

## **Vocabulary development in Norwegian L1 and L2 learners in the kindergarten–school transition\***

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### ABSTRACT

This study examined the vocabulary development of Norwegian second language (L2) learners with Urdu/Punjabi as their first language (L1) at two time-points from kindergarten to primary school, and compared it to the vocabulary development of monolingual Norwegian children. Using path models, the associations between number of picture books in the home, maternal education, and previous L1 and L2 vocabulary on the development of L2 vocabulary breadth and depth were investigated. The results indicate that despite the weaker vocabulary skills of the L2 sample, the growth trajectories of the L2 learners and the monolingual comparison group did not differ. For the L2 learners, we identified both concurrent and longitudinal predictors of vocabulary: the number of books in the home and the time of introduction of the L2 predicted concurrent vocabulary. L1 vocabulary, number of books in the home, and the time of introduction of the L2 predicted vocabulary growth.

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## INTRODUCTION

Vocabulary knowledge is important for the development of literacy and academic achievement for both monolingual (NICHD, 2005; Storch & Whitehurst, 2002) and bilingual children (August, Carlo, Dressler & Snow, 2005; Lervåg & Aukrust, 2010). Vocabulary development is facilitated by background factors, such as parental education (e.g. Carneiro, Meghir & Parey, 2013) and literacy activities in the home (Bus, IJsendoorn & Pellegrini, 1995). Second language (L2) learners face a challenge when learning an L2 vocabulary because they must learn it in addition to their first language (L1) vocabulary. The distributed time that L2 learners in a language minority context spend with each language also appears to affect the development of the L1 vocabulary. Consequently, L2 learners often have limitations in vocabulary knowledge in both of their languages (Oller, Pearson & Cobo-Lewis, 2007), and gaps between the vocabulary knowledge of monolingual and L2 learners are often observed (August *et al.*, 2005; Lervåg & Aukrust, 2010). However, we know less about how different background factors and L1 vocabulary affect vocabulary development in L2 learners than we do about the vocabulary development of monolingual language learners. Few longitudinal studies address such questions. In the current study, we used path analyses to examine mothers' educational level and number of picture books in the home as longitudinal predictors of vocabulary development in monolingual Norwegian language learners and children with Urdu or Punjabi as their L1, learning Norwegian as an L2. For the L2 learners we also included L1 vocabulary, the child's use of Norwegian to family and friends, and age of introduction of the L2 as predictor variables.

*Development of vocabulary in L1 and L2 learners*

A theoretical distinction exists between vocabulary breadth (form–meaning connections) and vocabulary depth (the extent of semantic representation) (Ouellette, 2006; Schmitt, 2014). Although some studies have failed to find conceptual differences between breadth and depth of vocabulary in monolingual and bilingual samples (Vermeer, 2001), other studies have found that vocabulary breadth and depth relate to reading in distinct ways (Ouellette, 2006; Wise, Sevcik, Morris, Lovett & Wolf, 2007). Moreover, L2 learners appear to face difficulties with both vocabulary breadth (August *et al.*, 2005; Oller *et al.*, 2007; Scheele, Leseman & Mayo, 2010) and vocabulary depth (August *et al.*, 2005). In a recent review, Schmitt (2014) argues that the relationship between breadth and depth appears to vary because of different conceptualizations and measures of vocabulary, as well as with word frequency and vocabulary size. Consequently, the

relationship between vocabulary depth and breadth might differ in L2 learners compared to monolingual learners.

Vocabulary development in monolingual children exhibits strong longitudinal continuity (Melby-Lervåg, Lervåg, Lyster, Hagtvet & Hulme, 2012), meaning that the rank ordering of children's scores appears to be largely preserved during development. The stability of vocabulary knowledge is also found in L2 samples (Verhoeven, 1994), and makes it difficult to identify predictors of vocabulary growth. Although a few studies have indicated that the growth of L2 learners' L2 vocabulary skills appears to be faster than the growth of monolingual learners' vocabulary skills, the L2 learners do not appear to catch up with their monolingual peers in the early years of formal education (Simos, Sideridis, Mouzaki, Chatzidaki & Tzeveleku, 2014). Consequently, identifying factors that facilitate language minority children's L2 development is a major concern.

*The relationship between socioeconomic factors and vocabulary in monolingual and L2 learners*

Compared to other linguistic skills, vocabulary appears to be particularly sensitive to variation in the linguistic environment that children are in (Hoff, 2006). One environmental factor that has been found to predict vocabulary both concurrently and longitudinally (Beitchman *et al.*, 2008; Hart & Risley, 1995; NICHD, 2005) is socioeconomic status (SES), particularly parental education (see Lawlor, Najman, Batty, O'Callaghan, Williams & Bor, 2006, for the relationship between SES factors and child intelligence). SES factors, such as parents' education, appear to affect children's language development indirectly through environmental factors such as parental behavior: for example the parents' shaping of the physical, social, cognitive, and cultural environment (Rindermann & Baumeister, 2015) and parents' language use (Hart & Risley, 1995; Hoff & Naigles, 2002; Pan, Rowe, Singer & Snow, 2005), or through early literacy activities, such as book reading (often indicated by the number of books in the home; Myrberg & Rosén, 2008). Huttenlocher (1998) found that children from lower SES families heard less than two-thirds the number of different words than children from middle SES families. Similarly, Hart and Risley (1995) found that SES was related to the time the parents spent interacting with their child and to the amount of verbal interaction. Consequently, children from higher SES backgrounds heard more different words and more words in total than children from lower SES backgrounds. Examining the effect of SES and maternal speech on the vocabulary development of two-year-old children, Hoff (2003) found that the observed difference in vocabulary development between samples of children from high and middle SES families was explained by differences

in their mothers' speech, indicating that maternal speech mediated the effect of SES. Re-analyzing data from the study by Hart and Risley (1995), and comparing them to the sample from Hoff (2003) using path analyses, Rindermann and Baumeister (2015) found that parental educational behavior was more important than parental education level for the language skills of two-, three-, and nine-year-old children. However, there is also some evidence that maternal education has an independent effect on L2 vocabulary, separate from the effect of parental educational behaviors such as language use (Rojas, Iglesias, Bunta, Goldstein, Goldenberg & Reese, 2016; Scheele *et al.*, 2010).

Home literacy activities such as book reading appear to predict vocabulary at different ages (e.g. Patterson, 2002), and Snow, Burns, and Griffin (1998) argue that literacy activities are more likely to occur in homes with many children's books and literacy materials than in homes with fewer such books and material. In a meta-analysis, Bus *et al.* (1995) found that book reading in the home explained a small but significant part of the variance in children's language and literacy skills in both concurrent and longitudinal studies. The sizes of the effect were independent of SES (middle or low).

There is significant variability among studies that have examined predictors of academic achievement in L2 learners, and both SES (Sirin, 2005) and parents' reading (Goldenberg, Rueda & August, 2006) appear to be less predictive of academic success for L2 than for monolingual language learners, particularly for L2 learners in a language minority context. However, the small number of studies that examine predictors of L2 vocabulary still suggest that SES (Armon-Lotem, Walters & Gagarina, 2011; Golberg, Paradis & Crago, 2008; Hammer, Komaroff, Rodriguez, Lopez, Scarpino & Goldstein, 2012; Rojas *et al.*, 2016) and frequency of reading (Patterson, 2002) predict L2 vocabulary skills. Scheele and colleagues (2010) found that the direct and indirect effects of SES were differently related to vocabulary breadth in their Dutch monolingual sample and both their bilingual samples (Moroccan–Dutch and Turkish–Dutch). SES (maternal education) had a positive and significant effect on Dutch language input in the monolingual sample. In the bilingual samples, there was a direct effect of SES on L2 language input in the Moroccan–Dutch sample, and an indirect effect on L2 vocabulary, but no effect in the Turkish–Dutch sample. Several explanations are given for this difference, but the amount and quality of L2 input (significantly correlated with SES) in the Moroccan–Dutch sample seems to offer one important explanation. Paradis (2011) found that both language use at home and mother's level of education had limited association with English L2 vocabulary in sequentially bilingual children from various L1 backgrounds.

Longitudinal studies investigating predictors of vocabulary growth in L2 learners have also suggested that literacy-rich home environments (e.g. educational television; Uchikoshi, 2006) and SES (e.g. maternal education; Rydland, Grøver & Lawrence, 2013) are important for L2 learners' vocabulary development. However, there are few longitudinal studies within the area, suggesting that more longitudinal studies of vocabulary development in L2 learners are needed to increase our understanding of the factors that predict development.

### *L2 exposure and usage in L2 vocabulary development*

Variance in language exposure and use appears to affect children's language development and vocabulary development in particular (Chondrogianni & Marinis, 2011). L2 learners' exposure and use of the L2 varies, for example, based on length of time in the majority society or differences in input in school, the home, and the community (Paradis, 2011). The delayed onset of acquisition and lack of opportunities to learn the L2, which many L2 learners experience, add to the explanation of why L2 learners often have less-developed vocabulary knowledge in the majority language compared to their monolingual peers (Scheele *et al.*, 2010).

Several studies have found correlations between the amount of L2 language exposure and L2 development (e.g. Cobo-Lewis, Eilers, Pearson & Umbel, 2002; Hammer *et al.*, 2012; Hoff, Core, Place, Rumiche, Señor & Parra, 2012). Variables like age of L2 onset (Armon-Lotem *et al.*, 2011) and length of exposure to the L2 (Chondrogianni & Marinis, 2011; Paradis, 2011) are found to influence L2 acquisition. There are conflicting results, however, and Chondrogianni and Marinis (2011) found that chronological age was a more important predictor of L2 vocabulary than was age of exposure, suggesting that cognitive maturity was a greater facilitator of L2 vocabulary acquisition than age of exposure.

The language use in language minority families is dynamic, often changing towards more use of the majority language (de Houwer, 2007). Results from studies examining various predictors of L2 proficiency indicate that both amount of exposure and children's language use are important for L2 learners' language development (Bohman, Bedore, Peña, Mendez-Perez & Gillam, 2010; Hammer *et al.*, 2012). Bohman and colleagues found an independent contribution of language use on L2 language proficiency, and suggest that language use might force the learner to process language in a way that only hearing a language does not (Bohman *et al.*, 2010). Similarly, Hammer and colleagues found that the amount of children's language use supported the development of vocabulary in both languages of the L2 learners in their sample (2012), and Paradis (2011) found that amount of language use was more strongly

correlated with L2 vocabulary than was amount of exposure. In a study of Spanish–English bilinguals in kindergarten, Rojas and colleagues found that language exposure and language use loaded on the same factor (Rojas *et al.*, 2016). In sum, the studies that have examined the effect of L2 exposure and L2 use find that both exposure and use predicts L2 development. However, the dynamic characteristic of language use in language minority families suggests that different factors might contribute differently to the L2 development at different ages and in different contexts. Thus, including variables of both exposure and use might help us to better understand L2 vocabulary development in a minority context.

### *The contribution of L1 to L2 vocabulary*

One theory has had a strong impact on the understanding of the relationship between proficiency in L1 and L2, often referred to as TRANSFER, namely the interdependence hypothesis. The theory argues that both L1 and L2 rest on a common underlying proficiency. This underlying proficiency appears to refer to a mutual central processing system from which both languages operate (Cummins, 1991). Consequently, L1 skills may affect and facilitate the development of L2.

Some studies lend support to the theory of interdependence. Using principal component analyses, Cobo-Lewis and colleagues found that there appeared to be interdependence between the literacy skills of bilingual Spanish–English children, but that the oral language skills (vocabulary) appeared to be language-specific (Cobo-Lewis *et al.*, 2002). They argue that the reason for the difference between oral language and literacy is that literacy is in nature metalinguistic (Bialystok, 1991), thus is easier to transfer across languages. In a recent meta-analysis, Melby-Lervåg and Lervåg (2011) found a small meta-correlation between L1 and L2 vocabulary, but there were large variations in the strength of the correlations among the studies. It has been argued that children from low-SES backgrounds are less likely to possess decontextualized language skills than are children from high-SES backgrounds (Hart & Risley, 1995), and that decontextualized language skills are more likely to lead to transfer (Cummins, 1991). However, Melby-Lervåg and Lervåg (2011) did not find any differences in transfer between high- and low-SES L2 learners in their meta-analysis.

In addition, the majority of research on the relationship between L1 and L2 development is conducted in bilingual Spanish–English samples (Melby-Lervåg & Lervåg, 2011), suggesting a need for research on languages that are more dissimilar to enhance our understanding of how the development of L1 and L2 are related.

## THE PRESENT STUDY

A number of factors might affect the L2 development of young children in a minority language context. In the present study we included some of these factors, representing both individual differences (L1 and L2 language proficiency) and external (environmental) factors (e.g. maternal education and number of picture books in the home) to examine how they affected L2 vocabulary. We used a longitudinal design to examine the development of vocabulary in a sample of L2 learners with Urdu/Punjabi as L1, learning Norwegian as L2, and compared the vocabulary development of Norwegian in the Urdu/Punjabi sample with the development of vocabulary in a sample of monolingual Norwegian language learners from the last year of kindergarten to the first grade in school. We treated vocabulary breadth and vocabulary depth separately (Ouellette, 2006; Schmitt, 2014). The following hypotheses guided our research:

1. L2 learners will have weaker (breadth and depth) vocabulary knowledge in Norwegian than monolingual learners. The L2 learners, however, will experience a steeper growth of Norwegian vocabulary skills.
2. We expect stability in the development of vocabulary breadth and vocabulary depth from kindergarten to Grade 1 in both the sample of monolingual children and the sample of L2 learners. Because of the strong link between vocabulary depth and breadth found in previous research (e.g. Schmitt, 2014) we might also find reciprocal relationships between the development of these related aspects of vocabulary knowledge.
3. External factors (number of picture books in the home, maternal education, and, for the L2 learners, the child's use of Norwegian and the age of introduction of Norwegian) will predict Norwegian vocabulary knowledge concurrently and longitudinally. The external factors will be particularly important in the Urdu/Punjabi sample because we expect a larger variation in these variables for the L2 learners.
4. In the Urdu/Punjabi sample, L1 vocabulary knowledge will predict the development of L2 vocabulary.

## METHOD

*Participants*

A total of 257 children participated in the study at the first point of assessment. Sixty-six children had Urdu or Punjabi as L1 and were learning Norwegian as L2. One hundred and ninety-one children were monolingual with Norwegian as L1. The mean age of the L2 learners was 63.9 months at the time of the first assessment and 77.7 months at the last assessment (SD = 2.27 months and 3.7 months, respectively), and the monolingual children's mean age was 63.6 months at the first assessment and 75.4 months at the last assessment

( $SD = 2.04$  months and  $3.23$  months, respectively). Some of the children had moved to other school districts by the second point of assessment ( $n = 11$ ), and 246 children were assessed in the first grade (61/185). The monolingual Norwegian sample was 47% girls and 53% boys, and the Norwegian L2 sample was 51% girls and 49% boys. All children attended kindergarten by the age of five. The language of instruction in Norwegian schools and kindergartens is Norwegian. The monolingual Norwegian sample came from slightly more rural areas than the Norwegian L2 sample. All children in the Norwegian L2 sample except two were born in Norway. The mothers had lived in Norway for a mean of 20.1 years ( $SD = 10.19$  years) and the fathers for a mean of 19 years ( $SD = 10.64$  years). About 60% of the mothers reported working full- or part-time, as did 98% of the fathers (Karlsen, Lyster & Geva, 2015). Most Pakistani immigrants in Norway come from the Punjab region and speak Punjabi as their L1. Punjabi is a spoken language in Pakistan,<sup>1</sup> while Urdu is also a written language. Furthermore, Urdu is the national language of Pakistan and is used as a common language. Moreover, the two languages are quite similar (Thiesen, 2003), and thus we will treat them as the same language in the analysis. Approximately 50% of the parents in the sample reported that they use both Urdu and Norwegian in the home, whereas 30% use mostly Urdu and approximately 20% use Urdu, Norwegian, and Punjabi. Forty-four percent of the parents reported that they tell stories or read to their child in Norwegian daily, and 27 % reported that they tell stories or read daily in Urdu or Punjabi (Karlsen *et al.*, 2015).

### *Procedure*

The monolingual sample was recruited from a large-scale study focusing on language development (Melby-Lervåg *et al.*, 2012). All L2 learners had knowledge of Norwegian to the extent that they understood the test instructions in the L2. The first assessment was conducted at the beginning of the children's last year in kindergarten (the year they reached age five), and the second assessment took place approximately 13–15 months after the first assessment, 5–6 months into the children's first school year. Each assessment took place isolated from peers, lasted between 30 and 50 minutes, and was conducted by trained assistants or doctoral students.

### *Measures*

In kindergarten, the children's vocabulary was measured and background information was assessed using a parent questionnaire. The Norwegian L2

<sup>1</sup> Punjabi is a written language in India, but is rarely written in Pakistan (Thiesen, 2003)



sample was given the tests of vocabulary breadth in both Norwegian and Urdu or Punjabi. In the first grade, vocabulary was assessed with the same vocabulary measures as in kindergarten. Test procedures were followed for all assessments.

*Vocabulary.* To assess vocabulary breadth in L1 and L2, Norwegian and Urdu/Punjabi versions of the British Picture Vocabulary Scale II (BPVS-II) were used (Dunn, Dunn, Whetton & Vurley, 1997). The BPVS is a receptive vocabulary test in which the child is asked to match a spoken word with one of four pictures. The Norwegian version was standardized by Lyster, Horn, and Rygvold (2010). The process of translating the BPVS-II into Urdu and Punjabi started with two independent mother-tongue speakers of the languages translating the test. They then discussed the translations with members of a research group, using both the Norwegian and the English version of the test as a source of information. Finally, the translated version of the test was given to a translator, who translated it back to Norwegian (Monsrud, Bjerkan & Thurmann-Moe, 2010). In order to assess Urdu/Punjabi vocabulary using the BPVS-II translations, words were presented in an auditory fashion from a computer, in either Urdu or Punjabi. The children were asked which language they preferred. The majority chose Urdu, and only a small number chose Punjabi. We found no significant differences between the children who preferred to be tested in Urdu and the children who preferred to be tested in Punjabi. Furthermore, there were no differences between the groups as a result of language use at home (Urdu, Urdu/Norwegian, Urdu/Punjabi/Norwegian).

For the Norwegian L2 sample, assessment of Urdu/Punjabi vocabulary was always conducted approximately one week after the assessment with the Norwegian version. The vocabulary test results and the Cronbach's alpha values for the difference between monolingual and L2 learners for all measures are presented in Table 1.

Vocabulary depth in Norwegian was assessed using the word definition tasks from the Norwegian version of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 1999). In this task, the child is asked to define different words, and is rewarded with 2, 1, or 0 points based on the quality of the definitions. In addition to measuring knowledge of vocabulary depth, this technique provides a productive language measure. One-way ANOVAs with language use at home (Urdu, Urdu/Norwegian, Urdu/Punjabi/Norwegian) as a between-group factor indicated significant differences between the groups in vocabulary depth in kindergarten ( $F(2,57) = 5.256, p = .008$ ). A Tukey HSD post-hoc test revealed that children from homes where Urdu was the language most frequently used scored significantly better than children from homes

TABLE 1. Means, standard deviations and Cronbach's alpha for the variables, in addition to effect sizes (Cohen's *d*) between groups

Measures	Kindergarten (five years old)					School (six years old)				
	ML Norwegian		L2 learners		ML-L2 difference <i>d</i>	ML Norwegian		L2 learners		ML-L2 difference <i>d</i>
	<i>M</i> (SD)	<i>α</i>	<i>M</i> (SD)	<i>A</i>		<i>M</i> (SD)	<i>α</i>	<i>M</i> (SD)	<i>α</i>	
Voc. breadth N	57.56 (11.44)	.911	32.15 (11.33)	.918	2.232**	73.65 (11.92)	.913	51.11 (13.12)	.926	1.800**
Voc. breadth U/P	–	–	21.27 (9.92)	.908	–	–	–	28.62 (12.19)	.929	–
Voc. depth N	21.25 (5.51)	.747	13.03 (6.70)	.863	1.346**	27.63 (5.37)	.741	20.53 (7.97)	.882	1.064**
Child's use of L2	–	–	3.12 (1.15)	.831	–	–	–	–	–	–

NOTES: ML: monolingual; Voc. breadth N: BPVS II Norwegian; Voc. breadth U/P: BPVS II Urdu or Punjabi; Voc. depth: WPPSI; Child's use of L2: child's use of Norwegian to family and friends; \*\*  $p < .01$ .

where Urdu/Punjabi/Norwegian were used ( $7.75 \pm 3.27$ ,  $p = .006$ ). No differences were found in Grade 1.

*Background information.* Mothers' education, number of picture books in the home, the child's use of Norwegian, and the time of introduction to Norwegian were assessed in kindergarten using a parent questionnaire. The questionnaire for the parents of the Norwegian L2 sample was distributed in both Urdu and Norwegian, and the language choice was optional. The educational level reported in the current study is independent of the country in which the education was conducted. While there may be a high correlation between mothers' and fathers' educational levels, there is still a tendency for mothers' education to be the most important for language development (Korupp, Ganzeboom & Lippe, 2002), likely because mothers spend more time with their children, at least at a young age.

The mothers in both groups were given six options to describe their highest level of education: no education, primary school, upper secondary school / vocational, upper secondary school / academic, higher education / less than four years, higher education / four years or more, or other education. The percentage of mothers answering this question was 79% in the Norwegian L2 sample and 87% in the Norwegian monolingual sample.

The number of picture books in the home was also assessed through the parent questionnaire. The number of books in the home is typically part of a home–language–literacy composite, but it has also been found to predict variation in children's academic achievement alone (Olofsson & Niedersøe, 1999). This variable does not provide information about the literacy activities in the home directly, but many studies use it to represent the value of literacy activities held by the parents (Bus *et al.*, 1995). The parents were given four options for the quantity of picture books: less than two, three to five, six to ten, eleven to fifty, or more than fifty. We did not ask for the language of the books. Eighty-eight percent of the Norwegian L2 sample and 85% of the Norwegian monolingual sample answered the question about the number of picture books in the home.

The child's use of Norwegian was assessed by asking the parents if the child most often used Norwegian (yes or no) when communicating with parents, siblings, other family members, and friends. The child got one point for each situation in which he/she used Norwegian more, creating a variable ranging from 1 to 4.

The time of introduction of the L2 was assessed by asking about the child's age when being introduced to Norwegian. The parents were given the following options: 0 years, 6 months, 1 year, 1.5 years, and so on until the age of 5, creating an 11-point scale.

## RESULTS

The means, standard deviations, and reliabilities for all variables at both time-points are shown in [Table 1](#), along with the effect sizes of the differences between the two groups. All analyses are based on raw scores. As predicted in part one of our first hypothesis, differences between the monolingual and L2 learners were large and significant for both vocabulary tests at both test points.

Two repeated-measure analyses of variance (ANOVAs) with time as a within-groups factor and group as a between-groups factor were conducted to investigate whether the children's vocabulary skills improved over time, and to examine part two of our first hypothesis: whether the improvement varied between groups. The results indicated that the children's vocabulary skills improved over time, with the main effect of time being significant for both the test of vocabulary breadth in Norwegian (BPVS-II) ( $F(1,244) = 442.31, p < .001, \eta^2 = .644$ ), and the test of vocabulary depth (WPPSI) ( $F(1,243) = 201.47, p < .001, \eta^2 = .453$ ). However, the interaction between time and groups was not significant for the test of vocabulary breadth (BPVS-II) ( $F(1,244) = 2.98, p = .085, \eta^2 = .012$ ) or for the test of vocabulary depth (WPPSI) ( $F(1,243) = 0.165, p = .658, \eta^2 = .001$ ), which indicates that there were no differences between the groups with respect to how fast their vocabulary skills improved during the course of the study.

[Tables 2](#) and [3](#) present the response frequencies for the categories of picture books in the home and mothers' educational level reports, respectively. Two Mann-Whitney  $U$  tests confirmed that monolingual learners had more picture books in the home than L2 learners ( $U = 1.535, p < .001$ ), and that the mothers of the monolingual language learners had higher educational levels than those of L2 learners ( $U = 1.931, p < .001$ ). There was a ceiling effect on the child's use of L2, indicating that the majority of the L2 learners primarily used Norwegian at home. The time of introduction of the L2 is provided in [Figure 1](#) and ranged from birth to age four, with eight children getting introduced to Norwegian at birth and nine children getting introduced to Norwegian at the age of four, which implies that some of the L2 learners were simultaneous bilinguals.

Estimated correlations among all variables for monolingual (upper diagonal) and L2 (lower diagonal) learners are provided in [Table 4](#). As expected, the vocabulary measures correlate with each other both concurrently and longitudinally in both groups. In addition, Time 1 vocabulary breadth in Urdu is moderately correlated with vocabulary breadth in Norwegian at Time 2. Unexpectedly, we did not find significant correlations between mothers' education and the number of picture books in the home in the Urdu/Punjabi sample. A small correlation was observed in the monolingual sample, implying that there

TABLE 2. *Frequencies for the picture book categories*

	Number of picture books (%)	
	ML Norwegian	L2 learners
0 to 2	0	8.6
3 to 10	6.7	60.3
11 to 50	46.0	25.9
More than 51	47.0	5.2

NOTE: ML: monolingual.

was a tendency in the monolingual sample for more picture books to be present in households in which the mother had a higher level of education.

### *Prediction of the development of vocabulary skills*

We used path models in order to examine a theoretical model of how different background factors predict the development of vocabulary in monolinguals and L2 learners. The advantages of this analytical approach include the possibility of including both observed and latent (error-free) variables. It also makes it possible for variables to act as both dependent and independent, consequently allowing for more complex relationships than in, for example, a strict regression analytical approach. All further analyses (including missing values) were handled with full information robust maximum likelihood estimation (robust FIML) with Mplus 7.31 (Muthén & Muthén, 1998–2015). To avoid attenuated associations between the variables as a function of measurement errors, the variables were reliability corrected by prescribing the measurement error based on the alpha score in the two samples. Correcting for measurement errors in this way can prevent and correct the negative consequences that measurement error can cause in path and regression analysis (see Cole & Preacher, 2014).

Two saturated path models (one for each group) were created to examine our second, third, and fourth hypotheses: whether earlier vocabulary skills (breadth and depth), the number of picture books in the home, the mothers' educational level, the child's use of Norwegian (L2), and the time of introduction of Norwegian were able to predict the development of later vocabulary skills (breadth and depth). In these models, vocabulary skills at six years of age were regressed on vocabulary skills at five years of age in addition to the number of picture books in the home and the mothers' educational level. In addition, vocabulary at five years of age was regressed on the number of picture books in the home and the mothers' educational level. For the L2 learners, vocabulary breadth in Urdu/Punjabi

TABLE 3. *Frequencies for the mothers' education categories*

	Mothers' education (%)	
	ML Norwegian	L2 learners
No education	0	5.8
Other education	3	13.5
Primary school	3.6	13.5
Upper secondary school / vocational	8.9	21.2
Upper secondary school / academic	18.3	23.1
Higher education / less than four years	32	15.4
Higher education / four years or more	34	7.7

NOTE: ML: monolingual.

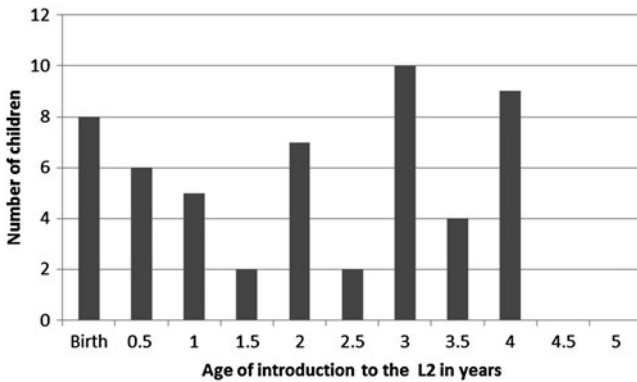


Fig. 1. Age of introduction of Norwegian for the L2 learners.

at five years of age, in addition to the child's use of Norwegian and the time of introduction of Norwegian, were added as predictors of later vocabulary skills in Norwegian. Vocabulary breadth in Urdu/Punjabi was also regressed on the number of picture books in the home, the mothers' educational level, the child's use of Norwegian, and the time of introduction of Norwegian. These models are provided in Figures 2 and 3 for monolingual and L2 learners, respectively. For simplicity, only the significant paths are drawn in the figures.

In the monolingual model, there appeared to be a reciprocal relationship between the development of vocabulary breadth and vocabulary depth. Vocabulary breadth at the age of five explained vocabulary depth at the age of six, and vocabulary depth at the age of five explained vocabulary breadth at the age of six – both beyond autoregressors (earlier measures of the same variable). In addition, the number of picture books in the home was concurrently associated with vocabulary breadth.

TABLE 4. *Estimated correlations between all variables for ML (upper diagonal) and L2 (lower diagonal) learners*

	1	2	3	4	5	6	7	8
1. Voc. breadth N 5	1.0	0.427**	0.584**	0.372**	0.059	0.169*	—	—
2. Voc. depth N 5	0.594**	1.0	0.410**	0.364**	0.126	0.044	—	—
3. Voc. breadth N 6	0.539**	0.339**	1.0	0.347**	0.106	0.111	—	—
4. Voc. depth N 6	0.624**	0.647**	0.590**	1.0	0.150	0.099	—	—
5. M education	0.257	0.221	0.006	0.179	1.0	0.169*	—	—
6. N books	0.298**	0.188	0.086	0.406**	0.261	1.0	—	—
7. Voc. breadth U/P 5	0.219	0.187	0.351**	0.207	0.131	-0.049	1.0	—
8. Child's use of L2	0.123	0.330**	0.225	0.322**	0.238	0.026	-0.046	1.0
9. L2 onset	0.391**	0.515**	0.460**	0.428**	0.221	0.137	-0.155	0.478**

NOTES: ML: monolingual; Voc. breadth N 5: BPVS-II Norwegian in kindergarten; Voc. depth N 5: WPPSI Norwegian in kindergarten; Voc. breadth N 6: BPVS-II Norwegian in the first grade; Voc. depth N 6: WPPSI Norwegian in the first grade; M education: mothers' educational level; N books: number of picture books at home; Voc. Breadth U/P 5: BPVS-II Urdu or Punjabi in kindergarten; Child's use of Norwegian with family and friends; L2 onset: the time of introduction of the L2; \*  $p < .05$ ; \*\*  $p < .01$ .

The results of the L2 model differed from those of the monolingual model in some interesting aspects. The development of vocabulary depth in Norwegian appeared to be explained by earlier vocabulary breadth in Norwegian, whereas earlier vocabulary depth in Norwegian did not explain the development of vocabulary breadth in Norwegian. Thus, our second hypothesis was fully confirmed in the monolingual sample, but only partly confirmed in our L2 sample. Further, in line with our fourth hypothesis, vocabulary breadth in Urdu/Punjabi at five years of age explained additional variance in vocabulary breadth in Norwegian at the age of six, beyond all other variables. Our third hypothesis was partly confirmed as the time of introduction to the L2 predicted both vocabulary breadth and depth concurrently, and vocabulary breadth longitudinally. Furthermore, the presence of a large number of picture books in the home was related to vocabulary breadth at age five and vocabulary depth at age six. Mothers' educational level and the child's use of Norwegian were not associated with a unique influence on any of the vocabulary measures. In addition, there were correlations between the parts of the two vocabulary measures that were not explained by the other variables at both time points (residual correlations).

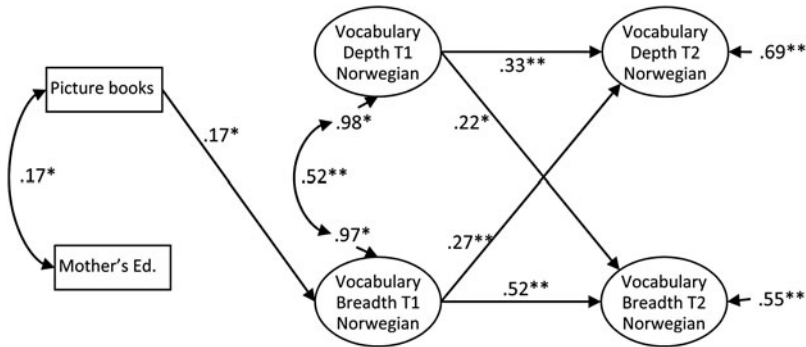


Fig. 2. Path model for the development of vocabulary breadth and depth in monolingual language learners. In this model, rectangles are observed variables (not possible to correct for measurement error); ellipses are variables corrected for measurement errors. One-headed arrows from a variable to another are regressions, and one-headed arrows from a number to a dependent variable are residuals. Curved two-headed arrows between variables are correlations, and curved two-headed arrows between residuals can be interpreted as partial correlations between the variables controlling for the dependent variables. All coefficients are standardized.

## DISCUSSION

The current study revealed a number of interesting findings regarding vocabulary development in monolingual and L2 learners during the transition period from kindergarten to primary school. The L2 learners clearly had weaker skills in L2 vocabulary compared to the monolingual comparison group, but their growth rates did not differ. Earlier vocabulary skills predicted later vocabulary skills, and a reciprocal relationship was observed between later vocabulary depth and vocabulary breadth in the monolingual sample. In the L2 sample, earlier vocabulary breadth in Norwegian predicted the development of vocabulary breadth and depth, and earlier vocabulary depth in Norwegian predicted the development of vocabulary depth, but not vocabulary breadth. Interestingly, vocabulary breadth in Urdu/Punjabi in kindergarten predicted the development of L2 vocabulary breadth among the L2 learners. Furthermore, the number of picture books in the home predicted vocabulary breadth concurrently in both samples, and in the L2 sample it also predicted the longitudinal development of vocabulary depth. In the L2 sample, the time of introduction of the L2 predicted vocabulary breadth and depth concurrently, in addition to the longitudinal development of vocabulary breadth. Finally, mothers' educational level was unrelated to vocabulary in both samples, and in the L2 sample the child's use of Norwegian was unrelated to the language variables.



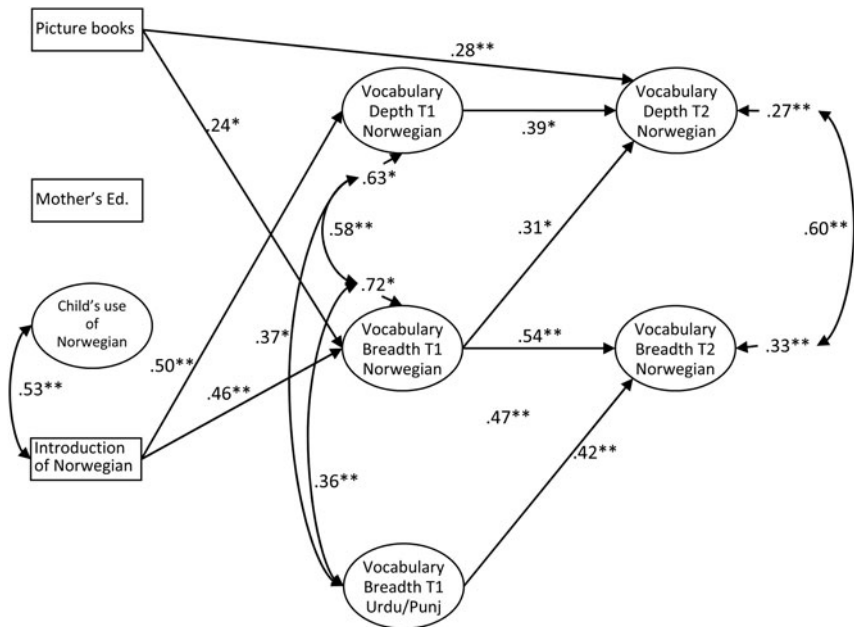


Fig. 3. Path model for the development of vocabulary breadth and depth in L2 learners. In this model, rectangles are observed variables (not possible to correct for measurement error); ellipses are variables corrected for measurement errors. One-headed arrows from a variable to another are regressions, and one-headed arrows from a number to a dependent variable are residuals. Curved two-headed arrows between variables are correlations, and curved two-headed arrows between residuals can be interpreted as partial correlations between the variables controlling for the dependent variables. All coefficients are standardized.

### *Vocabulary knowledge in L1 and L2 learners*

Our finding that the L2 learners had weaker vocabulary than the comparison group corresponds with previous research (e.g. Lervåg & Aukrust, 2010; Melby-Lervåg & Lervåg, 2014; Oller *et al.*, 2007; Scheele *et al.*, 2010). The L2 learners scored lower on measures of both vocabulary breadth and depth in kindergarten as well as in first grade, which is consistent with the results of August and colleagues (2005). This indicates that the L2 learners might have fewer phonological representations of words and fewer semantic associations to the words in their L2 lexicon (breadth and depth; Ouellette, 2006), which, in the present study, is partly explained by the age of introduction to Norwegian and the number of picture books in the home.

L2 learners' scores on the L1 tasks were even lower than those on the L2 tasks, indicating that the L2 learners were more proficient in Norwegian than

in their L1. This finding supports the argument made by Oller and colleagues (2007) that the distributed time of L2 learners with each language has consequences for both L1 and L2 proficiency. In correspondence with the dynamic changes of the language use of language minority families (de Houwer, 2007), most parents report that their child mainly used the majority language when communicating with friends and family. It could also be argued that the low scores on the L1 task might be the result of L1 attrition; that is, loss of L1 in the “process of becoming linguistically assimilated” in the L2 society (Wong-Fillmore, 1991, p. 324).

In contrast to what we expected and to what some previous studies have found (e.g. Simos *et al.*, 2014), growth in L2 learners’ vocabulary was not significantly steeper than that of L1 learners’ vocabulary. A consequence of parallel developmental trajectories may be that the size of the gap in kindergarten vocabulary will persist. However, the similar growth trajectories of monolingual and L2 learners’ vocabulary, in combination with the low vocabulary scores among the L2 learners, are quite unsettling. Although previous research has shown that L2 learners seldom catch up with their monolingual peers, a steeper developmental path is crucial for minimizing the gap and equipping the L2 learners with language skills that are sufficiently good to succeed academically.

### *Predicting vocabulary development*

The path analyses indicated a reciprocal relationship beyond autoregressive effects between vocabulary breadth and depth in the monolingual sample from age five to six. The results imply that if a child’s vocabulary is broad it is likely to positively affect the depth of the vocabulary as well. Similarly, if the child has a well-developed depth knowledge of words, it may be easier to understand new words; thus, this knowledge may affect the number of words in the child’s vocabulary (breadth). In the sample of L2 learners, we only observed a cross-effect from vocabulary breadth in kindergarten to vocabulary depth in the first grade. Previous studies have not examined the relationship between vocabulary breadth and depth longitudinally in monolingual and L2 samples. The longitudinal relationship between these aspects of vocabulary knowledge indicate that proficiency in expressing the meaning of words (depth) is based on knowledge of other words (breadth; Vermeer, 2001). However, other dimensions of vocabulary knowledge reflected in the instruments of the current study might shed additional light on the results (see also Wise *et al.*, 2007), namely that of receptive versus productive proficiency (the BPVS-II and the word definition task, respectively). It appears that receptive learning is easier than productive learning and use (Nation,

2001). Consequently, receptive skills might more easily affect the development of productive skills than vice versa. In samples of monolingual and French–English bilingual children, Yan and Nicoladis (2009) found that bilingual children had close to monolingual scores on measures of L2 receptive vocabulary, but lower scores on measures of language production, indicating that L2 learners' difficulties might be limited to productive skills. Contrasting with the results of Yan and Nicoladis, we found significant differences between the receptive and productive measures of the monolingual and L2 learners, indicating that these L2 learners have trouble with both comprehension and production. However, both measures used by Yan and Nicoladis were measures of vocabulary breadth, and Ouellette (2006) included both receptive and productive measures in her study of vocabulary breadth and depth. This illustrates the lack of consensus on how to conceptualize various aspects of vocabulary knowledge (see Schmitt, 2014). The current study was not designed to examine the relationship between the developments of these related aspects of vocabulary. To further untangle the relationship between the dimensions of vocabulary knowledge, future research should use various conceptualizations and investigate the relationships between them longitudinally.

Another interesting finding is the correlation between the residuals of vocabulary breadth and depth in the L2 sample that indicates that the variables have features that are not accounted for by the independent variables, including the autoregressors. Such features might be related to, for example, general cognitive skills (see 'The relationship between L1 and L2' below).

The L2 learners appeared to come from lower SES backgrounds with significantly fewer picture books and significantly less educated mothers (Scheele *et al.*, 2010). However, the L2 sample did have more heterogeneity (see Table 2), which might have affected the results: the number of picture books in the home predicted vocabulary breadth concurrently in both samples and, in the L2 sample, it also predicted the development of first grade vocabulary depth directly. Bus *et al.* (1995) found a stronger effect of book reading on young children's vocabulary compared to older children, which may indicate that children with weaker language skills (either because of age or L2 learning) will be more influenced by such language exposure. Furthermore, it is likely that number of picture books indicates the way parents value and engage in language and literacy activities (Myrberg & Rosén, 2008).

In line with the result by Paradis (2011), who found a limited association between mothers' educational level and L2 learners' vocabulary, we did not observe a relationship between mothers' education and vocabulary development in either the monolingual or the L2 sample (see also Scheele

*et al.*, 2010). These results contrast with the results of most previous studies on both concurrent vocabulary skills (Golberg *et al.*, 2008; Myrberg & Rosén, 2008; Scheele *et al.*, 2010) and vocabulary growth (Rydland *et al.*, 2013). The results are also in contrast with larger studies of the relationship between SES and child development (Beitchman *et al.*, 2008; Lawlor *et al.*, 2006). Our results indicate that independent of SES level, literacy activities at home (operationalized as number of picture books in the home) appeared to be of greater importance than mothers' educational level for the development of vocabulary in Norwegian monolingual and L2 learners in particular (see also Rindermann & Baumeister, 2015; Sirin, 2005). Finally, we found no differences between the groups in the relationship between vocabulary and mothers' educational level. A possible explanation for this is the egalitarian Norwegian society, with smaller differences between high and low SES than in many other societies.

In contrast with some previous research (Bohman *et al.*, 2010; Hammer *et al.*, 2012; Paradis, 2011), the child's use of the L2, Norwegian, did not predict vocabulary. However, the variable had a ceiling effect, indicating that most children primarily used Norwegian. Thus the lack of variation in this variable could be the cause of its lack of effect on vocabulary development in Norwegian. In addition, the results from the studies by Bohman *et al.* (2010) and Paradis (2011) indicate that language use might be more important for morphosyntactic development than for semantic development. Previous studies have also found effects of use of the L2 in the home (e.g. Bohman *et al.*, 2010; Golberg *et al.*, 2008), and it seems as though the impact of use of L2 in the home is dependent on the L2 skills of the speakers (Paradis, 2011). However, neither the predictive value of language use by family and friends at home (exposure) nor parents' L2 proficiency was examined in the current study.

The time of introduction of Norwegian predicted vocabulary concurrently, as found in previous studies (Armon-Lotem *et al.*, 2011; Hammer *et al.*, 2012; Hoff *et al.*, 2012). What is of particular interest, however, is that in addition to the concurrent relationship between time of introduction of Norwegian and both vocabulary breadth and depth, the time of introduction predicted the development of vocabulary breadth both directly and indirectly (indirect effect = .246,  $p = .014$ ) through the previous measure of vocabulary breadth. This implies that the time of introduction of the L2 was of great importance for the development of vocabulary in this sample of L2 learners. Some previous studies have found age to be a stronger predictor than age of L2 introduction (Chondrogianni & Marinis, 2011). In the current study the age range of the children was quite narrow, thus age differences were not likely to affect the results.

In sum, number of picture books predicted the development of vocabulary depth, while the time of introduction of Norwegian predicted the development of vocabulary breadth. This supports previous research arguing that amount and quality of language exposure affects vocabulary development (Armon-Lotem *et al.*, 2011; Hart & Risley, 1995; Hoff, 2003, 2006; Hoff *et al.*, 2012, Hoff & Naigles, 2002; Rindermann & Baumeister, 2015).

### *The relationship between L1 and L2*

Consistent with the interdependence hypothesis (Cummins, 1991), as well as with the results of the meta-analysis of Melby-Lervåg and Lervåg (2011), we found an effect of L1 vocabulary on L2 vocabulary growth. This suggests that L1 proficiency supports the development of L2. The results are in contradiction to the results of Cobo-Lewis and colleagues, however, who found that oral language skills were language-specific (Cobo-Lewis *et al.*, 2002). The correlation between the residuals of the L1 and L2 vocabulary breadth measures found in the path model might accord with the interdependence hypothesis: the correlation might be caused by a third variable, such as underlying cognitive abilities (see Simos *et al.*, 2014). This view is in line with the study by Paradis (2011), who found that general cognitive ability (memory and analytical skills) were strong predictors of L2 vocabulary. Furthermore, studies suggesting that cognitive maturity (age of introduction to the L2) is related to L2 vocabulary scores seem to support this view (Chondrogianni & Marinis, 2011). Golberg and colleagues, however, found that while cognitive maturity seemed to facilitate vocabulary growth, non-verbal ability (IQ) only had limited influence on vocabulary (Golberg *et al.*, 2008). It should be noted, though, that Golberg and colleagues transformed the ratings of IQ into a dichotomous variable. A continuous variable taking the total variation of the scores into account would provide a more nuanced version of the non-verbal ability of the children and probably increase the chance of revealing a relationship, and should be considered in future research.

### *Limitations and conclusions*

A limitation that tempers the interpretations that can be drawn from this study is the relatively small size of the L2 sample compared to the size of the path model. Small sample sizes might lead to instability when the estimated model becomes large. Still, no instability was found when we tried out different estimators (robust versus ordinary maximum likelihood) or different ways of handling missing data (multiple imputations versus full information maximum likelihood). Another problem with the relatively small L2 sample is relatively wide confidence intervals around

the parameter estimates. This increases the risk of Type 1 errors in the L2 model. In addition, only one type of literacy material is taken into consideration (picture books). However, few longitudinal studies include as many background factors as the previous study. Still, future studies should consider including factors such as general cognitive ability, and external factors such as time spent in kindergarten, use of L2 in the home, and parents' L2 proficiency to better understand the relationship between L1 and L2 vocabulary development. Furthermore, the relationships between different aspects of vocabulary proficiency should be assessed in both languages of L2 learners. Another limitation of the present study is the translations of the vocabulary tests, which did not incorporate the language-specific frequency of lexical items.

In the present study, we found that L2 learners have weaker vocabulary skills than monolingual language learners, and that the growth rates from kindergarten to the first grade do not differ between the groups. Earlier vocabulary predicted later vocabulary in both groups, and, for the L2 learners, number of picture books in the home, the age of introduction of the L2, and L1 proficiency also appeared to facilitate L2 vocabulary growth. Our findings underline the importance of the external factors and suggest that interventions aimed at improving vocabulary skills for L2 learners may have an effect. The interventions should focus on both vocabulary breadth and vocabulary depth, but given the fact that vocabulary breadth predicted vocabulary depth, a specific focus on vocabulary breadth might be important for L2 learners. One possible implication of the findings is that the parents of L2 learners should be encouraged to let their children attend kindergarten and be introduced to the L2 at an earlier age than was the reality for a large group of the L2 learners included in the present study. However, we did not examine the effect of time spent in kindergarten (see Karlsen *et al.*, 2015). In addition, our finding of an effect of L1 on L2 should not be overlooked, even though this may be explained by individual cognitive factors. Furthermore, because we assume that the number of picture books mirrors literacy activities in the home, information about the significance of varied and frequent book reading experiences should be provided to parents.

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