Differential effects of home and preschool learning environments on early language development

Daniel Schmerse[a],[*], Yvonne Anders[b], Manja Flöter[c], Nadine Wieduwilt[b], Hans-Günther Roßbach[d] and Wolfgang Tietze[b],[c]

[a]*Leibniz Institute for Science and Mathematics Education, Kiel, Germany;* [b]*Freie Universität Berlin, Germany;* [c]*PädQUIS gGmbH – Collaborative Institute of Alice Salomon University of Applied Science, Berlin, Germany;* [d]*University of Bamberg, Germany*

The present study is based on longitudinal data from a German early childhood education and care (ECEC) governmental initiative assessing children's grammatical and vocabulary development between 2;6 and 4;0 years ($N = 1,331$), quality of the home learning environment and quality of the preschool setting. Results showed that the quality of the home learning environment predicted development in grammatical skills, but not in receptive vocabulary at age 4, while the effects of preschool process quality showed similar relative impacts on both language outcomes. Further analyses revealed effects of accumulated advantages of preschool quality for children from medium- and high-quality home learning environments in their vocabulary development. The results are compared with previous findings from the German ECEC context and discussed with respect to implications for policy efforts to improve ECEC quality and ways in which both learning environments act together on children's development.

Keywords: home learning environment; ECEC quality; language development

Introduction

Children's language development is fundamentally shaped by their learning environments[1] (Hoff, 2003; Tomasello, 2006; Kuhl, 2011; Fernald *et al.*, 2013). During early childhood the family and the setting of early childhood education and care (ECEC) constitute primary learning environments for children, and the quality of the processes within these environments is associated with children's outcomes for language development (Hart & Risley, 1995; Bronfenbrenner & Morris, 1998; NICHD Early Child Care Research Network, 2003).

On average across OECD countries around 35% of children below the age of 3 years participate in some form of childcare and during the last decade the increase in participation has been particularly pronounced in Germany, with an 18.7% growth between 2006 and 2014 (OECD, 2014). The expansion of ECEC, especially for

---

Corresponding author. Leibniz Institute for Science and Mathematics Education (IPN), Olshausenstraße 62, 24118 Kiel, Germany. E-mail: schmerse@ipn.uni-kiel.de.

children below the age of 3 years, with a growing number of children and families coming from diverse cultural and linguistic backgrounds, has led to new demands for providing high-quality early childhood education in Germany in recent years (Federal Ministry of Family Affairs, Senior Citizens, Women and Youth, 2013). In particular, professional development of domain-specific process quality to promote children's language competency has been the primary focus of attempts to meet these demands, since language and literacy competencies are considered to be of major importance for school readiness and later academic success (NICHD Early Child Care Research Network, 2005; Duncan *et al.*, 2007).

Accordingly, recent developments in Germany in the realm of early language and literacy education mark a turn away from programme-based interventions which have proven to be of little effect (Wolf *et al.*, 2011; Lee *et al.*, 2014) towards a specific concept of embedding early language education into daily routines and activities such as meal times, pretend play or book reading, and emphasising the use of child-centred communicative strategies and various language modelling techniques in order to provide models of more advanced oral language and emergent literacy knowledge (Dickinson & Tabors, 2001; Girolametto *et al.*, 2003).

The current study addresses the impact of early language education embedded into daily routines on children's development, based on a sample of 335 day care centres including 258 centres from the initiative *core day care centres language & integration* ('Schwerpunkt-Kitas: Sprache & Integration'), which was specifically set up to enhance early language and literacy promotion (Anders *et al.*, 2014). As part of the initiative, the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth has provided around 500 million euros over the course of five years from 2011 to 2015 for staff and professional development in 4,000 day care centres throughout Germany. The day care centres involved were allowed to appoint an additional professional staff member qualified to promote language learning, especially in children below age 3 and children with a native language other than German, or from educationally disadvantaged families.

In light of the fact that children's language development is shaped by their learning environments, we turn to a brief review of influential factors from both the home learning environment and the ECEC setting in the subsequent subsections before spelling out the research questions.

Contributions of family background and home learning environment to language development

Various structural indicators of children's family background [e.g. home language, parental socio-economic status (SES) or maternal education] are associated with developmental outcomes (Bradley & Corwyn, 2002). With respect to parental SES, in-depth analyses of children's linguistic environment have shown that its quantity (e.g. number of words or sentences per hour/day) and its quality (e.g. sentence complexity, lexical diversity, use of prohibitions vs. declaratives) is closely related to parental SES and children's verbal abilities (Hart & Risley, 1995; Hoff, 2003). Disparities in children's language skills that are linked to structural indicators of children's family background are already in place before the age of 2. For example,

Fernald *et al.* (2013) found significant differences in speed of processing words in fluent speech, as well as in vocabulary skills, between children from lower- and higher-SES families at 18 months of age. By 2 years of age, disparities in these language skills already showed a 6-month gap between the two groups. However, there is also some evidence for considerable variability among low-SES families in how much speech parents address to their child, thus mediating the link between parental SES and early language processing skills (Weisleder & Fernald, 2013).

In addition to structural indicators of family background, more proximal process indicators, referred to as home learning environment (HLE), contribute to a child's development (Melhuish *et al.*, 2008) and are often hypothesised to play a mediating role in the close link between SES and children's developmental outcomes. Large-scale studies, such as the Effective Provision of Pre-School Education (EPPE) study, have demonstrated that creating informal learning opportunities in the home and parental involvement in activities such as reading to their child, teaching nursery rhymes, verbalising intentions, emotions and actions, or playing with phonemes, words and letters has significant influence on children's language development in addition to (and even exceeding) the influence of structural indicators such as maternal education, occupational status or parental SES (Melhuish *et al.*, 2001). Nevertheless, structural indicators of family background are frequently associated with the quality of the home learning environment in such a way that stimulating activities and educational processes are taking place less frequently in educationally and socio-economically disadvantaged families, leading to substantial differences in language learning opportunities created for young children in their homes (Shonkoff & Phillips, 2000; Bradley & Corwyn, 2002; Niklas & Schneider, 2013). There is also evidence that different dimensions of HLE (quality of parent–child interaction, storybook exposure, direct instruction) might contribute differentially to language outcomes such as vocabulary, grammar or emergent literacy in the preschool years (Lehrl *et al.*, 2012).

Contributions of ECEC quality to language development

A large number of studies indicate that high-quality ECEC is a key factor for long-term effects on children's language and cognitive development (Barnett, 1998, 2011; Shonkoff & Phillips, 2000; Jacob *et al.*, 2004; Mashburn *et al.*, 2008). For example, Sylva *et al.* (2011) report on the basis of data from the British EPPE study that high-quality ECEC in comparison with low-quality ECEC has similar positive effects on children's mathematical and language outcomes until the age of 11. Furthermore, these authors found that at age 11, but not during the preschool phase, children from educationally disadvantaged homes who attended high-quality ECEC benefit more than children from disadvantaged homes who attended low-quality preschools or had no preschool experience.

More recently, in a meta-analysis of studies on European ECEC, Ulferts and Anders (2016) assessed the impact of quantitative and qualitative aspects of ECEC on children's outcomes, including cognitive, language, social, emotional and educational development. One key finding of the analysis was that quality effects vary by outcome domain and partly by measure of ECEC quality. For instance, the authors found stronger associations between developmental outcomes and ECEC quality

measures that are interaction-focused (i.e. as measured by CLASS; Pianta *et al.*, 2008) than those additionally including ratings of material surroundings in their overall quality ratings (i.e. ECERS-R; Harms *et al.*, 1998). With respect to the domain-specificity of quality effects, the findings of Ulferts and Anders (2016) revealed that global process quality tended to be more strongly associated with language and literacy outcomes than with mathematical outcomes. The results of the meta-analysis furthermore confirmed the view that aspects of structural quality are prerequisites and predictors of process quality and are linked indirectly to children's development. Another key finding was that most European studies report either that during the preschool phase all children benefit equally from higher quality or that disadvantaged children do not benefit equally from higher quality compared with their peers from less disadvantaged backgrounds. For the domain of language development, for example, a Portuguese study by Abreu-Lima *et al.* (2013) found significant interaction effects for preschool process quality (assessed by ECERS-R) and maternal education on children's vocabulary skills, indicating greater benefits for children from educationally more advantaged homes.

Considering the context of German ECEC more specifically, Ebert *et al.* (2013) looked at preschool and HLE influences on vocabulary development. Based on data from the German BiKS study (Educational Processes, Competence Development and Selection Decisions in Preschool and School Age), these authors did not find overall effects of structural or processual measures of preschool quality on vocabulary growth. Neither domain-specific quality as measured by the ECERS-E subscale *literacy* (Sylva *et al.*, 2003) nor a special focus on language promotion, smaller class sizes or reduced child–staff ratio revealed a significant impact on vocabulary growth. In parallel with these findings for the domain of vocabulary skills, Weinert and Ebert (2013), using data from the BiKS study, found that neither quality of the home learning environment (assessed by HOME; Caldwell & Bradley, 2001) nor ECEC quality (assessed by ECERS-E subscale *literacy*) predicted growth in grammatical skills between 4 and 6 years of age, a language domain which has been argued to be less susceptible to environmental influences (Vasilyeva *et al.*, 2008). However, the results of the BiKS study did indicate that monolingual German-learning children's initial level in grammatical skills at first assessment was associated with socio-economic indicators of family background and quality of the home learning environment at 42 months of age (Weinert & Ebert, 2013). For children with a home language other than German, higher ECEC quality was associated with vocabulary skills at age 3 (Ebert *et al.*, 2013). In a cross-sectional Germany-wide investigation, Tietze *et al.* (2013) looked at associations between children's vocabulary development and process quality in two samples of 2- and 4-year-olds. However, they did not find significant associations either for global measures of quality (ECERS-R total score) or for domain-specific measures (ECERS-E total score).

The current study

In sum, within the context of the German ECEC system, studies have not found quality effects for language outcomes in the preschool years so far, and across different ECEC systems there are incongruent findings on the question of whether children

benefit differently from higher ECEC quality depending on their family background or the quality of their home learning environment. Addressing both of these issues, the present study, based on a large-scale sample of 335 day care centres and 1,331 children and their families, examines (a) to what extent the quality of HLE and ECEC influences both children's grammatical and vocabulary development between 2;6 and 4;0 years of age and (b) whether HLE and ECEC quality have similar effects on the developmental outcomes of different groups of children (i.e. children with a home language other than German or children from home learning environments of different qualities).

Since most research addressing the impact of the quality of children's learning environments on their language development has focused on vocabulary skills, and much less on grammatical skills (Zauche *et al.*, 2016), comparisons between both grammatical and vocabulary skills provide valuable insights regarding the relation between learning environment and language development (Weinert & Ebert, 2013). We therefore assess both outcomes in order to answer the question of whether home and preschool learning environments yield similar relative impact on these two central facets of language competence between 2;6 and 4;0 years of age.

The conceptual framework underlying the present study is the *structure–process model of educational quality* (Kluczniok & Rossbach, 2014), which is widely adopted in longitudinal studies on the impact of home and ECEC quality on children's development (Cryer *et al.*, 1999; NICHD Early Child Care Rsesearch Network, 2002; Sylva *et al.*, 2004) and distinguishes four major dimensions of quality, namely structural characteristics, orientation quality, process quality and quality of teacher–parent collaboration (Pianta *et al.*, 2005; Kluczniok & Rossbach, 2014). It is assumed that process quality has a direct influence on children's outcomes, whereas structural characteristics and orientation quality provide the prerequisites and predictors for process quality, thus impacting children's development indirectly (NICHD Early Child Care Research Network, 2002), and that quality dimensions can be identified within the institutional setting as well as within the home setting (Kluczniok *et al.*, 2013).

Method

Sample

In total, $N = 335$ day care centres were recruited Germany-wide and participated in assessment 1 (spring 2013), of which 328 day care centres also participated in assessment 2 (spring 2014). Centre managers in these settings were predominantly female (95.5%) and had on average 23 years of professional experience (including 13 years as centre manager). The majority (65%) finished 5-year vocational training, 25% held an academic certificate and 10% had other non-academic professional training. For each centre, one day care group was chosen in order to assess language- and literacy-specific process quality, children's language development as well as the quality of children's home learning environment and information on family background (home visits). Per group, four children and their families were recruited for participation. In total, $N = 1,331$ children (49.5% female) and their families participated in assessment

1, of which $N = 1,123$ also participated in assessment 2. Children's average age of entry into day care was 17 months.

Measures

Outcome measures.   Children's German language skills were tested using tests for receptive vocabulary (German version of the Peabody Picture Vocabulary Test, PPVT; Dunn & Dunn, 2007) and reception of grammar (i.e. subscale *sentence comprehension* of the German language development test for 3- to 5-year-olds, SETK 3-5; Grimm *et al.*, 2010 and subscale *verb–argument constructions* of the German test of sentence comprehension in children, TSVK; Siegmüller *et al.*, 2011). The version of the PPVT contained 40 test items on the first assessment and 60 items on the second assessment, the TSVK contained 12 test items and the SETK 3-5 contained 22 test items. All testing was conducted during home visits by trained interviewers according to a standardised procedure and lasted for 20 to 30 minutes.

All three tests (PPVT, SETK 3-5 and TSVK) made use of the same testing procedure, that is children were presented with a verbal stimulus (word or sentence) while being shown a set of different pictures, one of which matched the verbal stimulus. Children were asked to point to the picture that corresponded to the verbal stimulus. If children did not react initially, the interviewer repeated the stimulus once. If children repeatedly did not react, the interviewer went on to the next item. In addition, the subtest *sentence comprehension* of the SETK contained 10 final test items for which children were asked to carry out an action expressed by the test item (e.g. 'Put the buttons that are red on top of the box'). If children failed to perform actions on two such consecutive items, testing was aborted in order to spare children from feelings of frustration and non-compliance in future testing situations.

One important advantage of testing grammatical skills receptively is that children can be tested at younger ages (starting around 2 years) and that children do not have to formulate sentences themselves, which they may not do due to shyness or unfamiliarity with the interviewer. Moreover, receptive testing of grammar is particularly suited for assessing larger sample sizes, because it can be administered in minimum time, does not require transcription or linguistic analyses and thus represents an economic way to assess children's language skills. TSVK and SETK subscale scores were summed to form a composite termed *sentence comprehension* (34 test items) for further statistical analysis.

Predictors

Child characteristics.   The characteristics of the child included gender, age in months and non-verbal cognitive skills. The mean age of children was 2 years and 10 months (2;10) at the first assessment and 4;0 at the second assessment. Children's cognitive development was assessed with the mosaic test from the German version of the Wechsler Preschool and Primary Scale of Intelligence-III (HAWIVA-III; Ricken *et al.*, 2007).

Family characteristics.   The set of family background variables was chosen in accordance with other large-scale studies on home and preschool influences on children's development (Sylva *et al.*, 2010; Anders *et al.*, 2012). The selection of variables was further validated through pre-analyses that ensured sufficient consideration of family characteristics while being economical in order to minimise potential collinearity issues. The characteristics of family background included maternal education, income and children's home language. These data were obtained through interviews with parents in their homes. Interviews were paper-and-pencil-based and conducted in German ($n = 1,237$), Russian ($n = 33$), Turkish ($n = 38$) or English ($n = 13$). Non-German interviews were conducted by native speakers of the respective language who also had native or near-native language proficiency in German. The status of home language was assessed by asking in which language the parent interviewed (as well as their partner) predominantly spoke to the child at home. For 75.0% of the children, German was the language spoken predominantly at home (i.e. by both parents) and in 24.5% of the families at least one parent did not speak German to the child. Maternal education was assessed by asking for the mother's highest school degree. Responses were categorised on a four-point scale (1 = no degree, 4 = completed upper secondary education). In addition, parents were asked to provide an estimate of last month's net household income (in euros).

Home learning environment.   The measures of HLE included indicators of early language and literacy promotion assessed by (a) a specially constructed questionnaire and (b) selected items of the Early Childhood Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 2001). The questionnaire (HLE) included 15 items addressing the frequency of literacy- and language-promoting activities between parents and children, as well as the frequency of joint usage of language-promoting materials. Parents rated on a seven-point scale (1 = daily, 7 = never; reversed scores) how often they engaged in joint activities such as picture book reading, pretend play, nursery rhymes, library visits, etc. (e.g. 'How often do you and your child play language games such as guessing games or finger and clapping games?'). The items were based on instruments used in the EPPE study (Sylva *et al.*, 2004), the German BiKS study (von Maurice *et al.*, 2007) and the German National Educational Panel Study (Blossfeld *et al.*, 2011). The observation items of the HOME measure included presence of literacy-related materials (two items), as well as items tapping the interactional quality between mother and child (five items).

Structural characteristics of the ECEC setting.   The structural characteristics of the ECEC setting included child–staff ratio, mean age of children in the group and proportion of dual-language learners (DLL) per group (i.e. children whose home language was not German).

Process quality.   To assess process quality, the German version of the Early Childhood Environment Rating Scale-Revised Edition (ECERS-R; Harms *et al.*, 1998; Tietze *et al.*, 2007) was used. The present analyses are based on the ECERS-R subscale *language-reasoning*, since this measures domain-specific quality aspects with respect to the promotion of verbal skills. The scale comprises four items (books and

pictures, encouraging children to communicate, using language to develop reasoning skills and informal use of language) assessing the quality of language and book use in the classroom. Quality assessment was conducted by specially trained observers in children's ECEC classrooms. Each observation lasted for about 2 to 4 hours. Following the observation, each classroom teacher was interviewed to obtain information on educational processes that could not be observed directly during the visit.

Statistical analyses

We examined the research questions outlined above by regression analyses performed in Mplus (Muthén & Muthén, 2012) using full information maximum likelihood (FIML) estimation. FIML estimation uses the complete observed information matrix in order to compute the standard errors for the parameter estimates. In our models we assume that child language outcome at age 4;0 is a function of variables representing the quality of home learning environment and preschool plus time-invariant child and family characteristics. In order to reduce omitted-variable bias in the regression coefficients and to account for children's prior performance on language outcomes at age 4;0, we included the child's performance on vocabulary testing at age 2;10 if the dependent variable was receptive vocabulary and the child's performance on sentence comprehension tests at age 2;10 if the dependent variable was sentence comprehension.

Children's language skills were predicted stepwise first by child factors and family background factors (Model 1), then by measures of the home learning environment (Model 2) and finally by measures of preschool quality including structural aspects as well as process quality (Model 3). This was done separately for the outcome measures receptive vocabulary and sentence comprehension at age 4;0. In a second step, we performed additional analyses modelling potential moderator effects that could emerge from children's home language or home learning environments. Thus, we extended Model 3 by including two interaction terms each: one interaction term between home language and process quality and one interaction term between home learning environment and process quality. To model the clustered structure of the data, we used cluster robust standard error estimation (McNeish *et al.*, 2017). Before turning to the model results, we outline the descriptive findings for the full sample.

Results

Descriptive results

Table 1 shows descriptive statistics and bivariate correlations for the outcome measures, child and family background factors, the aggregated scales assessing quality of the home learning environment, as well as preschool factors (structural characteristics and process quality). The results showed that children's mean scores for receptive vocabulary and sentence comprehension increased significantly over time. Regarding process quality, the range of possible ECERS-R ratings was 1–7, with preschool classrooms rated lower than 3 considered as being of low quality, those rated between 3 and 5 of medium quality, and those rated 5 and above of high quality (Harms *et al.*,

1998). According to this classification, ratings for the present sample were on average of high quality.

For subsequent analyses, we examined bivariate correlations between all predictor variables in order to detect potential issues of multicollinearity. No indicators of multicollinearity issues were found, with most correlations being low to moderate. Predictor variables included in interaction terms were grand-mean-centred.

Effects of family background and home learning environment on vocabulary and grammatical development

As shown in Table 2, all structural indicators of family background revealed significant effects on both vocabulary and sentence comprehension skills at 48 months, controlling for prior competence at 34 months. Overall, the effect of family background was similar for vocabulary and grammatical development.

The quality of the home learning environment yielded differential effects on vocabulary and grammatical development. Receptive vocabulary at 48 months was not predicted by the self-reported frequency of language-promoting activities between parents and children (HLE, Model 3), whereas HLE significantly predicted sentence comprehension scores at 48 months (Model 3, $\beta = 0.114$, $p < 0.001$). The aggregated score for selected items of the HOME measure (presence of literacy-related materials and observed interactional quality) did not predict vocabulary at 48 months and showed a trend towards significance for grammatical development ($\beta = 0.056$, $p = 0.098$).

Effects of ECEC quality on vocabulary and grammatical development

With respect to structural characteristics of the preschool setting, child–staff ratio, the proportion of dual-language learners and the mean age of the group were taken into account. The results showed that the child–staff ratio had a significant negative effect on grammatical development ($\beta = -0.062$, $p < 0.05$) and revealed a trend towards significance for vocabulary development at 48 months ($\beta = -0.053$, $p = 0.08$). None of the other structural characteristics had a significant impact on either outcome measure. Regarding domain-specific process quality in ECEC settings (ECERS-R *language-reasoning*), we found that higher quality had a positive effect on vocabulary development ($\beta = 0.05$, $p < 0.05$) and showed a trend towards significance for sentence comprehension at 48 months ($\beta = 0.047$, $p = 0.09$).

Dependence of ECEC process quality effects on children's home language and home learning environment

We hypothesised that different groups of children (i.e. children with a home language other than German and children from home learning environments of different quality) might profit differentially from high ECEC quality. To test this hypothesis, we included two interaction terms in Model 3: one interaction term between HLE and process quality and one interaction term between home language and process quality.

Table 1. Bivariate correlations and descriptive statistics for outcome measures and predictor variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sentence comprehension (T1)	—															
2. Sentence comprehension (T2)	0.59	—														
3. Receptive vocabulary (T1)	0.79	0.65	—													
4. Receptive vocabulary (T2)	0.61	0.78	0.70	—												
5. Child gender	−0.08	−0.09	−0.06	0.00	—											
6. Child age in months (T2)	0.35	0.23	0.30	0.28	0.00	—										
7. Cognitive abilities (T2)	0.38	0.40	0.29	0.34	−0.10	0.32	—									
8. Maternal education	0.20	0.29	0.21	0.28	0.00	−0.09	0.16	—								
9. Home language	0.34	0.33	0.44	0.42	−0.01	−0.02	0.07	0.09	—							
10. HOME	0.30	0.32	0.35	0.33	0.01	−0.06	0.13	0.38	0.33	—						
11. Home learning environment	0.18	0.28	0.22	0.19	−0.12	0.06	0.15	0.19	0.11	0.23	—					
12. ECERS-R language-reasoning	−0.01	0.04	0.01	0.06	0.00	−0.03	0.06	0.02	−0.02	0.02	0.02	—				
13. Child–staff ratio	0.07	0.01	0.00	0.00	−0.05	0.30	0.07	−0.04	−0.03	−0.08	−0.02	0.02	—			

Table 1.   (Continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14. Proportion DLL per group	−0.17	−0.16	−0.23	−0.24	−0.03	0.11	−0.01	−0.09	−0.46	−0.21	0.00	−0.06	0.02	—		
15. Group mean age	0.14	0.11	0.08	0.10	−0.07	0.48	0.18	−0.07	−0.05	−0.09	0.05	−0.07	0.54	0.22	—	
16. Monthly family income	0.27	0.32	0.31	0.31	0.02	−0.10	0.14	0.44	0.21	0.31	0.16	0.03	−0.08	−0.13	−0.10	—
M	16.66	26.41	27.52	42.59		48.40	19.83	3.32		5.44	5.18	5.10	7.19	28.61	3.97	1,423
SD	7.94	5.11	6.59	8.34		4.34	8.15	0.79		1.26	0.77	1.09	3.58	27.26	3.10	626
Min	0.00	7.00	8.00	15.00		38.37	0.00	1.00		0.00	1.44	1.67	2.00	0.00	13.31	187
Max	34.00	34.00		6.00		58.48	46.00	4.00		7.00	6.89	7.00	35.00	10.00	54.72	3,846

Notes: DLL = dual-language learners, T1 = time 1, T2 = time 2. Home language: 0 = language other than German, 1 = German. Gender: 1 = female, 2 = male. For dichotomous variables (child gender and home language), descriptive statistics are not shown. Cognitive abilities and child age correspond to assessment T2. All other predictor variables correspond to assessment T1.

Table 2. Regression models with standardised estimates for coefficients and standard errors for language outcomes at 48 months

Predictor	Vocabulary						Sentence comprehension					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
Child factors												
Vocabulary (T1)	0.536***	(0.03)	0.529***	(0.03)	0.529***	(0.03)						
Sentence comprehension (T1)							0.417***	(0.03)	0.397***	(0.03)	0.396***	(0.03)
Age in months (T2)	0.118***	(0.03)	0.120***	(0.03)	0.121***	(0.03)	0.055†	(0.03)	0.055†	(0.03)	0.050	(0.03)
Gender	0.042†	(0.02)	0.041†	(0.02)	0.036†	(0.02)	−0.032	(0.03)	−0.023	(0.03)	−0.027	(0.03)
Cognitive abilities (T2)	0.117***	(0.03)	0.117***	(0.03)	0.109***	(0.03)	0.188***	(0.03)	0.182***	(0.03)	0.177***	(0.03)
Family background characteristics												
Maternal education	0.125***	(0.03)	0.116***	(0.03)	0.118***	(0.03)	0.119***	(0.03)	0.088**	(0.04)	0.089*	(0.04)
Family income	0.064*	(0.03)	0.059*	(0.03)	0.058*	(0.03)	0.118***	(0.03)	0.104***	(0.03)	0.104**	(0.03)
Home language	0.155***	(0.03)	0.149***	(0.03)	0.132***	(0.03)	0.147***	(0.03)	0.127***	(0.03)	0.120**	(0.04)
Home learning environment												
HOME			0.033	(0.03)	0.030	(0.03)			0.057†	(0.03)	0.056†	(0.03)
HLE			0.001	(0.03)	0.002	(0.03)			0.117***	(0.03)	0.114***	(0.03)
Preschool quality												
Child–staff ratio					−0.053†	(0.03)					−0.062*	(0.03)
Proportion DLL per group					−0.052	(0.03)					−0.026	(0.04)
Group mean age					0.055	(0.04)					0.063	(0.04)
ECERS-R language-reasoning					0.050*	(0.02)					0.047†	(0.03)
Total R^2	0.545***		0.547***		0.552***		0.421***		0.440***		0.446***	

Notes: Standard errors are in parentheses. DLL = dual-language learners; HLE = home learning environment; T1 = time 1; T2 = time 2. Gender: 1 = female, 2 = male. Home language: 0 = language other than German, 1 = German.
†$p < 0.10$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Including these interaction terms did not change the significance of any predictor in Model 3.

The results for receptive vocabulary did not reveal a significant effect of the interaction ECERS-R × home language ($\beta = 0.032$, $p = 0.185$). The interaction ECERS-R × HLE just failed to reach statistical significance for standardised coefficients ($\beta = 0.043$, $p = 0.053$), however it did reach statistical significance for non-standardised coefficients ($\beta = 0.409$, $p = 0.049$). These results indicate that the effect of process quality on children's vocabulary development did not depend on their home language (mono- and dual-language learners benefitted equally), but it did depend on the quality of children's home learning environment. Figure 1 represents this dependency, showing that children with medium-quality HLE ($M = 5.19$, $SD = 0.72$) and high-quality HLE ($+1$ SD) tended to benefit more from the quality of the preschool than children with low-quality HLE (-1 SD). For the development of sentence comprehension skills, none of the interaction terms revealed significant effects or a trend towards significance (ECERS-R × home language: $\beta = 0.025$, $p = 0.406$; ECERS-R × HLE: $\beta = -0.002$, $p = 0.945$).

Taken together, the results demonstrate that the development of grammatical skills between 34 and 48 months relies strongly on the quality of the home learning environment. The quality of the preschool setting showed comparable effects for both outcomes at 48 months, controlling for prior competence at 2 years of age. Furthermore, children from home learning environments of different quality tended to profit differently in their vocabulary development from higher ECEC process quality.

Discussion

The results of the current study yielded three main findings. First, we found differential effects of the home learning environment on early grammatical and vocabulary development between 2;6 and 4;0 years. Second, contrary to previous studies within the German ECEC context which did not reveal effects of preschool process quality
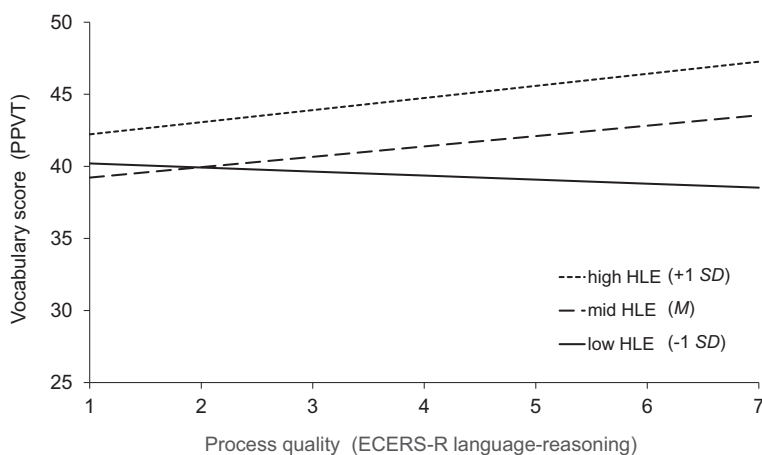

Figure 1.   Effects of preschool process quality on vocabulary skills at 48 months for low-, medium- and high-quality home learning environments.

on children's vocabulary skills (Ebert *et al.*, 2013; Tietze *et al.*, 2013), the present analyses demonstrate that development in children's vocabulary skills is related to high process quality in German ECEC settings. Third, we found that children with high- and medium-quality home learning environments tended to benefit more from preschool process quality than their more disadvantaged peers. We discuss these findings in turn.

Effects of the home learning environment

There are several possible explanations for the observed dissociation of HLE effects on children's vocabulary vs. grammatical skills at age 4. One possibility is that the HLE questionnaire used in the current study does not adequately capture the kind of processes that promote vocabulary development, but rather those supporting grammatical development. In fact, Lehrl *et al.* (2012) have shown that different dimensions of HLE (quality of parent–child interaction, storybook exposure, direct instruction) are associated with different language outcomes. These authors found that the observed quality of parent–child interactions predicted receptive vocabulary and that storybook exposure predicted sentence comprehension at 4;6 years, but not vice versa, controlling for prior competence of each outcome (however, see Skwarchuk *et al.*, 2014 for associations between children's exposure to storybooks and the development of vocabulary). Therefore, it is possible that the measures used in our study might not adequately capture the educational processes within the family setting that are predictive of children's vocabulary development. While we cannot rule out this possibility, there are two points that weaken this assumption. First, in our analyses we also included selected items of the HOME observation instrument that tapped the quality of interaction between parent and child, and this predictor did not reveal a significant impact. Second, because the influences of the home learning environment on children's vocabulary skills are already in existence by their second birthday (Weisleder & Fernald, 2013), it seems possible that prior competence in vocabulary skills at T1 would mediate such effects. Indeed, running the full model (Model 3) without controlling for prior performance at T1 revealed a substantial increase in effect size and a highly significant level for the HOME predictor variable, but not of the HLE predictor variable, supporting a mediation hypothesis of parent–child interaction quality through vocabulary skills at 34 months.

Furthermore, our findings are in line with those of Weinert and Ebert (2013), who found the effects of HLE on children's grammatical competence using a very similar measure of receptive grammar (picture–sentence matching test) for the same age group (48 months), though these authors looked only at mono-lingual German-speaking children in their sample.

Effects of ECEC quality

Our findings indicate that high domain-specific process quality is associated with children's language development. Previous studies in the German ECEC context did not reveal such effects (e.g. Ebert *et al.*, 2013). There might be several reasons why this is the case. In contrast to the study by Ebert and colleagues, who used the ECERS-E

literacy subscale as a measure of domain-specific process quality in their analyses, our measure of domain-specific process quality was based on the ECERS-R *language-reasoning* subscale—a different instrument with a stronger focus on interaction quality. As Ebert and colleagues point out, the ECERS-E subscale *literacy* has been shown to predict children's pre-reading skills, but at the same time has also been shown to fail to predict children's verbal language skills (Sylva *et al.*, 2006). Recent meta-analytic results demonstrate that the ECERS-R subscale *language-reasoning* is a more consistent predictor of receptive vocabulary skills than the ECERS-R total score, other ECERS-R subscales or the ECERS-R factors *teaching and interactions* and *provisions for learning* (Brunsek *et al.*, 2017).

Another possibility is that different reported levels of process quality are responsible for divergent findings. The average quality level reported in Ebert *et al.* (2013) had a 'low' mean of 3.2 on the ECERS-E *literacy* scale, which is consistent with other German studies (e.g. Rossbach *et al.*, 2010; Tietze *et al.*, 2013). In comparison, in our data we found an average 'high' quality level of 5.1 on the ECERS-R *language-reasoning* subscale. One possible reason for the absence of quality effects on children's language outcomes in previous studies from the German ECEC context, therefore, might have been that low domain-specific process quality failed to reach a threshold of (at least) good quality in order to show positive effects (Burchinal *et al.*, 2010). However, data on domain-specific process quality in classrooms of the BiKS sample used in the Ebert *et al.* (2013) study assessed with the ECERS-R subscale *language-reasoning*—the same instrument used in the present study—show that scores are very similar to those in the current study (e.g. BiKS wave 5: $M = 4.7$, $SD = 1.08$; see Weinert *et al.*, 2013). Thus, it seems unlikely that different levels of domain-specific classroom quality are responsible for the different patterns observed in studies in the German ECEC context, but rather that the larger sample size of the current study provided a better empirical basis to detect comparatively small effects of process quality.

Differential effects of accumulated advantages

In the current study, children from medium- and high-quality HLE profited more from higher process quality in preschool in their vocabulary development. These results support a 'Matthew effect' of accumulated advantages rather than a compensatory effect (Walberg & Tsai, 1983). Our findings are in line with other studies that have investigated quality effects of German preschools for children from advantaged and less advantaged home environments. For example, Anders *et al.* (2012) reported similar significant interaction effects of home learning environment and preschool process quality (assessed by ECERS-E) on children's mathematical competencies, which revealed that only children from medium- or high-quality home learning environments seemed to benefit from higher process quality in preschool. In addition, we did not find support for the hypothesis that dual-language learners profited more from higher quality in their vocabulary development than their mono-lingual German-speaking peers. While a lack of support for a compensatory hypothesis of preschool quality is consistent with recent meta-analyses of European ECEC studies (Ulferts & Anders, 2016), it seems to contrast with findings from the

US Head Start Impact Study (Miller *et al.*, 2014). For the domain of receptive vocabulary, Miller *et al.* (2014) found a modest-sized effect of participation in the Head Start programme for 3- to 4-year-old children whose parents reported low and middle ranges of pre-academic stimulation, but no effect for children whose parents reported high levels of stimulation in the home learning environment. Although it is possible that different analytic strategies could lead to such divergent findings, we cannot rule out that methodological limitations of our study—such as selection effects in our sample—might play a certain role in explaining our results. Hence, it could be the case that in our study children from homes with high-quality HLE are more likely to attend preschools with higher process quality. An intraclass correlation coefficient (ICC) of 0.13 indicates that a modest proportion of variance in children's home learning environment quality is explained at the level of their preschool setting.

Given the significance of the home learning environment for children's early development, political efforts to improve early language and literacy skills should not focus exclusively on the impact of ECEC settings, but also address the importance of parents' role in supporting children's language development. In our view, this could be achieved in two ways: (a) by raising public awareness of the importance of parental role in supporting children's language development (e.g. in antenatal classes for parents or child health examinations) and (b) by strengthening collaboration and communication between parents and early childhood educators to foster the impact with which both contexts act together on children's development (e.g. teachers might advise parents on how to provide a responsive and supportive learning environment for their child's language skills). In accordance with this suggestion, the model of educational quality proposed by Kluczniok and Roßbach (2014) conceptualises teacher–parent collaboration as an integral part of ECEC quality. The evaluation of the initiative *core day care centres language & integration* revealed that there is high demand for professional development of parent–teacher collaboration in German ECEC settings (Anders *et al.*, 2014). This implication receives additional significance when taking into account that the observed effects of preschool quality might interact in complex ways with the quality of the home learning environment. Such complex interactions are not yet well understood, and should thus be taken into closer consideration in future research.

Acknowledgements

<div align="center">NOTE</div>

[1] By using the term 'learning environments' we refer to social, physical, psychological and pedagogical contexts in which learning occurs and which affect children's multi-faceted developmental outcomes. While a detailed theoretical conceptualisation of the term 'learning environment' is beyond the scope of this article, we use the term in order to emphasise the proximal educational processes within children's developmental contexts.

References

Abreu-Lima, I. M. P., Leal, T. B., Cadima, J. & Gamelas, A. M. (2013) Predicting child outcomes from preschool quality in Portugal, *European Journal of Psychology of Education*, 28, 399–420.

Anders, Y., Roßbach, H.-G., Weinert, S., Ebert, S., Kuger, S., Lehrl, S. & von Maurice, J. (2012) Home and preschool learning environments and their relations to the development of early numeracy skills, *Early Childhood Research Quarterly*, 27, 231–244.

Anders, Y., Rossbach, H.-G. & Tietze, W. & Evaluationsteam (2014) *Wissenschaftliche Evaluation der 'Offensive Frühe Chancen: Schwerpunkt-Kitas Sprache und Integration': Wie kann die sprachbe-zogene Prozessqualität effektiv gestärkt werden?* [Evaluation of the initiative 'Early chances: Core day care centres for language and integration': Effectively improving process quality and language support]. Available online at: www.fruehe-chancen.de/fileadmin/user_upload/FC_Ergeb nisueberblick_om.pdf (accessed 17 September 2016).

Barnett, W. S. (1998) Long-term effects on cognitive development and school success, in: W. S. Barnett, S. S. Boocock (Eds) *Early care and education for children in poverty. Promises, programs, and long-term results* (Albany, NY, State University of New York), 11–44.

Barnett, W. S. (2011) Effectiveness of early educational intervention, *Science*, 333, 975–978.

Blossfeld, H.-P., Rossbach, H.-G. & von Maurice, J. (Eds) (2011) Education as a lifelong process: The German National Educational Panel Study (NEPS) [Special Issue]. *Zeitschrift für Erziehungswissenschaft*, 14.

Bradley, R. H. & Corwyn, R. F. (2002) Socioeconomic status and child development, *Annual Review of Psychology*, 53, 371–399.

Bronfenbrenner, U. & Morris, P. A. (1998) The ecology of developmental processes, in: W. Damon, R. M. Lerner (Eds) *Handbook of child psychology* (vol. 1) (Hoboken, NJ, John Wiley & Sons), 993–1028.

Brunsek, A., Perlman, M., Falenchuk, O., McMullen, E., Fletcher, B. & Shah, P. S. (2017) The relationship between the Early Childhood Environment Rating Scale and its revised form and child outcomes: A systematic review and meta-analysis, *PloS one*, 12(6), e0178512.

Burchinal, M., Vandergrift, N., Pianta, R. & Mashburn, A. (2010) Threshold analysis of association between child care quality and child outcomes for low-income children in pre-kindergarten programs, *Early Childhood Research Quarterly*, 25, 166–176.

Caldwell, B. M. & Bradley, R. H. (2001) *HOME inventory and administration manual*, (3rd edn) (Little Rock, AR, University of Arkansas).

Cryer, D., Tietze, W., Burchinal, M., Leal, T. & Palacios, J. (1999) Predicting process quality from structural quality in preschool programs: A cross-country comparison, *Early Childhood Research Quarterly*, 14, 339–361.

Dickinson, D. K. & Tabors, P. O. (Eds) (2001) *Beginning literacy with language: Young children learning at home and school* (Baltimore, MD, Brookes Publishing)).

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P. *et al.* (2007) School readiness and later achievement, *Developmental Psychology*, 43, 1428–1446.

Dunn, L. M. & Dunn, D. M. (2007) *PPVT-4: Peabody picture vocabulary test* (Pearson Assessments).

Ebert, S., Lockl, K., Weinert, S., Anders, Y., Kluczniok, K. & Roßbach, H.-G. (2013) Internal and external influences on vocabulary development in preschool age, *School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice*, 24, 138–154.

Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (2013) *Vierter Zwischenbericht zur Evaluation des Kinderförderungsgesetzes* [4th Interim report on the evaluation of the Childcare Funding Act] (Niestetal, Silber Druck oHG).

Fernald, A., Marchman, V. A. & Weisleder, A. (2013) SES differences in language processing skill and vocabulary are evident at 18 months, *Developmental Science*, 16, 234–248.

Girolametto, L., Weitzman, E. & Greenberg, J. (2003) Training day care staff to facilitate children's language, *American Journal of Speech-Language Pathology*, 12, 299–311.

Grimm, H., Aktas, M. & Frevert, S. (2010) *Sprachentwicklungstest für drei- bis fünfjährige Kinder (SETK 3–5); Diagnose von Sprachverarbeitungsfähigkeiten und auditiven Gedächtnisleistungen*

[Language Development Test for 3- to 5-year-old children; diagnosis of language processing skills and auditory memory skills] (2nd edn) (Göttingen, Hogrefe).

Harms, T., Clifford, R. M. & Cryer, D. (1998) *Early Childhood Environment Rating Scale*, Revised edn (New York, Teachers College Press).

Hart, B. & Risley, T. R. (1995) *Meaningful differences in the everyday experiences of young American children* (Baltimore, MD, Brookes Publishing).

Hoff, E. (2003) The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech, *Child Development*, 74, 1368–1378.

Jacob, R. T., Creps, C. L. & Boulay, B. (2004) *Meta-analysis of research and evaluation studies in early childhood education: Final report* (Cambridge, MA, Abt Associates).

Kluczniok, K. & Rossbach, H.-G. (2014) Conceptions of educational quality for kindergartens, *Zeitschrift für Erziehungswissenschaft*, 17, 145–158.

Kluczniok, K., Lehrl, S., Kuger, S. & Roßbach, H.-G. (2013) Quality of the home learning environment during preschool age—Domains and contextual conditions, *European Early Childhood Education Research Journal*, 21, 420–438.

Kuhl, P. K. (2011) Social mechanisms in early language acquisition: Understanding integrated brain systems supporting language, in: J. Decety & J. Cacioppo (Eds) *The Oxford handbook of social neuroscience* (Oxford, Oxford University Press), 649–667.

Lee, H.-J., Jahn, M. & Tietze, W. (2014) Summative evaluation, in: Baden-Württemberg Stiftung (Ed) *Sag'mal was – Sprachliche Bildung für Kleinkinder* [Say something – language education for young children] (Tübingen, Narr).

Lehrl, S., Ebert, S., Roßbach, H. G. & Weinert, S. (2012) Die Bedeutung der familiären Lernumwelt für Vorläufer schriftsprachlicher Kompetenzen im Vorschulalter [Effects of the home learning environment on children's emerging literacy], *Zeitschrift für Familienforschung*, 24, 115–133.

Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D. *et al.* (2008) Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills, *Child Development*, 79, 732–749.

McNeish, D., Stapleton, L. M. & Silverman, R. D. (2017) On the unnecessary ubiquity of hierarchical linear modelling, *Psychological Methods*, 22(1), 114–140.

Melhuish, E., Sylva, K., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2001) *Social/behavioural and cognitive development at 3–4 years in relation to family background*. The Effective Provision of Pre-school Education Project, Technical Paper 7 (London, Institute of Education/DfES).

Melhuish, E., Sylva, K., Sammons, P., Siraj-Blatchford, I., Taggart, B., Phan, M. & Malin, A. (2008) Preschool influences on mathematics achievement, *Science*, 321, 1161–1162.

Miller, E. B., Farkas, G., Vandell, D. L. & Duncan, G. J. (2014) Do the effects of head start vary by parental preacademic stimulation?, *Child Development*, 85, 1385–1400.

Muthén, L. K. & Muthén, B. O. (2012) *Mplus: The comprehensive modeling program for applied researchers. User's guide* (7th edn) (Los Angeles, CA, Muthén & Muthén).

NICHD Early Child Care Research Network (2002) Child-care structure → process → outcome: Direct and indirect effects of child-care quality on young children's development, *Psychological Science*, 13, 199–206.

NICHD Early Child Care Research Network (2003) Does quality of child care affect child outcomes at age 4"?, *Developmental Psychology*, 39, 451–469.

NICHD Early Child Care Research Network (2005) Pathways to reading: The role of oral language in the transition to reading, *Developmental Psychology*, 41, 428–442.

Niklas, F. & Schneider, W. (2013) Home literacy environment and the beginning of reading and spelling, *Contemporary Educational Psychology*, 38, 40–50.

OECD (2014) *OECD family data base* (Paris, Organisation for Economic Cooperation and Development).

Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D. *et al.* (2005) Features of pre-kindergarten programs, classrooms, and teachers: Do they predict observed classroom quality and child–teacher interactions?, *Applied Developmental Science*, 9, 144–159.

Pianta, R. C., LaParo, K. M. & Hamre, B. K. (2008) *Classroom Assessment Scoring System manual: Pre-K* (Baltimore, MD, Brookes Publishing).

Ricken, G., Fritz, A., Schuck, K. D. & Preuß, U. (2007) *HAWIVA®-III, Hannover-Wechsler-Intelligenztest für das Vorschulalter-III* [German version of the Wechsler Preschool and Primary Scale of Intelligence-III] (Göttingen, Hogrefe).

Rossbach, H. G., Sechtig, J. & Freund, U. (2010) *Empirische Evaluation des Modellversuchs 'Kindergarten der Zukunft in Bayern-KiDZ': Ergebnisse der Kindergartenphase* [Empirical evaluation of the model program 'Kindergarten of the future in Bavaria': Results from the kindergarten phase] (vol. 7) (Bamberg, University of Bamberg Press).

Shonkoff, J. P. & Phillips, D. A. (2000) *From neurons to neighborhoods: The science of early childhood development* (Washington, D.C., National Press).

Siegmüller, J., Kauschke, C., vanMinnen, S. & Bittner, D. (2011) *Test zum Satzverstehen von Kindern (TSVK) Eine profilorientierte Diagnostik der Syntax* [Test of sentence comprehension in children. A profile-oriented diagnostic of syntax] (Munich, Elsevier, Urban & FischerVerlag).

Skwarchuk, S. L., Sowinski, C. & LeFevre, J. A. (2014) Formal and informal home learning activities in relation to children's early numeracy and literacy skills: The development of a home numeracy model, *Journal of Experimental Child Psychology*, 121, 63–84.

Sylva, K., Siraj-Blatchford, I. & Taggart, B. (2003) *Assessing quality in the Early Childhood Rating Scale Extensions (ECERS-E)* (Stoke-on-Trent, Trentham Books).

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2004) *The Effective Provision of Pre-school Education project (EPPE): Technical Paper 12. The Final Report* (London, Institute of Education, University of London).

Sylva, K., Siraj-Blatchford, I., Taggart, B., Sammons, P., Melhuish, E., Elliot, K. & Totsika, V. (2006) Capturing quality in early childhood through environmental rating scales, *Early Childhood Research Quarterly*, 21, 76–92.

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2010) *Early childhood matters: Evidence from the Effective Pre-School and Primary Education project* (London, Routledge).

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2011) Pre-school quality and educational outcomes at age 11: Low quality has little benefit, *Journal of Early Childhood Research*, 9, 109–124.

Tietze, W., Schuster, K.-M., Grenner, K. & Roßbach, H.-G. (2007) *Kindergarten-Skala Revidierte Fassung (KES-R)* [German version of the Early Childhood Environment Rating Scale. Revised edition] (Weinheim, Beltz).

Tietze, W., Becker-Stoll, F., Bensel, J., Eckhardt, A. G., Haug-Schnabel, G., Kalicki, B. *et al.* (Eds) (2013) *Nationale Untersuchung zur Bildung, Betreuung und Erziehung in der frühen Kindheit (NUBBEK) [National survey on early childhood education and care]* (Weimar, Verlag das Netz).

Tomasello, M. (2006) Acquiring linguistic constructions, in: D. Kuhn, R. S. Siegler (Eds) *Handbook of child psychology* (vol. 7) (Hoboken, NJ, John Wiley & Sons), 255–298.

Ulferts, H. & Anders, Y. (2016) *Effects of ECEC on academic outcomes in literacy and mathematics: Meta-analysis of European longitudinal studies*. Curriculum Quality Analysis and Impact Review of European ECEC. Report D 4.2. Available online at: ecec-care.org/fileadmin/careproject/Publications/reports/CARE_WP4_D4_2_Metaanalysis_public.pdf. (accessed 27 October 2017)

Vasilyeva, M., Waterfall, H. & Huttenlocher, J. (2008) Emergence of syntax: Commonalities and differences across children, *Developmental Science*, 11, 84–97.

von Maurice, J., Artelt, C., Blossfeld, H.-P., Faust, G., Rossbach, H.-G. & Weinert, S. (2007) *Bildungsprozesse. Kompetenzentwicklung und Formation von Selektionsentscheidungen im Vorund Grundschulalter. Überblick über die Erhebung in den Längsschnitten BiKS-3-8 und BiKS-8-12 in den ersten beiden Projektjahren* [Educational Processes, Competence Development and Selection Decisions in Preschool and School Age: Overview of data collection in the first two years of the longitudinal studies BiKS-3-8 and BiKS-8-12]. Available online at: psydok.sulb.uni-saarlnd.de/volltexte/2007/1008 (accessed 16 October 2017).

Walberg, H. J. & Tsai, S. L. (1983) Matthew effects in education, *American Educational Research Journal*, 20, 359–373.

Weinert, S. & Ebert, S. (2013) Spracherwerb im Vorschulalter – Soziale Disparitäten und Einflussvariablen auf den Grammatikerwerb [Language development in pre-school children – Social disparities and effects on the acquisition of grammar], *Zeitschrift für Erziehungswissenschaft*, 16, 303–332.

Weinert, S., Roßbach, H.-G., Faust, G., Blossfeld, H.-P. & Artelt, C. (2013) *Bildungsprozesse, Kompetenzentwicklung und Selektionsentscheidungen im Vorschul- und Schulalter* [Educational Processes, Competence Development and Selection Decisions in Preschool and School Age] (BiKS-3-10, version 3). Institut zur Qualitätsentwicklung im Bildungswesen (IQB) dataset. Available online at: doi.org/10.5159/IQB_BIKS_3_10_v3 (accessed 4 January 2018).

Weisleder, A. & Fernald, A. (2013) Talking to children matters: Early language experience strengthens processing and builds vocabulary, *Psychological Science*, 24, 2143–2152.

Wolf, K. M., Felbrich, A., Stanat, P. & Wendt, W. (2011) Evaluation der kompensatorischen Sprachförderung in Brandenburger Kindertageseinrichtungen [Evaluation of compensatory language promotion in Brandenburg kindergartens], *Empirische Pädagogik*, 25, 423–438.

Zauche, L. H., Thul, T. A., Mahoney, A. E. D. & Stapel-Wax, J. L. (2016) Influence of language nutrition on children's language and cognitive development: An integrated review, *Early Childhood Research Quarterly*, 36, 318–333.