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Peer Effects on Early Language Development in Dual Language Learners

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This study investigated the vocabulary development of children ($N = 547$) from linguistically and socioeconomically diverse classrooms in Germany from age 3 in preschool to age 7 in Grade 1. The results showed that for dual language learners (DLLs, $n = 107$) growth rates in their German majority language skills varied over classrooms. Compared to monolingual children, DLLs improved faster in classrooms with higher peer-level skills in the majority language than DLLs in classrooms with lower peer-level skills (controlling for socioeconomic status and classroom quality). DLLs showed stronger growth dynamics than monolingual children during later preschool stages. The findings highlight the role of preschool peers in DLLs' acquisition of the majority language before entering elementary school.

The linguistic composition of schools in many societies is becoming increasingly diverse. In the United States one in six students, in the EU countries, on average, one in seven students who enter the school system come from a home in which a language other than the society's majority language is spoken (Hussar et al., 2020; OECD, 2018). At school-entry, dual language learners (DLLs) and their monolingual peers differ in their skills in the majority language (National Academies of Sciences, Engineering, and Medicine [NASEM], 2017; Passaretta & Skopek, 2018). These differences in proficiency can pose challenges to DLLs' academic achievement in addition to socioeconomic risk factors or immigration experiences which disproportionally affect DLLs (Hoff, 2013; Mullis, Martin, Foy, & Hooper, 2017; NASEM, 2017; OECD, 2018). Against this backdrop, improving DLLs' chances to gain stronger majority language skills before school entry has become a focus of early childhood education (ECE) programs (Buysse, Peisner-Feinberg, Páez, Hammer, & Knowles, 2014; Grøver, Rydland, Gustafsson, & Snow, 2020; Larson et al., 2020; Walker et al., 2020; Yazejian, Bryant, Freel, Burchinal, & Educare Learning Network Investigative Team, 2015). Crucially, research has shown that ECE programs can succeed in promoting DLLs' second language skills while offering opportunities for DLLs to maintain and strengthen verbal and literacy skills in their first language (Barnett, Yarosz, Thomas, Jung, & Blanco, 2007; Durán, Roseth, Hoffman, & Robertshaw, 2013; Slavin, Madden, Calderón, Chamberlain, & Hennessy, 2011) which substantially contribute to DLLs' later academic achievement as well (Edele & Stanat, 2016).

With the growing recognition that preschool environments considerably support language development, researchers have begun to examine the contribution of preschool peers to children's language learning (Chen, Justice, Tambyraja, & Sawyer, 2020; DeLay, Hanish, Martin, & Fabes, 2016; Foster, Burchinal, & Yazejian, 2020; Henry & Rickman, 2007; Justice, Petscher, Schatschneider, & Mashburn, 2011; Mashburn, Justice, Downer, & Pianta, 2009; Reid & Ready, 2013; Ribeiro, Zachrisson, & Dearing, 2017; Weiland & Yoshikawa, 2014). Despite a growing literature on peer effects in ECE, however, relatively little is known about the extent to which peer effects may moderate the differences in majority language skills between DLLs and their monolingual peers.

This study aims to address this issue by using multilevel growth curve modeling to examine the developmental trajectories of DLLs' German majority language skills in relation to the skills of their classroom peers over 3 years prior to school-entry. Specifically, the study investigates (a) whether DLLs and their monolingual peers differ in their

The data used in this study were made available by the Research Data Centre (Forschungsdatenzentrum, FDZ) at the Institute for Educational Quality Improvement (Institut zur Qualitätsentwicklung im Bildungswesen, IQB) in Berlin (Germany).

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growth trajectories (above and beyond differences related to socioeconomic status [SES]), (b) to what extent the effect of the home language status on majority language skills varies between preschool classrooms, and (c) whether the skill levels of classroom peers have differential effects on the development of majority language skills for DLLs and monolingual children (controlling for classroom quality). Previous studies on DLLs' preschool experiences have not addressed the role of peers' language skills. Existing research on peer effects, on the other hand, has rarely examined their impact on bilingually developing children. This study intends to address this lack of research and inform the debate about which aspects of preschool learning environments contribute to narrowing the majority language gap (Hoff, 2013; Kim, Curby, & Winsler, 2014; Larson et al., 2020; Limlingan, McWayne, Sanders, & López, 2020; Walker et al., 2020).

Effects of Preschool Experiences on DLLs' Language Development

The language development of young children is associated with the amount of language exposure they receive during infancy and early childhood. More exposure to and more frequent usage of a particular language promotes children's abilities in that language (Hammer et al., 2014; Hoff, 2013). For children growing up bilingually, language exposure and usage are distributed across different languages. As a result, their phonological, lexical, and grammatical knowledge is organized across two systems that compete for cognitive resources (DeAnda, Poulin-Dubois, Zesiger, & Friend, 2016) and interfere in complex ways depending on the languages' linguistic distance (Floccia et al., 2018) and consistency of their use (Byers-Heinlein, 2013). Importantly, the level of exposure to a particular language may vary widely among young DLLs as a function of parental language use (Marchman, Martinez, Hurtado, Greuter, & Fernald, 2017), SES (Hoff, 2013), chance and duration of participation in ECE programs (Yazejian et al., 2015), and the language context in the preschool classroom (Garcia, 2018; Limlingan et al., 2020; Raikes et al., 2019). Similarly, measures of DLLs' home learning environment, including literacy activities, quality of parent–child interactions, and availability of learning materials (Rodriguez, & Tamis-LeMonda, 2011) can covary with the relative frequencies of the languages used in their homes. Recent evidence showed that home literacy experiences in the majority language are more strongly related to the majority language skills of DLLs than to those of monolingual children (Højen, Hoff, Bleses, & Dale, 2021).

In comparison to their monolingual peers, DLLs disproportionally come from economically disadvantaged or immigrant families increasing their likelihood to face disparities in access to high-quality ECE programs (Espinosa et al., 2017). Comparable inequalities in early education experiences have been reported for several developed countries including the United States (Bassok & Galdo, 2016; Espinosa et al., 2017), Japan (Kachi, Kato, & Kawachi, 2020), as well as several European countries (e.g., Kuger, Kluczniok, Kaplan, & Rossbach, 2016; Slot, Bleses, Justice, Markussen-Brown, & Højen, 2018; Slot, Leseman, Verhagen, & Mulder, 2015; Willard, Agache, & Leyendecker, 2019). Given that the benefits of ECE participation for language outcomes may only be effective at comparatively high-quality levels (Zaslow et al., 2016), disparities in access to higher quality preschools limit their potential impact for DLLs. At the same time, it is well established that for DLLs entering preschool early has stronger positive effects on their majority language outcomes by school-age compared to monolingual children, even when controlling for classroom quality (Ebert et al., 2013; Ertanir, Kratzmann, Frank, Jahreiss, & Sachse, 2018; Kohl, Willard, Agache, Bihler, & Leyendecker, 2019; Yazejian et al., 2015). DLLs who attend ECE earlier may also experience larger long-term academic benefits (OECD, 2016). What is less clear, however, is what particular aspects of DLLs' preschool experiences contribute to these effects, including the classroom's language context, process quality, and peer composition (Buysse et al., 2014).

Findings from the United States and European large-scale, longitudinal ECE studies suggest that independent of their home language status or their entry-level skills in the majority language, children benefit equally from higher classroom quality (Keys et al., 2013; Sammons et al., 2002; Schmerse et al., 2018). More recently, research has shown that preschool teachers' use of DLLs' home language for instructional activities has effects on children's first and second language skills. Several studies from the United States where three in four DLLs come from Spanish-speaking homes (Hussar et al., 2020) compared the acquisition of English and Spanish proficiency among children in classrooms, in which teachers used varying degrees of English and Spanish (Garcia, 2018; Limlingan et al., 2020; Raikes et al., 2019). Overall, the findings from these investigations consistently indicated that if teachers used a moderate to a high degree of Spanish as the language of instruction, DLLs showed larger gains in their receptive Spanish language skills. For DLLs' English proficiency, findings were more heterogeneous. While some studies reported no effects of lower or moderate frequency of teachers' Spanish use (Raikes et al., 2019), others found that more frequent use of Spanish was associated with smaller gains in DLLs' receptive English skills (Franco et al., 2019; Garcia, 2018), even when controlling for classroom quality (Limlingan et al., 2020). More conclusive evidence from randomized trials suggests that two-way Spanish-English immersion preschool programs support Spanish language skills at no detriment to English language skills (Barnett et al., 2007; Durán et al., 2013).

Beyond the exposure to teachers' language use, another measure that has been employed to characterize the classroom language context is the percentage of DLLs in the classroom. Studies from the United States consistently showed that a higher percentage of DLLs in the preschool classroom was unrelated to the development of DLLs' home language skills, but was associated with smaller improvements in DLLs' English proficiency (Garcia, 2018; Limlingan et al., 2020). On the other hand, European ECE studies from Denmark and Germany found that DLLs' majority language skills were not related to the percentage of DLLs in the classroom (Ebert et al., 2013; Kohl et al., 2019; Schmerse et al., 2018; Willard et al., 2019), although there may be smaller indirect effects via classroom process quality (Slot et al., 2018). One shortcoming of compositional measures is that they provide no information on the particular language used in verbal peer interactions. Observational data from U.S. studies indicated that in preschool classrooms where half of the children are Spanish-English DLLs, children were more likely to interact with same-language peers (DeLay et al., 2016) but overall DLLs' verbal peer interactions occurred equally often in Spanish and English (Franco et al., 2019). Analogous observational data from German preschools with a high proportion of DLLs showed that the vast majority of peer interactions (90%) took place in the majority language, German (Jahreiß, Ertanir, Sachse, & Kratzmann, 2018). Taken together, these findings support the notion that verbal peer interactions in preschool classrooms may expose DLLs to a high amount of majority language input with potential effects on their majority language skills (Rydland, Grøver, & Lawrence, 2014). Consequently, one hypothesis is that DLLs' development of majority language proficiency might depend on the level of their classroom peers' majority language skills. So far, however, peer effects have rarely been studied with a particular focus on the language development of DLLs.

Peer Effects on Early Language Development

In general, peer effects, sometimes referred to as compositional effects, occur when a variable (e.g., prior skill level) aggregated at the contextual level (e.g., classroom) has an effect on the outcome beyond the effect of the same variable at the individual level (Raudenbush & Bryk, 2002). Peer effects in preschool and kindergarten classrooms have been examined for language outcomes (e.g., Henry & Rickman, 2007; Mashburn et al., 2009; Ribeiro et al., 2017), problem behavior (Choi et al., 2018), prosocial behavior (Schmerse & Hepach, 2021), and executive function skills (Weiland & Yoshikawa, 2014).

The available evidence for peer effects on early language outcomes, largely from the United States, suggests that classroom peers' average language skills (Henry & Rickman, 2007; Mashburn et al., 2009), as well as the classrooms' socioeconomic composition (Reid & Ready, 2013; Weiland & Yoshikawa, 2014), are related to children's individual development in the majority language. Furthermore, the research has shown that the association appears to be stronger for children with lower language skills (Justice et al., 2011) and children from socioeconomically disadvantaged backgrounds (Ribeiro et al., 2017), although some studies did not find significant effects of peers' language skills (Choi et al., 2018; Shager, 2012). Recent evidence also suggests that the level of peers' language skills may partly explain the effects of age composition in preschool classrooms (Foster et al., 2020). Based on the assumption that peer effects depend on the number of opportunities to interact with peers, some authors have suggested extending the compositional approach to peer effects by also incorporating the observed intensities of peer interactions for individual children (Chen et al., 2020).

The growing amount of evidence for peer effects in ECE notwithstanding, surprisingly little research has been conducted on the question of whether DLLs benefit from their peers' skills in the majority language. This lack of empirical work is surprising given that for many children from minority language homes, preschool classrooms are often one of the first main contexts with frequent majority language contact. So far, only one study has explicitly examined the dependency of peer effects on children's DLL status. Based on a sample of predominantly Spanish-English DLLs, Atkins-Burnett, Xue, and Aikens (2017) showed that in contrast to children who spoke only or primarily English, 5-year-old Spanish-English DLLs' conceptual vocabulary (i.e., their combined vocabulary for English and Spanish) was associated with the level of their peers' conceptually scored vocabulary skills. These authors found that gains in DLLs' conceptual vocabulary were largely driven by improvements in their English vocabulary skills. This indicates that peer effects are perhaps particularly relevant to DLLs' majority language skills. Because of the conceptual scoring in this study, however, this hypothesis had not been examined.

Taken together, the findings on DLLs' preschool environments indicate that the classroom language context supports the acquisition of DLLs' majority language skills. One aspect of DLLs' preschool experiences that might play a particular role in this process is the classroom language context related to peers. While there has been a growing number of peer effects studies in early education, research on the role of classroom peers in shaping DLLs' gains in majority language skills is sparse. One hypothesis is that the development of DLLs' majority language skills might depend on the level of their classroom peers' majority language skills. Thus far, however, this assumption has not been tested.

The Present Study

This study examines growth trajectories in early German vocabulary skills in relation to children's home language status and their classroom peers' skills in the majority language (German). For many DLLs, preschool classrooms are important developmental contexts with frequent majority language contact. Accordingly, it is hypothesized that DLLs in peer groups with higher majority language skills improve in their proficiency at a faster rate than DLLs in peer groups with lower majority language skills. Unlike other peer effects studies that rely on relatively short periods, this study assesses development over 3 years from preschool entry until the transition into Grade 1. Using a multilevel growth curve modeling approach, the study examines variability in developmental change at the individual and the peer group level to addresses the question of whether peers play a moderating role for DLLs in gaining stronger majority language skills. To answer these questions, the study draws on a rich data set from linguistically and socioeconomically diverse preschool classrooms and aims to extend our understanding of DLLs' majority language development in ECE.

Method

Sample

The data of the present investigation came from the German longitudinal study *BiKS-3-10* (Weinert, Roßbach, Faust, Blossfeld, & Artelt, 2013). The overall aim of the *BIKS-3-10* project was to address the interdependence of competency development and educational experiences across a range of outcomes during the preschool and elementary school years. Children in the study were enrolled for the start of an elementary school in fall 2008 and participated in regular annual assessments of school-readiness skills starting in fall 2005. The data contained a broad set of key variables on classroom quality, children's home learning environment, and family background.

The data are based on a stratified random sample with $N = 547$ children (49% female) from 97 preschools in the German states of Bavaria and Hesse. Children were sampled from one randomly selected classroom per preschool. The average number of children assessed per classroom was 5.5. The average group size per classroom was 22.8 children ($SD = 4.2$). There was no pattern of cross-classification of children across classrooms. On average, children attended preschool 6 hr per day ($SD = 1.19$) for 5 days a week. Twenty-one percent of mothers reported a university degree as their highest level of education, 65% a vocational training degree, and 10% a lower secondary school degree without vocational training. The distribution of maternal education levels mirrored those of the overall female population in Germany aged 30–-35 years at the time of data collection. Intraclass correlations showed that the proportion of the total variance in maternal education due to differences between preschool classrooms was 11%. Eighty-five percent of mothers and 83% of fathers were born in Germany, and 22% of parents described themselves as native speakers of a language other than German. Children's mean age at preschool entry was 38 months ($SD = 5.4$ months) and 47% had regularly attended child care before preschool entry. Children's mean age at the first assessment in the study was 44 months ($SD = 5.0$ months).

Note that in the German ECE system children attend preschool ('Kindergarten'), which is not part of the school system, typically from age 3 to

6 years. Transition into formal schooling starts with entry into elementary school at the age of 6–7 years. German preschools are state-subsidized and attendance fees are comparably low. Parents tend to choose a preschool in proximity to their home (Becker & Schober, 2017). The pedagogical approach in German ECE primarily follows a child- and situation-oriented tradition with an emphasis on free play. In the vast majority of preschool classrooms, teachers use German as the only language (Kohl et al., 2019).

Measures

Vocabulary Skills

Children's German receptive vocabulary skills were assessed using an adapted version of the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997). The version of the PPVT contained 15 sets of word-picture matching items ordered by increasing difficulty with a total of 175 items. Children were presented with one item at a time. Testing was terminated after six or more incorrect responses within one set of items. Children were administered the PPVT at four time points, three times throughout the preschool period in their preschool settings and once in their home settings 3–-4 months after children had transferred from preschool to Grade 1 in elementary school. Children's mean age was 3.7 years (SD = 5.0 months) at Time 1, 4.7 years (SD = 4.4 months) at Time 2, 5.6 years (SD = 4.3 months) at Time 3, and 7.1 years (SD = 4.2 months) at Time 4. Sum scores of correct answers (max. 175) for each time point were used in the analyses. Previous research using the adapted PPVT version (European Child Care and Education Study Group, 1999) with samples of 4-year-old (n = 396) and 8-year-old children (n = 306) demonstrated sufficient reliability (range for split-half reliability coefficients = .86–.96). Furthermore, data from the current sample provided evidence for convergent validity by strong correlations with the German version of the Test for Reception of Grammar (TROG-D; Fox-Boyer, 2006) at Time 2 (r = .63) and Time 3 (r = .63).

Dual Language Exposure

Parents indicated whether they were native speakers of a language other than German or had a partner for which this was the case (n = 121). In 54 households one parent was a native speaker of a language other than German (23 mothers and 31 fathers). In 67 cases, both parents were native speakers of a language other than German. A total of 32 different languages were spoken among these households with Turkish (28%), English (14%), and Russian (10%) as the most frequently mentioned. In addition, parents who were native speakers of a language other than German provided information on the relative use of German versus another language at home. They answered five questions regarding their language use with the child, their partner's language use with the child as well as language use among parents, child and siblings, and all family members together. The questions were rated on a 5-point scale ranging from 1 = *only German* to 5 = *only another language* (3 indicated *partly German, partly another language*). In 14 cases parents indicated that German was the only language used in the household. Based on these items, children in this study were defined as DLLs if they had at least one parent who was a native speaker of a language other than German and if they were also exposed to a language other than German at home (n = 107). In addition, DLLs' relative language exposure was measured by calculating the mean across the five items tapping home language use (M = 3.00, SD = 1.14; see Table S3 for descriptive statistics of individual items).

Home Learning Environment: Parent–Child Interaction

Parents (96% mothers) participated in a semi-standardized picture book task with their children (Kuger, Pflieger, & Roßbach, 2005). During interviews in home visits, parents were presented with specifically developed picture books and were asked to jointly look at the picture story with their children. The pictures displayed different sceneries (e.g., bakery, train station, doctor's office) and contained numbers, letters, sets of objects, patterns, and shapes. All picture book tasks were conducted in German, except for 15 cases which were conducted in Turkish. Interviewers were trained for reliable coding (> 80% agreement) and rated the quality of parent–child interactions based on items adapted from the Home Observation Measurement of the Environment (Caldwell & Bradley, 2003). Eleven aspects of cognitive stimulation (e.g., engaging in joint attention, using questions, encouraging categorization, addressing numbers, letters, patterns, or spatial concepts) were rated on a 7-point scale. The 11-item scale showed acceptable internal consistency (Cronbach's α = .83). The mean across items comprising the scale was utilized in the analyses (M = 3.23, SD = 0.58).

Socioeconomic Status

Parental SES was measured using the International Socio-Economic Index of occupational status (ISEI; Ganzeboom & Treiman, 1996) and was based on the highest value among parents if two values were present. The index is based on parents' occupation and associated likely earnings and can take the lowest value of 16 (nonskilled workers) and the highest value of 90 (judges). In the *BiKS-3-10* sample, the mean value for the highest ISEI was 52.4 ($SD = 16.3$). The standard deviation of the SES index in the present sample is comparable to the OECD average. Thus, the sample is characterized by average socioeconomic heterogeneity.

Peer Vocabulary Skills

Peer vocabulary skills were calculated as the classroom-average PPVT scores at Time 1 using all available data from the classroom. This approach has been used in several studies on peer effects in preschool and kindergarten classrooms and the sampling rate per classroom lies within a well-established range in the existing peer effects literature (e.g., Henry & Rickman, 2007; Mashburn et al., 2009; Ribeiro et al., 2017). Choosing Time 1 peer vocabulary skills to model between-group differences was motivated by the straightforward interpretation of its effect on the intercept in a growth-curve model and by the fact that Time 1 data had the least number of missing values. The intercorrelations between Time 1, Time 2, and Time 3 peer-average scores provided evidence for high stability over time (T1–T2: $r = .75$, $p < .001$; T2–T3: $r = .77$, $p < .001$; T1–T3: $r = .66$, $p < .001$). The average classroom level of PPVT scores at Time 1 was $M = 34.3$ ($SD = 12.1$).

Classroom Quality

Classroom quality was assessed at age 4 using the German adaptation (Tietze, Schuster, Grenner, & Roßbach, 2007) of the Early Childhood Environment Rating Scale–revised edition (ECERS–R; Harms, Clifford, & Cryer, 1998). Instead of the overall ECERS–R score of global quality, the current analyses relied on the ECERS–R Interaction score which predominantly captures the quality of teacher–child interactions as a more sensitive measure to child outcomes (Burchinal, Zaslow, & Tarullo, 2016). The 10 items comprising the scale (e.g., encouraging children to communicate, encouraging children to develop reasoning skills, staff–child interactions, interaction among children) describe the extent to which teachers are actively engaged with children and encourage learning ($M = 4.31$, $SD = 1.09$, range = 1–7, Cronbach's $\alpha = .83$). According to the classification of Harms et al. (1998), scores from 1 to 2.9 indicate poor quality, scores 3 to 4.9 medium to good quality, and scores > 5 good to excellent quality.

Child–Teacher Ratio

The child–teacher ratio (CTR) was assessed as a measure for structural classroom quality. The CTR was calculated based on observations of children and adults present in a given classroom on several occasions throughout the day. Ratios indicate the number of children per teacher, that is, lower ratios indicate fewer children per teacher ($M = 10.58$, $SD = 4.84$).

Analytic Approach

Multilevel growth curve analyses were conducted using a three-level mixed-effects modeling approach to assess within-persons, between-persons, and between-groups aspects of developmental change. The model estimated linear and nonlinear change over time in children's German PPVT scores from ages 3 to 7 years. Between-persons' predictors of initial status, growth, and change in growth over time included DLL status, SES, and quality of the home learning environment. Classroom-level predictors included classroom process quality, CTR, and classroom peers' average vocabulary skills. Gender and preschool entry age were included as covariates. All continuous predictor variables used in the analyses were grand-mean centered. Random intercept models were run to calculate intraclass correlation coefficients (ICC) estimating the proportion of the total variance that was located between preschool classrooms. The ICCs were .15 for Time 1 vocabulary skills, .12 for SES, .05 for quality of the home learning environment, and .35 for DLL status.

The strategy for the model building included testing an unconditional growth model (Model 1) with fixed and random linear and quadratic effects for the time predictor (age). In the next step, all predictors of interest and the covariates were added except for peer vocabulary (Model 2). The final model (Model 3) additionally included peer vocabulary as a predictor as well as an interaction between peer vocabulary and DLL status. In addition, the effect of relative exposure to different languages at home was examined in a subsample analysis for DLLs. In this analysis, testing the unconditional growth model was repeated. The dichotomous predictor DLL status was replaced by the "dual language exposure" predictor but all other predictors were kept identical.

Time Predictor

A continuous time metric was used because in the data there was heterogeneity in time measures (unbalanced data). Although assessment intervals were the same for all participants, the ages at the onset of assessment varied across children. Therefore, the current analyses made use of the flexible treatment of the time variable in multilevel growth curve modeling. The time variable was treated continuously rather than as a set of fixed points to reduce estimate biases (Mehta & West, 2000). The time predictor (age) was centered on children's mean age at the first assessment so that the model's intercept corresponded to age at Time 1. In addition, the time predictor was rescaled into years so that the coefficients for the time predictor reflect vocabulary growth over 1 year.

Model Specification

The Level-1 model estimates the linear and quadratic growth curves for repeated measures (nested within children):

$$Y_{hij} = \pi_{0hi} + \pi_{1hi}(\text{time}_{hij}) + \pi_{2hi}\left(\text{time}^2_{hij}\right) + \varepsilon_{hij},$$

where Y_{hij} is the predicted outcome at age j (in years) for the ith child in classroom h, π_{0hi} is the estimated test score for child i in classroom h at 3.7 years (mean age at first measurement), π_{1hi} is the estimated linear slope for child i, π_{2hi} is the estimated quadratic slope for child i, and ϵ_{hij} is the error term.

The Level-2 model estimates person-level effects to explain variance in initial status, growth, and change in growth between children (nested within classrooms):

$$\pi_{0hi} = \beta_{00h} + \beta_{01h}(\text{HLE}_{hi}) + \beta_{02h}(\text{HISEI}_{hi}) + \beta_{03h}(\text{DLL}_{hi}) + \beta_{04h}(\text{covariates}_{hi}) + r_{0hi},$$

$$\pi_{1hi} = \beta_{10h} + \beta_{11h}(\text{HLE}_{hi}) + \beta_{12h}(\text{HISEI}_{hi}) + \beta_{13h}(\text{DLL}_{hi}) + r_{1hi},$$

$$\pi_{2hi} = \beta_{20h} + \beta_{21h}(\text{HLE}_{hi}) + \beta_{22h}(\text{HISEI}_{hi}) + \beta_{23h}(\text{DLL}_{hi}) + r_{2hi},$$

where β_{00h} is the average intercept (initial status) in class h, β_{10h} is the average linear slope in class h, β_{20h} is the average quadratic slope in class h with the respective associated effects of the home learning environment (HLE_{hi}), SES (HISEI_{hi}), DLL status (DLL_{hi}), and the respective associated random effects r_{0hi}, r_{1hi}, and r_{2hi} for child i in classroom h. Child covariates β_{04h} including gender, age at preschool entry, and prior daycare experience (yes-no) served as control predictors for the initial status.

The Level-3 model estimates group-level effects between classrooms:

$$\beta_{00h} = \gamma_{00} + \gamma_{01}(\text{ECERS}_h) + \gamma_{02}(\text{CTR}_h) + \gamma_{03}(\text{PEER VOC}_h) + \gamma_{04}(\text{PEER VOC}_h) \times (\text{DLL}) + u_{0h},$$

$$\beta_{10h} = \gamma_{10} + \gamma_{11}(\text{ECERS}_h) + \gamma_{12}(\text{CTR}_h) + \gamma_{13}(\text{PEER VOC}_h) + \gamma_{14}(\text{PEER VOC}_h) \times (\text{DLL}) + u_1(\text{DLL}_h),$$

$$\beta_{20h} = \gamma_{20} + \gamma_{21}(\text{ECERS}_h) + \gamma_{22}(\text{CTR}_h) + \gamma_{23}(\text{PEER VOC}_h) + \gamma_{24}(\text{PEER VOC}_h) \times (\text{DLL}),$$

where γ_{00} is the average intercept (initial status) of classrooms in the sample, γ_{10} is the average linear slope of classrooms, γ_{20} is the average quadratic slope of classrooms with the respective associated effects of classroom quality (ECERS), CTR, and average peer vocabulary (PEER VOC). Note that the Level-3 model did not include random effects for linear and quadratic growth as model selection based on likelihood ratio tests suggested no significant variation at the between-groups level. However, the Level-3 model did include a random effect estimating the variation of classroom-average effects of DLL exposure and a cross-level interaction between DLL exposure and peer vocabulary. This cross-level interaction allowed for an examination of whether classroom peers' vocabulary skills had differential effects on single versus DLLs' initial vocabulary status, growth, and change in growth over time.

Effect Sizes

To estimate standardized effect sizes (ES), all continuous independent variables of interest were z-transformed. The dependent variable was standardized by centering the PPVT scores of all time points on the sample mean at Time 1 divided by the sample SD at Time 1. Thus, the reference point for the intercept in the standardized model version was 0. The ES of the standardized estimates can be interpreted as the shift in the intercept in SD units that would be expected from a 1 SD change in the independent variable.

Confirmatory and Exploratory Analyses

The primary analysis, that is, the full model predicting vocabulary growth in the majority language German, is a confirmatory test of the hypothesized positive relation between growth in DLLs' majority language skills and the level of their classroom peers' majority language skills. Additional analyses should be considered exploratory: (a) moderation effects (by variation in the relative exposure to different languages) and (b) robustness checks excluding the Time 4 data.

All analyses were performed in *R*, version 3.6.0 (R Core Team, 2019) using the packages *lme4* (Bates, Mächler, Bolker, & Walker, 2015) for model estimation, *mitml* (Grund, Robitzsch, & Lüdtke, 2018) for pooling estimates over multiply imputed data sets, and *sjPlot* (Lüdecke, 2018) for data visualization.

Missing Data

Rates of missing data varied by time point of assessment due to sample attrition over time (see Table 1). Dropout analyses revealed that children with PPVT data at Time 4 differed from children who had missing data on the PPVT at Time 4 in terms of higher SES, classroom quality, and vocabulary skills at Time 1, but not with respect to the quality of the home learning environment, age of preschool entry, and peer vocabulary skills (see Table S1). The ES of these comparisons were small ($d < .3$). Missing data at Time 4 were mostly due to decisions of elementary schools not to participate in the study after children had transferred from preschool to elementary school. These facts supported the assumption that missing data patterns were missing at random (MAR) which means that the probability of missing data on a variable X depends on other measured variables, but not on the value of X itself. In the current analyses, missing data were addressed by applying multiple imputation (MI) estimation which is based on the MAR assumption. MI is a state-of-the-art procedure to handle missing data and is generally recommended over simpler procedures such as listwise or pairwise deletion (Enders, 2010). Imputation of multilevel data requires that the multilevel structure must be taken into account in the imputation algorithm (Lüdtke, Robitzsch, & Grund, 2017). Thus, multilevel MI was used based on a joint modeling approach with decomposed within and between-group covariance structures which is

Table 1
Bivariate Correlations and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	*n*	*M*	*SD*	Min	Max	Missing data (%)
1. PPVT score Time 1 (3.7 years)										530	34.2	19.0	0	102	3.1
2. PPVT score Time 2 (4.7 years)	.68***									500	56.1	21.7	0	109	8.6
3. PPVT score Time 3 (5.6 years)	.63***	.69***								430	77.8	22.1	13	153	21.4
4. PPVT score Time 4 (7.1 years)	.56***	.57***	.61***							406	103.3	17.3	22	149	25.8
5. Dual language learner	−.32***	−.36***	−.42***	−.26***						547			0	1	0
6. Socioeconomic status (HISEI)	.30***	.29***	.37***	.32***	−.24***					545	52.5	16.3	16	90	0.4
7. Home learning environment	.25***	.28***	.21***	.21***	−.20***	.24***				536	3.2	0.6	1.7	6.0	2.0
8. Child–teacher ratio	−.08	−.01	.04	−.01	−.12**	.02	.05			543	10.6	4.8	3.2	28.0	0.7
9. Classroom quality (ECERS–R)	.11*	.08	.07	.05	−.12**	.04	.00	.08*		543	4.3	1.1	1.7	6.9	0.7
10. Classroom peers' mean PPVT score	.63***	.44***	.41***	.35***	−.28***	.19***	.14***	−.12**	.18***	547	34.3	12.1	5.0	63.3	0

Note. Minimum and maximum values refer to actual ranges in the sample. Child–teacher ratio refers to the number of children divided by the number of staff present. Home learning environment, child–teacher ratio, ECERS–R and classroom average PPVT scores are based on Time 1 assessment. ECERS–R = Early Childhood Environment Rating Scale (Interaction Factor); HISEI = Highest International Socio-Economic Index; PPVT = Peabody Picture Vocabulary Test.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

implemented in the *R* software package *mitml* (Grund et al., 2018). All variables and covariates which are potentially related to the probability of missing data were included in the imputation model, thereby increasing the plausibility of the MAR assumption (Enders, 2010). Analyses report pooled estimates over 30 imputed data sets.

Results

Preliminary Analyses

Descriptive statistics and zero-order correlations are presented in Table 1. Comparisons of descriptive statistics between single language learners (SLLs) and DLLs are provided in Supporting Information (Table S2). Overall, correlation sizes were high among PPVT scores across time points. DLL status was moderately associated with lower German vocabulary scores and weakly associated with lower SES, quality of the home learning environment, classroom quality, and CTR. Peer vocabulary was weakly associated with SES, quality of the home learning environment, classroom quality, and CTR.

Unconditional Growth Model

Model comparison based on a likelihood-ratio test (LRT) indicated that the unconditional growth model including linear and quadratic slopes of the time predictor as fixed effects provided a better fit than a model including only linear slopes as a fixed effect. Further LRT comparisons revealed that including the variation of linear and quadratic slopes as random effects at the between-persons level significantly improved model fit, but additionally allowing for random variation of linear and quadratic slopes at the between-groups level did not.

In the unconditional growth model (see Table 2, Model 1), there was a significant linear slope ($b = 25.29$, $SE = 0.73$, $p < .001$, 95% range for slopes [12.21, 38.37]) and a significant negative quadratic slope ($b = -1.43$, $SE = 0.19$, $p < .001$, 95% range for slopes [−4.91, 2.05]), indicating that vocabulary test scores increased over time, but gains became smaller over time. Based on the calculation of the ICC, between-persons variation in PPVT scores accounted for approximately 47% of the total random variation in vocabulary scores across time ($\text{ICC} = \sigma^2_{\text{Level 2}}/(\sigma^2_{\text{Level 3}} + \sigma^2_{\text{Level 2}} + \sigma^2_{\text{Residual}}) = 0.47$). Between-groups variation accounted for approximately 11% of the total random variation in vocabulary scores across time.

Peer Effects Growth Model

Results from the growth models excluding peer effects (Model 2) and including peer effects (Model 3) are shown in Table 2. Effects on the intercept in Model 3 indicated a significant negative association between vocabulary skills at age 3.7 years and preschool entry age ($b = -0.26$, $SE = 0.11$, $p < .05$, ES = −0.07) as well as the status as DLL ($b = -8.64$, $SE = 2.07$, $p < .001$, ES = −0.44). Vocabulary skills at age 3.7 years were positively associated with parental SES ($b = 0.16$, $SE = 0.04$, $p < .001$, ES = 0.13), quality of the home learning environment ($b = 3.82$, $SE = 1.20$, $p < .01$, ES = 0.12), and classroom peers' average vocabulary skills ($b = 0.51$, $SE = 0.07$, $p < .001$, ES = 0.32). There was a significant positive linear change ($b = 25.52$, $SE = 0.79$, $p < .001$, ES = 1.34) and a negative quadratic change ($b = -1.53$, $SE = 0.22$, $p < .001$, ES = −0.08) in vocabulary skills over time. SES and DLL status related to both linear change (SES: $b = 0.12$, $SE = 0.05$, $p < .05$, ES = 0.10; DLL: $b = -5.24$, $SE = 2.10$, $p < .05$, ES = −0.26) and quadratic change in PPVT scores (SES: $b = -0.03$, $SE = 0.01$, $p < .05$, ES = −0.02; DLL: $b = 1.49$, $SE = 0.50$, $p < .05$, ES = 0.08). Thus, children from higher SES backgrounds and German-only SLLs showed larger gains, but for those children gains became smaller over time.

Model 2, which did not include a peer effects predictor, indicated that the effect of DLL status on linear slopes varied differentially over classrooms (DLL: $b = -5.88$, $SE = 1.96$, $p < .01$, 95% range for slopes [−19.37, 7.61]). A negative correlation between the classroom random intercept and the random slopes effect of DLL status in Model 2 ($r = -.67$) showed that in classrooms with higher initial average PPVT scores the difference in linear growth between DLLs and German-only SLLs was substantially smaller. Including peer vocabulary skills as a predictor into the model (Model 3) explained 72% of the DLL effects variance between classrooms. Moreover, a significant cross-level interaction between DLL status and peer vocabulary revealed that the effect of peer vocabulary skills on linear growth was stronger for DLLs compared to German-only SLLs ($b = 0.10$, $SE = 0.04$, $p < .05$, ES = 0.06). Figure 1 displays SLLs' and DLLs' growth trajectories over time and in relation to their classroom peers' vocabulary skills. A three-way interaction with the quadratic time predictor (age^2 × peer vocabulary × DLL) was not significant and therefore not included in the final model.

Table 2
Results from Multilevel Growth Curve Models

	Model 1		Model 2		Model 3		
	Est.	(*SE*)	Est.	(*SE*)	Est.	(*SE*)	ES
Fixed effects							
Intercept	29.38***	(0.93)	30.08***	(1.08)	30.39***	(1.04)	
Gender (female = 1)			0.61	(1.12)	0.71	(1.06)	0.04
Preschool entry age			−0.21	(0.11)	−0.26*	(0.11)	−0.07
Child care attendance			2.56*	(1.17)	2.35*	(1.15)	0.12
HLE			4.45***	(1.25)	3.82**	(1.20)	0.12
SES			0.20***	(0.04)	0.16***	(0.04)	0.13
DLL status (DLL = 1)			−9.99***	(2.00)	−8.64***	(2.07)	−0.44
Classroom quality			1.45*	(0.65)	0.96	(0.60)	0.05
Child–teacher ratio			−0.25	(0.14)	−0.06	(0.13)	−0.02
Peer vocabulary					0.51***	(0.07)	0.32
Peer vocabulary × DLL					−0.19	(0.14)	−0.12
Age (linear slope)	25.29***	(0.73)	26.44***	(0.83)	25.52***	(0.79)	1.34
Age × HLE			0.62	(1.42)	0.50	(1.37)	0.03
Age × SES			0.10*	(0.05)	0.12*	(0.05)	0.10
Age × DLL			−5.88**	(1.96)	−5.24*	(2.10)	−0.26
Age × classroom quality			−0.02	(0.68)	−0.22	(0.69)	−0.01
Age × child–teacher ratio			0.20	(0.14)	0.17	(0.14)	0.05
Age × peer vocabulary					−0.10	(0.07)	−0.06
Age × peer vocabulary × DLL					0.11*	(0.05)	0.06
Age^2 (quadratic slope)	−1.43***	(0.19)	−1.74***	(0.21)	−1.53***	(0.22)	−0.08
Age^2 × HLE			−0.38	(0.36)	−0.23	(0.34)	−0.01
Age^2 × SES			−0.03*	(0.01)	−0.03*	(0.01)	−0.02
Age^2 × DLL			1.30**	(0.49)	1.49**	(0.50)	0.08
Age^2 × classroom quality			−0.04	(0.17)	0.03	(0.18)	0.00
Age^2 × child–teacher ratio			−0.05	(0.04)	−0.05	(0.04)	−0.01
Age^2 × peer vocabulary					0.01	(0.02)	0.00
Random effects							
Level 1 (within-persons)							
Residual	134.69		135.58		132.60		
Level 2 (between-persons)							
Intercept	106.83		77.34		66.12		
Age	42.81		30.03		31.80		
Age^2	3.01		1.98		2.13		
Level 3 (between-groups)							
Intercept	36.53		2.21		0.10		
DLL			45.52		12.85		

Note. Results from models with unstandardized dependent and independent variables. Model 3 additionally shows effect sizes based on standardized dependent and independent variables. Est. = estimate; ES = effect size; DLL = dual language learner; HLE = home learning environment; SES = socioeconomic status.
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

Effects of Variation in Dual Language Exposure

To examine the effect of relative exposure to different languages on DLLs' German vocabulary growth, subsample analyses for DLLs were conducted. Model comparisons based on LRT revealed that the unconditional growth model including linear slopes provided a better fit than a model additionally including nonlinear (quadratic) slopes. Predictors were held constant compared to the full sample growth model except that the categorical predictor "DLL status" was replaced by the predictor for relative language exposure at home (centered on DLLs' mean of that variable). A significant effect of peer vocabulary on the slope predictor ($b = 0.07$, $SE = 0.03$, $p < .05$) corroborated evidence

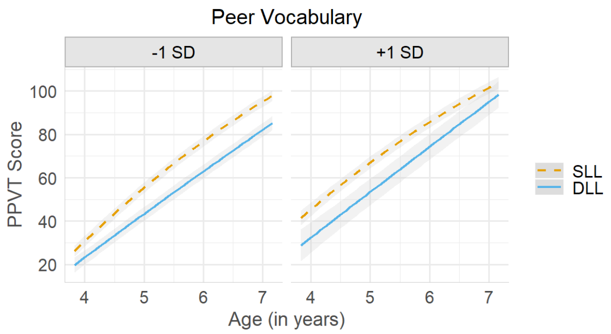

Figure 1. Predicted average growth in German vocabulary for SLLs (German-only) and DLLs moderated by classroom peers' vocabulary level.
Note. SLL = single language learners (German-only); DLL = dual language learners; PPVT = Peabody Picture Vocabulary Test. [Color figure can be viewed at wileyonlinelibrary.com]

that DLLs in classrooms with higher peer majority language skills showed larger gains over time. Results furthermore indicated that higher exposure to a language other than German at home was associated with lower initial German vocabulary scores at age 3.7 years ($b = -6.71$, $SE = 1.69$, $p < .001$). However, variation in relative language exposure did not moderate linear growth ($b = 0.43$, $SE = 0.43$, $p = .32$), the effect of peer vocabulary skills on linear growth ($b = 0.01$, $SE = 0.03$, $p = .84$), or any other predictor (for details, see Table S4).

Robustness Checks

Assessment at Time 4 in the study occurred 3 to 4 months after children had transferred from preschool to elementary school. Thus, part of the peer effect for DLLs observed in the analyses might not be attributed to DLLs' preschool peers, but their elementary classroom peers instead. However, re-running the growth model with data from only the first three time points of assessment (all during preschool) revealed a similar cross-level interaction between DLL status and peer vocabulary skills ($b = 0.21$, $SE = 0.09$, $p < .05$, ES = 0.12). This "T1–T3 growth model" did not include nonlinear change (as a result of LRT model comparisons), but replicated the significant cross-level interaction while all other predictors were held constant.

Discussion

This study investigated growth trajectories in vocabulary skills in the majority language German for children from linguistically and socioeconomically diverse preschool classrooms over 3 years. DLLs showed smaller gains in German vocabulary over time than their monolingual peers. Crucially, this effect varied between classrooms and was dependent on the vocabulary skill level of classroom peers. In comparison to monolingual children, DLLs in peer groups with higher levels of German vocabulary skills improved at a faster rate than DLLs in classrooms with lower average peer-level skills. Importantly, these effects were observed above and beyond differences related to the age of preschool entry, SES, and the home learning environment, all of which have been linked to the majority language gap between single and DLLs (Ebert et al., 2013; Hoff, 2013; Yazejian et al., 2015). In sum, the results from this study support the assumption that peers play a moderating role for DLLs in gaining stronger majority language skills by the time they enter elementary school.

Overall, and in accordance with previous research, DLLs had smaller majority language vocabularies at preschool entry and initially showed smaller gains compared to their monolingual peers (Hammer et al., 2014; Kohl et al., 2019; Yazejian et al., 2015). However, DLLs showed a continued linear growth dynamic during later stages of the preschool period compared to German-only SLLs whose growth rates decelerated over time. More importantly, the difference between DLLs' and German-only SLLs' growth dynamics was dependent on the classroom language context related to peers. In comparison, DLLs improved at a faster rate among classroom peers with higher levels of German vocabulary skills. As a result, the difference in the shapes of change over time led to a trend of convergence between DLLs and monolingual children in these contexts. Thus, the emerging convergence around the age of school entry was partly driven by monolingual children's decelerating growth rates and simultaneously by DLLs' stronger growth in classrooms with higher peer vocabulary skills. It is noteworthy that the finding of decreasing growth rates is consistent with previous longitudinal analyses of PPVT data which found strong linear effects of growth in early childhood that begin to decelerate during middle childhood (Rice & Hoffman, 2015). Interestingly, variance in nonlinear change in this study was not explained by classroom-level predictors, but entirely by learner status. While monolingual children's growth rates decreased, DLLs showed no deceleration in the observed age range.

Particularly relevant to the objective of this study was the fact that the observed DLL effects varied substantially between classrooms. This finding is noteworthy as it shows that factors associated with DLLs' preschool environments may potentially explain some of the differences in majority language skills not only in the initial status but also in growth rates over time. Previous research from the German ECE context based on cross-sectional data found positive associations between levels of DLLs' German vocabulary skills and classroom process quality (Kohl et al., 2019; Willard et al., 2019). Analyses of longitudinal data, on the other hand, did not reveal differential quality effects for DLLs in German preschools (Ebert et al., 2013; Schmerse et al., 2018). The findings of this study are in line with the latter results. In the growth models, there were no significant DLL × Classroom Quality interactions with linear or nonlinear change, respectively. In fact, their classroom peers' skills in the majority language were more relevant to DLLs' gains in German vocabulary scores. Including peer vocabulary skills into the model explained 71% of the variation in DLL effects between classrooms.

Another finding that emerged from including peer vocabulary skills into the model was a reduction in the effect of classroom quality on the initial status of children's German vocabulary skills. Thus, at the outset of the study children in classrooms with higher peer-level skills also experienced higher classroom quality. However, the nature of this association is not quite clear. One interpretation might point to a potential mediational role of peers' language skills for effects of classroom process quality in the sense that higher classroom quality may benefit a child indirectly by elevating the language levels of all (or most) of their peers in the classroom. The direction might also be reversed, that is, higher average language skills in the classroom might enable teachers to provide higher process quality. Such a strong interpretation, however, seems unlikely given the fact that the observed quality effect occurred only for the initial status and not for the growth of vocabulary skills. A more cautious interpretation suggests that the association reflects a selection effect of children with higher language skills into higher quality preschools. As mentioned before, disparities in access to higher quality preschools might limit their potential impact, particularly for DLLs and socioeconomically disadvantaged children who disproportionally experience such disparities (Bassok & Galdo, 2016; Willard et al., 2019).

Similarly, unmeasured neighborhood effects may have contributed to the current findings as well. Research shows that DLLs are more likely to attend preschool classrooms with other children who also have a minority language background. This holds for both the United States as well as the German ECE context (Becker & Schober, 2017; Garcia, 2018). This nonrandom selection into preschool contexts reflects the fact that institutional differences between preschools are systematically associated with the family backgrounds of the children who attend them (Duncan & Raudenbush, 1999). This may include, among other factors, differences in learning environments outside the classroom context but may also comprise differences in parental involvement or family-preschool partnerships (Hachfeld, Anders, Kuger, & Smidt, 2016).

A notable strength of this study is its longitudinal design covering an important developmental period of children's language learning. Unlike many peer effects studies that rely on relatively short periods of less than a year, the current analyses allowed for comparisons of developmental trajectories of SLLs and DLLs over the preschool years as a function of the peer language context. The growth trajectories across the 3.5-year period indicated that for DLLs in peer groups with higher German vocabulary skills, the difference in majority language skills compared to monolingual children in the study was narrowing. At the same time, for DLLs in peer groups with lower German vocabulary skills the difference was widening. Thus, the present results support the assumption that preschool peers might be particularly relevant to DLLs' second language skills (Atkins-Burnett et al., 2017). This interpretation is also strengthened by observational data showing that DLLs interact frequently with their DLL peers in the majority language (Jahreiß et al., 2018). This fact may be less surprising for German preschool classrooms where most DLLs have relatively few opportunities to interact with same-language peers (Kohl et al., 2019). Yet, majority language interactions among DLLs also frequently occur in classrooms in which DLLs share a common home language with most of their peers (Franco et al., 2019). In sum, the findings from this investigation suggest that for DLLs, the growth rates in building a majority language vocabulary significantly depend on the peer context.

Limitations

The findings obtained should also be considered against some limitations concerning the interpretation of these results. The first issue relates to the interpretation of compositional effects more generally. Various assumptions have been made about the processes underlying compositional effects, including processes at the peer level (e.g., peer-to-peer interactions, group-based norms; Wilkinson, Parr, Fung, Hattie, & Townsend, 2002), the institutional level (e.g., covariation of classroom quality and composition; Kuger et al., 2016), and the regional level (e.g., variation in resources and parental involvement across neighborhoods; Duncan & Raudenbush, 1999). In nonexperimental studies, these levels are frequently interrelated. Therefore, biases in estimating peer effects that arise from institutional effects and the nonrandom parental selection of preschool contexts require adequate control measures (Duncan & Raudenbush, 1999). A notable strength of this study is that it does include such control variables capturing socioeconomic, parenting, and classroom characteristics. However, attributing the observed compositional effect to actual peer interactions remains more challenging. Although the group-average level of peer competency is compatible with the idea of peer-to-peer interactions as a driving mechanism, compositional effects based on aggregated variables neither capture the more fine-grained peer networks that children engage in, nor are they able to differentiate between more proximal processes (peer interactions) and more indirect processes such as group-based norms or motivational orientations (Wilkinson et al., 2002). Nevertheless, aggregated measures of peer competency (Justice et al., 2011), social network analyses (DeLay et al., 2016), and aggregated measures weighted by the individual frequency of peer interactions (Chen et al., 2020) all provide converging evidence for the pivotal role of peers in early language development.

A second issue relates to the measures of the home learning environment and DLLs' language exposure. This study employed both a dichotomous variable to classify the status as a DLL as well as a numerical variable that accounted for DLLs' relative exposure to German versus another language at home. Alternatively, a more fine-grained measure based on detailed exposure time information (in hours per day) might have provided a more accurate assessment. Such temporal estimates of exposure moderately correlate with naturalistic measures of DLLs' language input in their home environment (Marchman et al., 2017). Relatedly, the operationalization of the HLE measure was confounded with parents' status as non-native speakers of German. Parents who referred to themselves as native speakers of a language other than German were disadvantaged in receiving higher scores on the measure because their level of proficiency in German was potentially confounded with the rating. The data did not contain self-report items assessing parents' proficiency in German to further investigate this possibility. The potential bias may thus have overestimated the DLL effect on the intercept, but is unlikely to have affected the estimation of growth parameters or peer effects.

Third, measuring DLLs' vocabulary solely based on a test in the majority language underestimates their vocabulary skills across languages. A conceptual scoring approach that combines DLLs' vocabulary in their first and second language would have accounted for this fact. However, such an approach might only be suitable in a situation where the majority of DLLs in the sample share a common home language or comparable standardized tests in each home language are available. With a total of 32 different home languages spoken among the 107 DLL families in the sample, these conditions were not met in this study. Future research assessing the first and second language skills of DLLs across a broader range of different home languages is needed to better understand whether peer language skills may exhibit differential effects on DLLs' two languages.

Fourth, the study lacked more detailed information about within-classroom processes that are pivotal to conclusively establishing the mechanism underlying peer effects. For example, measuring the frequency and structure of different types of classroom activities could be helpful in understanding (a) whether language experiences for children differ based on their DLL status or language levels and (b) whether different classrooms offer different opportunities for children to interact with peers (Sawyer et al., 2018). Finally, measuring individual differences in the intensity of interactions among children of varying language levels seems essential for better understanding the operational mechanism of peer effects (Chen et al., 2020; DeLay et al., 2016).

Conclusion

In summary, the findings from this investigation suggest that for young DLLs the growth rates in acquiring a majority language vocabulary and the chances of narrowing the majority language gap significantly depend on the peer context. The study adds to a growing body of research that underlines the importance of facilitating peer interactions in ECE settings. Recognizing that peers contribute to DLLs' societal language learning recommends professional development of early childhood educators regarding strategies to incorporate collaborative peer learning across ability levels and different language backgrounds. Such strategies may include systematically organizing activities in ways that promote language use among peers in large and small group interactions. Strategies may also involve pairing children of different societal language levels in collaborative tasks and helping them to engage with each other by encouraging, demonstrating, and scaffolding conversations.

The results also highlight the crucial role of time spent in early peer contexts for building a majority language vocabulary. Adding to the knowledge that entering preschool early has more positive effects for DLLs, this study furthermore illustrates that their acquisition of a societal language vocabulary shows a stronger growth dynamic during later stages of the preschool period compared to monolingual children. Future research should address how the composition of peer groups in both preschool and later in elementary school act together on shaping the developmental trajectories of DLLs.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Table S1. Comparisons Between Participants With and Without Missing Data at Time 4 (Welch's *t*-Tests)

Table S2. Comparisons (Welch's *t*-Tests) of Single Language Learners German Only and Dual Language Learners

Table S3. Parent Report Items on Relative Language Exposure at Home for Dual Language Learners ($n = 107$)

Table S4. Results From Multilevel Growth Curve Models for DLL Subsample