, p < 0.001, \eta_p^2 = 0.311$ , and for the interaction between literacy activities and country,  $F(20, 1230) = 5.02, p < 0.001, \eta_p^2 = 0.075$ .

Analysis of the individual items showed some interesting patterns across countries. First, both the Mexican and Chilean parents reported lower frequencies of “visiting the library for children’s books” compared to the Canadians, which is consistent with the scarcity of children’s books in those countries [50]. Second, for most of the code-based activities [36,37], including “point to letters and words while reading”, “recognize printed letters”, “print words” and “teach the sounds of letters”, Chilean parents reported engaging in these activities significantly more frequently than either Canadian or Mexican parents. Mexican parents reported significantly less frequently “singing or reciting the alphabet” and “asking questions when we read together” than Canadian or Chilean parents. For “help to read words”, Chilean parents rated this skill as more important than Mexican parents, but Chilean did not differ from Canadians. In contrast, for several meaning-related activities including “identify words on signs”, “introducing new words and definitions”, and “making up rhymes in songs”, there were no significant differences across countries. These reported frequencies suggest a stronger and more consistent focus on code-based home literacy activities in Chilean parents compared to the other two groups.

#### 4. Discussion

The current study explored children’s home learning environments across three countries: Mexico, Chile, and Canada, to provide a more detailed international perspective on parental academic expectations and numeracy and literacy activities [3]. We found both differences and similarities in how parents in the different countries respond to the same questions about the home numeracy and literacy environments of their families.

##### 4.1. Do Parents’ Reports of Academic Expectations Vary across Countries?

There was considerable variability in the parental reports of academic expectations across the three countries. Mexican and Chilean parents rated the more advanced numeracy expectations as more important than Canadian parents. Moreover, Mexican parents rated the most complex numeracy skill (i.e., multiplying) as significantly more important than both Chilean and Canadian parents. In terms of literacy expectations, there were no differences across countries in the basic items (i.e., print names, print all letters, read a few words), except for the items “know some alphabet letters” and “know all alphabet letters”, which Canadian parents rated as more important than the other two groups. In terms of the most complex skill (i.e., read chapter books), Mexican parents had higher ratings than Canadian and Chilean parents.

Our findings showed that, for many of the items, parents in the three countries had similar expectations about the skills that are important for children to achieve before Grade 1. This finding might imply that three groups have a similar understanding of the literacy and numeracy skills children need to develop during this stage. However, some differences emerged, mostly for the most complex items. There are various interpretations of the patterns of differences in academic expectations. One possibility is that parents from different countries have dissimilar knowledge [51] about the crucial skills that children need to develop prior to starting first grade. Mexican parents had the least amount of education of the three groups. Among other factors, such as income or occupation, parental education

is used as a proxy of socioeconomic status of the family [52]. In a recent study comparing the expectations of Mexican parents from low- and high-SES schools, the low-SES parents, who also had significantly less educational attainment than their high-SES counterparts, reported higher expectations for both numeracy and literacy complex skills (e.g., count to 1000, know multiplying, read chapter books) than high-SES parents [11]. Thus, the differences in expectations shown in the present research may reflect the differing levels of education of the three groups. Another possibility is that the Mexican parents may have been more influenced by social desirability in their responses and tended to rate all the skills as important without differentiating much among them. Future cross-cultural research should assess differences in academic expectations considering the variability in parental education and social strata [36]. Exploring all these factors simultaneously will help to disentangle the effects of these various influences on children's home environments [3,53].

#### *4.2. Do Parents' Reports of Home Numeracy and Literacy Activities Vary across Countries?*

We also found variability across countries in the reports of home numeracy and literacy activities, despite some key similarities. There were similar reported frequencies for more than half of the numeracy activities and for several of the meaning-related literacy activities. Thus, parents in the three countries engage with similar frequency in many home learning activities with their children.

Some interesting differences were found between Chilean parents and the other two groups. Chilean parents reported engaging frequently in numeracy activities that have an intentional focus on teaching children about symbolic math [26]. This finding is consistent with results from another Latin American country, Uruguay, where parents reported engaging frequently on activities involving counting objects and identifying numbers [54]. Similarly, Chilean parents reported a higher frequency of code-based home literacy activities than Mexican and Canadian parents. This focus on formal home learning activities is aligned with prior work in which less-educated mothers from Latin American countries privilege code-based activities over meaning-related interactions [15,22]. Thus, Chilean parents reported more formal home learning activities compared with the other two groups.

We propose three reasons why Chilean parents might concentrate on formal home learning activities. First, these activities might relate to parental values and beliefs about the experiences that foster numeracy and literacy skills. Low-income immigrant Latino parents believed that focusing on formal skills development is the best way to help children learn math [23]. This belief may lead them to engage more often in these types of activities. Second, the parental emphasis on formal numeracy experiences might reflect the common practices in the Chilean educational system. For example, Bautista Galeano et al. [55] observed preschool Chilean teachers while they were teaching mathematics and found that they focused mainly on number recognition and number-quantity correspondence. Third, Chilean children were slightly older than Canadian and Mexican children, and the activities parents reported might be aligned with their developmental stage [5,56].

Despite reporting high expectations for the more complex numeracy and literacy benchmarks compared with the other two groups, Mexican parents reported similar levels of engagement in many of the numeracy and literacy activities, especially as compared to the Canadian parents. A possible explanation for this discrepancy between expectations and activities for the Mexican parents is that the activities that these parents carry out at home are directed by the school, not by their personal expectations. A second explanation, not exclusive of the first one, is that the responses of the Mexican parents may have been affected by a stronger social-desirability bias than those of the other two groups.

Compared to Canadian parents, Chilean and Mexican parents rarely visited the library to borrow children's books. This difference reflects the scarcity of children's books and libraries in those countries. Importantly, this question supports the validity of the questionnaire more generally, because the lack of children's books in Latin American countries is well documented [50]. In contrast, other meaning-based activities such as asking questions or finding definitions of words were similar across countries. These results highlight the

importance of culturally sensitive questions about the home learning environment when comparing specific activities [3].

#### 4.3. Limitations and Future Directions

The current research illustrates many of the complexities of cross-cultural and international research [53]. First, the groups differed in terms of parents' education. It is not realistic to expect equivalent educational levels in countries that differ greatly in their economic and educational circumstances (i.e., the Human Development Index, as discussed in the introduction). Nor is it possible to statistically control for education in comparing across groups, because of the differences in the range of the indices. Second, the Mexican, Chilean, and Canadian children had experienced different types and amounts of schooling at the time of the study; Mexican children had more schooling than the other groups (8, 4, and 0 months for Mexican, Chilean, and Canadian children, respectively). Third, the Chilean children were a few months older than those in the other two groups. It is very difficult to match both age and schooling across countries that have different rules for when children start school and for the amount of preschool that is mandatory.

As in many other studies, we recruited convenience samples in each country. Future studies should include representative stratified random samples at each location, including subsamples of children of similar age from families of different socioeconomic and educational levels across and within countries [53]. Given the differences in the amount and type of education that children receive in different countries, attempts to understand the influence of schooling in the home learning environment are necessary. For example, follow-up studies could account for the numeracy and literacy activities in schools [55] to disentangle the school and home learning activities.

Our study used self-reports to capture the home learning environments of children. However, questionnaires have limitations because of social desirability, especially given the constant messages parents receive about early education through the media, social media, government, or other organizations. Therefore, naturalistic methods of data collection [3] are needed to better understand the home learning environments of children across countries. Moreover, other family members (i.e., siblings, grandparents, extended family) are likely involved in children's learning experiences [57]; furthermore, parents have been found to be responsive and adjust their home learning activities depending on their children's performance [58]. Future research should consider the complexities of the home learning experiences, which could be captured by using other research methods [3]. The present study used a cross-sectional design; results need to be replicated using longitudinal designs to better understand the differences and similarities in the home learning environments across different countries.

Despite these limitations and the difficulties of conducting international research, our results are important for several reasons. First, they provide initial support for variable patterns of findings in terms of home literacy and numeracy environments among diverse samples. Second, this research points to the importance of replicating findings in different contexts. Third, our results provide some insights for future researchers attempting cross-cultural work in this field and acknowledge the need for developing home learning environment models that consider a variety of contextual factors [3,59].

## 5. Conclusions

This study contributes to research on the variability in children's home learning environments by adding cross-cultural evidence about parents' reports of numeracy and literacy expectations and their activities with preschool/pre-kindergarten children in samples from Mexico, Chile, and Canada. The results highlighted similarities and differences across groups. In terms of similarities, we found that parents in different contexts engaged in many of the same home learning activities; parents in the three countries reported similar frequencies on more than half of the numeracy activities and on some meaning-related literacy activities. Differences included higher expectations of Mexican parents for Grade 1

numeracy and literacy skills; a stronger focus of Chilean parents on code-based literacy activities than Mexican and Canadian parents; and a lower frequency of visiting the library in Chilean and Mexican parents compared with Canadian parents. These results highlighted the importance of culturally sensitive approaches to studying home learning environments across countries, which accurately capture the academic expectations of parents and the learning activities that they engage in with their children.

**Author Contributions:** Conceptualization, C.J.L., J.-A.L. and M.I.S.; methodology, C.J.L., J.-A.L. and M.I.S.; formal analysis, C.J.L., J.-A.L. and M.I.S.; investigation, C.J.L., J.-A.L. and M.I.S.; resources, C.J.L., J.-A.L. and M.I.S.; data curation, C.J.L., J.-A.L. and M.I.S.; writing—original draft preparation, C.J.L., J.-A.L. and M.I.S.; writing—review and editing, C.J.L., J.-A.L. and M.I.S.; supervision, J.-A.L.; project administration, C.J.L., J.-A.L. and M.I.S.; funding acquisition, C.J.L., J.-A.L. and M.I.S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by Fondo Nacional de Ciencia y Tecnología through a grant ANID/CONICYT FONDECYT Iniciación No. 11140899 to María Inés Susperreguy; by ANID—Millennium Science Initiative Program—Code NCS2021\_014 to María Inés Susperreguy; by Consejo Nacional de Ciencia y Tecnología (CONACYT) to Carolina Jiménez Lira (Doctoral grant); and by the Natural Sciences and Engineering Research Council of Canada to Jo-Anne LeFevre.

**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Carleton University Research Ethics Board, and by the Ethics Committee of the Faculty of Education at the Pontificia Universidad Católica de Chile.

**Data Availability Statement:** The data cannot be made available as the content form that the participants signed did not include a statement regarding public data availability.

**Acknowledgments:** The authors are grateful to the schools, daycares, teachers, and parents who participated in the study, as well as to the research assistants who contributed to data collection, Kelsey MacKay and Brianna Herdman in Canada, and María Fernanda Montoya, Vivian Singer, and Gabriela Butamanco in Chile. We also thank Rigoberto Marín Uribe for helping arrange access to the preschools in Mexico.

**Conflicts of Interest:** The authors declare no conflict of interest.

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