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# Chapter 2

## Quality of Early Learning Environments: Measures, Validation, and Effects on Child Development



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**Abstract** Individual differences and disparities in educationally relevant competencies and skills evolve from the very beginning of a child's life. This chapter focuses on early learning environments as an important basis for acquiring those competencies and skills that depend and impact on education. Drawing on the Newborn Cohort Study of the German National Educational Panel Study (NEPS-SC1) and additional validation studies, we address and empirically evaluate different quality measures of parenting behaviour and extrafamilial childcare along with their effects on early child outcomes. Results highlight the importance of considering differentiated measures of early learning environments such as indicators of cognitive-verbal stimulation or parental responsive emotional support from the very beginning, because these relate differentially to various domains of early child development. Furthermore, although different facets of interaction quality are associated with socio-economic family characteristics (SES), they relate to each other only moderately. In addition, we report on the validity and effects of quality measures of early external childcare in the NEPS-SC1 and discuss the emergence of individual differences and SES-related disparities in early child development.

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## 2.1 Relevance, Results, and Challenges of Research on Early Childhood Education and Development

Education and the development of educationally relevant competencies start well before formal schooling (Belsky et al., 2007). Both developmental and educational research extensively substantiate the assumption that important individual differences arise from the very beginning and are influenced, from early on, by a wide range of internal and external factors as well as by dynamic interactions between these factors (e.g., Bronfenbrenner & Morris, 2006; Thelen & Smith, 2006). Theoretical models such as the bioecological framework of development (Bronfenbrenner & Morris, 2006) highlight the coaction of children's (developing) characteristics with various processes in proximal learning environments and more distal influencing factors including structural and orientational characteristics of the family and external childcare institutions, their interrelations, and the effects of exo- and macrosystems in societies.

Longitudinal studies tracing the development of children and influencing factors from early on allow us to explore the effects of early childhood education along with the early roots of and mechanisms underlying the emergence and consolidation of individual differences and social disparities in those competencies and skills that depend and impact on education and educational careers (e.g., Weinert et al., 2017; Weinert & Ebert, *in press*). Yet, when conducting large-scale panel studies on early child development and influencing factors, major challenges have to be met. These are especially pronounced when the very early phases of development are considered (see Weinert et al., 2016). Thus, the present chapter addresses substantive research questions on, for example, the dimensional structure and effects of early educational processes (e.g., parental interaction behaviour), as well as methodological issues such as the validity of quality measures of early learning environments.

### 2.1.1 *Theoretical and Empirical Background and Research Questions*

**Some Important Results on the Emergence and Stabilization of Individual Differences and Social Disparities** From an empirical point of view, developmental disparities related to family background characteristics such as socio-economic status (SES, as indicated by, e.g., parental education, occupation, and/or family income) have been documented in the very early preschool years and even in infancy (Attig & Weinert, 2020; Fernald et al., 2013; Halle et al., 2009; Hart & Risley, 1995; Law et al., 2019). For instance, substantial SES-related disparities were found in the

German BiKS-3-18 study.<sup>1</sup> Amongst others, results of this study documented significant disparities according to family background particularly in children's early language skills and their domain-specific knowledge (factual content knowledge; early mathematical skills) already at the age of 3 years shortly after entering preschool (Dubowy et al., 2008; Kurz et al., 2008). This result holds across many countries and for various competence domains (e.g., Elliott & Bachman, 2018; Hart & Risley, 1995; Hoff, 2006). Furthermore, and despite developmental growth, study results have demonstrated a high level of stability not only in skill differences (Weinert et al., 2010) but also in the observed disparities related to family background characteristics (Weinert & Ebert, 2013, 2017, *in press* for overviews). In addition, and in line with international findings, significant and long-lasting effects of both the home learning environment (at least partially via child development, see Ebert et al., 2020; Lehl et al., 2020; Liang et al., 2020) and of preschool quality (e.g., Anders et al., 2013; Sylva et al., 2011) have been documented. Note that these effects may be either additive or compensatory but may also interact (Anders et al., 2012), thus leading to a partial increase in the gap between children from more disadvantaged and more privileged families (see also Weinert & Ebert, 2017).

**Domain-Specific Development and Stimulation in Preschool Age** One important result from many studies on child development is that developmental trajectories, challenges, and accomplishments are often domain-specific even though there are highly relevant interrelations between different developmental domains such as language, cognition, and socio-emotional development (e.g., Burchinal et al., 2014; Rose et al., 2018; Weinert, 2020, 2022; Weinert & Artelt, 2019; Weinert & Ebert, 2017, *in press*). The same holds true for many environmental effects in preschool age that often turn out to be domain- or even subdomain-specific. For instance, whereas a structurally complex language input has been shown to be particularly relevant for the acquisition of grammar from 3 to 4 years onwards (Anderka, 2018; Huttenlocher et al., 2010), stimulating interactions in joint book reading situations have proven to be especially supportive for vocabulary acquisition (Lehl et al., 2012). Furthermore, explicit literacy instruction (e.g., teaching of letter knowledge) seems to be particularly related to early reading development (Lehl et al., 2012; Sénéchal, 2006; Sénéchal & LeFevre, 2002; Sénéchal et al., 1998; see Weinert & Ebert, 2017, for a brief overview). Interestingly, the very same environmental factors accounted (at least partially) for the observed disparities related to socio-economic family background (see Anderka, 2018).

**The Very Early Phases of Development** Thus, because many studies have demonstrated important individual differences and SES-related disparities to be rather stable from 3 to 4 years onward, the very early roots and the impact of infant and

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<sup>1</sup>The BiKS-3-18 study started in 2005 with a sample of about 550 children at the age of three years tracing their development and relevant contextual factors across 15 years by extensive observations in the children's homes, in preschools, and later in schools, as well as by comprehensive tests, interviews, and questionnaires (see Weinert et al., *in press*).

very early childhood education, and particularly the factors that account for the emergence of individual differences and SES-related disparities, are key issues in research on early child development and education. However, particularly with respect to the very early phases, there is still a profound need to explore (internal and external) influences and their impact on future life and educational careers. In particular, although various developmental theories and empirical results highlight the importance of early caregiver–child interactions and their quality (e.g., Ainsworth, 1973; Belsky, 1984; Bowlby, 1969; Bruner, 1983; Vygotsky, 1978), the conceptualizations of high-quality interactions or relevant facets of early parent–child interaction differ widely, and their specific (or general) effects still need to be investigated in more depth.

**Conceptualizations of Quality of Early Parent–Child Interactions** Whereas some theoretical accounts focus on socio-emotional aspects of caregivers’ behaviour such as being warm and emotionally supportive (Ainsworth, 1974; De Wolff & van IJzendoorn, 1997), others emphasize the importance of cognitive-verbally stimulating behaviour (Bruner, 1983; Vygotsky, 1978). In addition, whereas many theories stress the impact of caregivers’ sensitivity to the child’s signals and needs, the exact definition or concept of this sensitivity varies across theories and studies (see Linberg, 2018, for an overview). Drawing on attachment theory (Ainsworth, 1974; Bowlby, 1969), it is, in some cases, the contingent, prompt, and adequate responsiveness of the mother (as a primary caregiver) that is seen as most important. Others stress the impact of maternal stimulation in the zone of proximal development (Vygotsky, 1978) and thus stimulations or even instructions that go beyond the child’s actual level of action and development, thereby fostering developmental progress. In addition, from an empirical point of view, the exact operationalization of the respective concepts differs across studies. Overall, many studies on the very early phase of child development adhere to a domain- and process-general quality concept that includes the prompt and contingent responsiveness of the mother as well as her warm and emotionally supportive behaviour combined with a positive regard of the child (De Wolff & van IJzendoorn, 1997). Other studies focus on a cognitively stimulating maternal interaction behaviour in the zone of proximal development (often referred to as scaffolding behaviour; Bruner, 1983) as well as the mother’s instructional behaviour (Attig & Weinert, 2018; NICHD, 2002a, b; Weinert et al., 2017). These studies have demonstrated a significant impact of maternal interaction behaviour on children’s socio-emotional as well as cognitive and language development (e.g., Barnett et al., 2012; Baumwell et al., 1997; Nozadi et al., 2013; Tamis-LeMonda et al., 1996). However, partially due to this rather general concept of interaction quality, they mostly did not unravel whether and which facets, aspects, or dimensions of maternal behaviour impact on which domain of early child development (but see Huang et al., 2022).

**Research Questions** The present chapter aims to shed light on the validity, dimensionality, and effects of quality measures of parental interaction behaviour in the very first years of a child’s life, on influencing factors such as family stress and education, and on quality measures and effects of early external childcare as another

learning environment. It reports on analyses that draw on data of the Newborn Cohort Study (SC1) of the German National Educational Panel Study (NEPS; Blossfeld & Rossbach, 2019) and two additional validation studies, thereby focusing on the following research questions:

### 1. Validity of quality measures of parental interaction behaviour

- Are the measures of early mother–child interaction assessed in the Newborn Cohort Study of the NEPS (NEPS-SC1) valid in the sense that they indicate relevant differences in maternal interaction behaviour and, thus, in children’s early home learning environment? Are they reasonably stable across situations, time points, and coding systems?
- Can a more fine-grained micro-analytical coding system validate the scales of the macro-analytical rating system of early mother–child interaction used in NEPS-SC1? This question is related to the next question addressing the dimensionality and effects of parental interaction behaviour.

### 2. Dimensions of parental interaction behaviour and effects on child development

- Is positive parenting behaviour (e.g., maternal sensitivity) in early mother–child interactions a unitary construct, or should it be differentiated into distinct dimensions such as socio-emotionally supportive and cognitive-verbally stimulating behaviour from early on? In other words, in the very first years of a child’s life, are mothers comparatively supportive (or less supportive) across different facets of parenting behaviour and different domains of child development? The issue whether early parenting behaviour already differs along various dimensions of support is not only theoretically but also practically relevant, because it suggests that mothers may support their children in one area though not to the same extent in another area of development—with important implications for intervention.
- Do different dimensions of maternal behaviour in early mother–child interactions differentially impact the different areas of child development such as socio-emotional and cognitive-verbal development?

### 3. Association of parental interaction behaviour with social background variables

- Are the observed differences in maternal interaction behaviour related to family SES (SES-related disparities) from early on as suggested by international studies (e.g., Bradley et al., 2001a, b; Gudmundson, 2012) even when also considering children’s interaction behaviour and characteristics? How do cumulative risk factors affect the quality of mother–child interaction?
- If quality aspects of maternal interaction behaviour are associated with SES and, in addition, contribute to specific areas of child development, do they account for or even mediate the association between SES and child development?

#### 4. Quality of external childcare and effects

- Because the use of early external childcare in the first years is increasing, the present chapter also reports whether questionnaire measures on quality of external childcare institutions (as used in the NEPS-SC1) can be validated by direct observations.
- Is the use of early external childcare below age 3 associated with children’s socio-emotional outcomes in Germany?

To address these issues, we draw on research and data of the Newborn Cohort Study of the NEPS as well as two additional validation studies. The NEPS-SC1 is a longitudinal large-scale study that includes a wide range of individual, familial, and institutional characteristics that are highly relevant when it comes to unravelling the dynamics of child development and the effects of early childhood education. The validation studies, set up—amongst others—to compare the NEPS play situation and ratings across different mother–child interaction situations, i.e., to test the generalizability of the measures and the stability of maternal behaviour across situations (see below) and to validate the report measures on the quality of external childcare, as well as most of the research questions were part of the project ‘ViVA’<sup>2</sup> and related dissertation projects. ViVA aimed to enhance the data of the NEPS-SC1 by focusing on methodological questions and issues as well as on substantive empirical research.

### ***2.1.2 The Newborn Cohort Study of the German National Educational Panel Study (NEPS-SC1)***

The Newborn Cohort Study of the NEPS (NEPS Starting Cohort 1: NEPS-SC1) is the first longitudinal large-scale study in Germany designed to trace the development of a representatively drawn sample of about 3500 infants and their context persons from the age of 7 months onwards (Weinert et al., 2016; Würbach et al., 2016). Assessments started in 2012 with videotaped observations and computer-assisted personal parent interviews (CAPI) in the family homes. The second wave was conducted when children were 14 months (computer-assisted parent telephone interview, CATI) and 17 months old (videotaped observations in the child’s home in one half of the sample); and the third wave, when children were on average 26 months old (assessments in the family home). Thereafter, assessment waves are being conducted every year (assessments in the family home). Overall, within the NEPS-SC1 study, children’s development is traced through semi-standardized

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<sup>2</sup>ViVA III: Video-Based Validity Analyses of Measures of Early Childhood Competencies and Home Learning Environment; ViVAplus: Impact of early childcare arrangements and the home-learning environment on child development; funded by the German Research Foundation within Priority Programme 1646 (grant to S. Weinert and H.-G. Rossbach; WE 1478/7-1, 7-2, RO 820/14-1, 14-2).

videotaped observations; standardized direct measures and tests of children's basic cognitive abilities as well as their domain-specific skills and competencies; and by caretaker reports taking a multi-informant perspective from parents and preschool teachers when possible. The home learning environment is indicated by various assessments including videotaped observations of mainly early mother-child interactions (first three waves), reports on joint activities (e.g., frequency of joint picture book reading), as well as data on—amongst others—attitudes, co-parenting, extrafamilial childcare arrangements, and socio-demographic characteristics of the families (Hachul et al., 2019; Schlesiger et al., 2011; Weinert et al., 2016). Furthermore, characteristics and quality of extrafamilial childcare were assessed by a drop-off questionnaire to the childcare institutions and childminders (across the first seven waves, at least one questionnaire available from childminders, educators, or head of institution:  $n = 1563$ ).

**Some Important Validation Issues** Although there are longitudinal newborn cohort studies being carried out around the world (see Hachul et al., 2019, for a brief overview), major challenges have to be met especially when considering the very early phases of development and the assessment of early precursors and child characteristics as well as relevant facets of the learning environments from the very beginning of a child's life (see Weinert et al., 2016, for a more in-depth discussion and the solutions chosen in the Newborn Cohort Study of the NEPS). In particular, measures have to be validated thoroughly, because instruments often have to be rather short (due to restricted assessment time) or must be conducted within varying non-standardized settings (e.g., in the children's homes) by trained though still non-professional test administrators or interviewers. To address these validation aspects, the following aims were pursued within the ViVA project:

1. To validate short scales on child characteristics administered in the NEPS-SC1. These short measures were compared to more comprehensive scales and/or (elicited) child behaviour, with overall satisfactory results, for example, regarding the validity of parent-report measures on early child temperament (see Bayer et al., 2015; Freund, 2018a, b; Vogel, 2020)<sup>3</sup> and the standardized observation of infants' sensorimotor development (adapted from items of the Bayley Scales of Infant Development; Bayley, 2006; see Attig et al., 2015, 2016).
2. To extend and add to the coding of videotaped, standardized observations of children's visual attention in various computer-assisted habituation-dishabituation tasks (taken from baby lab studies and transferred to the children's homes; Weinert et al., 2016). These tasks were conducted to measure domain-general as well as domain-specific early cognitive child characteristics and skills that have been shown to predict later cognitive development (see Bornstein & Sigman, 1986; Fagan & Singer, 1983; Kavšek, 2004).<sup>4</sup>

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<sup>3</sup>These analyses also show differences and similarities between report and observational measures of child characteristics (Freund, 2018b; Vogel, 2020; see also Sect. 2.2.1).

<sup>4</sup>These additional measures will be integrated into the NEPS scientific use files later on (see, e.g., Seitz & Weinert, 2022 for first results on these measures).

3. To validate, extend, and differentiate the assessment of qualitative aspects of the observed home learning environment (semi-standardized mother-child interaction situation – play situation; see below).
4. To validate the report measures on the quality of external childcare institutions by direct observations.
5. To conduct substantive analyses.

The present chapter focuses particularly on early mother–child interaction as an important basis of early child development. In particular, our emphasis will be on quality measures of the early home learning environment of young children and their impact on early child development (Sect. 2.2) as well as on factors influencing early interaction quality (Sect. 2.3). Further, we shall briefly report on the validity of the NEPS-SC1 report measures on the quality of early external childcare and on effects of early extrafamilial childcare attendance on children’s early socio-emotional outcomes (Sect. 2.4).

## **2.2 Early Mother–Child Interaction: Stability of Quality Measures, Distinguishable Dimensions, and Effects on Early Child Development**

Within the first years of a child’s life, research has suggested that the family is the most important environment that impacts significantly on that child’s development (Bornstein, 2002; Walper, 2012). In many societies, the mother is still the predominant caregiver particularly in the very early phases of a child’s life. Hence, in the following section, we shall focus on mother–child interactions.

### ***2.2.1 Quality Measures of Mother–Child Interaction as an Important Basis of Early Child Development***

**Assessment and Indicators of Quality of Mother–Child Interactions in the NEPS-SC1** Because parent reports may be biased and interactional quality indicators may not be explicitly accessible by the acting person her- or himself, the NEPS-SC1 implemented a semi-standardized mother–child interaction situation in the first three assessment waves when children were 7, 17, and 26 months old.<sup>5</sup> In the family homes, mothers were presented with a standardized set of toys and asked to

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<sup>5</sup>In fact, the NEPS also included a few father–child interactions. Because the NEPS in the first wave includes questions concerning pregnancy, birth, maternal depression, and breastfeeding, it intends to have the mother as respondent. As a consequence, it was mostly the mother who took part in the interaction situation.

play with their child as they would normally do for 5 (wave 1) to 10 min (waves 2 and 3). Interactions were videotaped and later coded by extensively trained coders (see Table 2.1; Linberg et al., 2019a, c).

**Table 2.1** Items rated by the NEPS macro-analytic coding system

Items	Description
<b>Parental interaction behaviour</b>	
Sensitivity to distress <sup>a</sup>	Captures how promptly and appropriately parent reacts to signals of emotional stress in child.
Sensitivity to non-distress	Captures whether parent perceives and reacts in a prompt and appropriate manner to social gestures and expressions of child that signal emotional relaxation.
Intrusiveness	Captures to what extent parent actively limits child's actions – her/his autonomy – by being adult-centred and imposing parental agenda on child regardless of child's signals.
Detachment	Captures to what extent parent seems to be uninvolved or misses child's signals.
Stimulation	Assesses degree to which parent attempts to foster child's development by teaching or stimulating cognitive development and enriching the play situation.
Language stimulation (wave 3 only)	Assesses amount and quality of verbal enrichment of play situation, including prompting and expanding child's verbalizations, asking open-ended questions, using de-contextualized language, and verbal distancing from the here and now.
Numeracy stimulation (wave 3 only)	Captures the reference to mathematical concepts in the play situation at a very basic level (e.g., counting, comparing, sorting, distinguishing patterns, or referring to amount and variation).
Positive regard	Assesses extent of positive emotions parent expresses in the observed interaction through body language, mimicry, and language.
Negative regard	Captures any signs of a critical and antagonistic maternal attitude towards child (e.g., unfriendly behaviour, negative voice, being harsh or tense).
Emotionality	Captures dynamics of maternal emotions (are emotions and their changes appropriate to the situation and within usual range?).
<b>Child's interaction behaviour</b>	
Positive mood of child	Captures extent to which child seems to be satisfied with the situation.
Negative mood of child	Captures extent to which child seems to be dissatisfied with the situation.
Activity level of child	Assesses level of gross motor activity of child during the observation.
Non-social sustained attention of child	Assesses whether child focuses on objects or other non-social activities based on the relative time spent on focused play and how easily child is distracted.
Positive engagement with parent	Captures extent to which child actively participates or actively initiates an interaction with parent.

*Note.* <sup>a</sup>Because child distress was hardly ever observed, there were many cases in which this item could not be applied

The procedures as well as the coding system were adapted from the NICHD study (1991, 1992a, b; see Sommer et al., 2016, for a detailed rationale) to also allow for international comparisons. In particular, eight dimensions of maternal interaction behaviour (in wave 3: two additional items on domain-specific language and math stimulation) and five aspects of the children's behaviour were rated on qualitatively defined 5-point scales ranging from 1 (*not at all characteristic*) to 5 (*highly characteristic*) (see Table 2.1; Linberg et al., 2019a, c for an elaborate description). Interrater reliability was high (see Linberg et al., 2019a, c, p. 16). Note that due to a slight adaptation of the coding system to the age and development of the children, the scales are not directly comparable across waves.

**Additional Micro-Analytic Coding** To extend and validate the macro-analytic coding system for interaction quality and to assess different dimensions of maternal interaction behaviour more precisely, a more fine-grained micro-analytic coding system was developed to additionally analyse the mother–child interaction situations videotaped in the first three waves of the NEPS-SC1 (see Linberg, 2018, for the system developed for the first two waves).<sup>6</sup> With respect to the first two waves, this instrument follows two theoretical assumptions: (a) that the construct of the quality of parental interaction behaviour can be subdivided into different dimensions (similar to existing approaches for older children; Hamre et al., 2013; Klieme & Rakoczy, 2008), and (b) that interactions are a dyadic process between two active partners with each partner contributing to the interactional exchange (Bornstein et al., 2008; Linberg, 2018). Methodologically, the instrument was constructed as a combined event- and time-sampling procedure that draws on existing micro-analytic coding systems (Bornstein et al., 2008; Kärtner et al., 2010; Olson & Masur, 2015; Seifer et al., 1996). It captures the event of a three-turn reciprocal interaction sequence in its different dimensions within a certain time frame (10-s interval in wave 1; 15-s interval in wave 2). The three-turn reciprocal interaction sequence covers the child's interaction behaviour (needs, signals, and interests such as vocalizations and the level of action), the subsequent behaviour of the mother (responsivity, language, emotional support, cognitive stimulation), and the subsequent interaction behaviour of the child. Thereby, the instrument accounts for the dyadic nature of interactions as well as the temporal reference between child's and mother's interaction behaviour.

In particular, it allows us to assess and possibly to differentiate maternal emotional support and cognitive-verbal stimulation behaviour amongst others and to analyse their effects on subsequent child behaviour. As already mentioned, the dimension 'emotional support' has its roots in attachment theory (Ainsworth et al., 1974) and parenting styles (Baumrind, 1989), in which the parent reacts in a prompt, warm, and appropriate manner to the child's signals. Cognitive-verbal 'stimulation'

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<sup>6</sup>The coding system for waves 1 and 2 was developed in the educational subproject of the ViVA project (see Linberg, 2018). The micro-coding for wave 3 differs and will not be included in this chapter.

in contrast is based on the concept of scaffolding in which a parent scaffolds a child's behaviour or problem-solving by attuning her or his stimulating reaction to the child's signals, needs, and interests (Berk & Winsler, 1995; see Linberg, 2018, for a more detailed description).

Thus, both the child's signal and (re-)action as well as maternal responsive emotional support and cognitive-verbally stimulating behaviour were captured within the interval and then aggregated across all intervals (see Linberg, 2018, for a more detailed description).

In the following, we shall first report on the stability of the macro-analytic coding across situations and time points and then on its dimensionality and validation based on the micro-analytic coding system.

### ***2.2.2 Stability of Quality Measures of Mother–Child Interaction Across Situations and Time Points***

An important question concerning the validity and meaningfulness of (quality) indicators of parents' and children's interaction behaviour is its dependence on and stability across different interaction situations. Indeed, Maas et al. (2013) questioned how generalizable observed interaction behaviour in a joyful play situation is to the extensive other more goal-oriented interactional situations in the daily life of a parent–child dyad. Their observation of 292 mother–infant dyads showed substantial effects of the interaction situation on maternal behaviour (mean levels assessed with the global NICHD rating scales) towards their 6-month-old toddlers during free and face-to-face play compared to diaper changing. Mothers showed higher positive regard, less flatness and detachment, and more stimulation behaviour during the play situations compared to the caregiving situation. Infants were, for example, more sociable and displayed more positive affect in the face-to-face play episode than in free play and during diaper change (Maas et al., 2013, p. 46). Despite the observed situational effects, most maternal and infant behaviour scales showed moderate stability of interindividual differences across the different play situations with ICCs ranging from .39 to .71 ( $p < .001$ ), but less consistency between playing and diaper change. This might be explained by the different situational characteristics with respect to structure and goal orientation.

To investigate whether these results also hold for the NEPS-SC1 measures, a small community-based validation study including a sample of 50 mothers and their 7-month-old children (comparable to the age of the children in the first wave of the NEPS-SC1) was conducted (see Appendix Table 2.A1 for sample characteristics).<sup>7</sup>

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<sup>7</sup>This study was conducted by Jan-David Freund and Anja Linberg within the ViVA project (developmental subproject; grant to S. Weinert) and by Franziska Vogel within her dissertation project.

This study aimed, among other things, to test for the mean-level stability of the observed indicators and for the stability of individual differences in interaction behaviour (of both mothers and their children) by using the same toys (in the play situation) and the same assessment and coding procedures as in the NEPS-SC1 across different interaction situations. In particular, maternal and child behaviour in mother–child interactions was observed across three different interaction situations: namely, playing, feeding, and diaper change (see Vogel, 2020, for an in-depth description of the assessments). These two additional situations were chosen because they might cover quite different requirements compared to the less goal-oriented and probably less demanding play situation.

**Situation-Specific Quality Levels** The comparison of the mean quality levels of the various maternal interaction variables showed a comparatively higher level of maternal stimulation behaviour in the play compared to the feeding and diaper-changing situation, thus replicating the results of the study by Maas et al. (2013). Further, mothers tended to be less sensitive and more intrusive, but also more detached during play compared to the more goal-oriented interaction situations (Vogel, 2020, pp. 117–121). Interestingly and despite high interrelations between maternal and child behaviour within mother–child interactions (see below), the children did not show significantly different mean levels on the various behavioural indicators across the diverse interaction contexts (Vogel, 2020, pp. 122–124).

**Stability of Individual Differences in Interaction Behaviour in Early Parent–Child Interactions** Whereas the observed differences in the level of maternal interaction behaviour between situations hint to an adaptation of maternal behaviour to the specific affordances of the interaction situation, an additional major question is whether the assessed behavioural differences between individuals (either mother or child) are relatively stable across situations. This would imply that the individual differences observed in one interaction situation are more or less representative for differences in the interactional learning environment provided by mothers and/or for interactional characteristics of children in mother–child interactions in the early years.

**Low Stability of Individual Differences in Children’s Interaction Behaviour** Although the mean levels of the children’s behaviour observed during mother–child interaction were rather stable (i.e., they did not differ significantly) across the various interaction situations, the stability of individual differences turned out to be low and mostly nonsignificant (Vogel, 2020, pp. 132–134). Thus, individual differences in the children’s behaviour seem to be rather situation-specific in these assessments. In the same vein, Linberg (2018), using NEPS-SC1 data, found that the children’s positive mood between waves 1 and 2 was not stable. These findings converge with the result that the observed behaviour of the children during a stressless play situation (Freund, 2018a, b; based on NEPS-SC1 data) and even in the probably more stress-inducing caretaking situations realized in the ViVA validation study (Freund,

2018a, b; Vogel, 2020, pp. 137–139) did not relate to parent-report measures of their temperament. This hints to the assumption that children’s behaviour observed in short mother–child interactions and parent-report measures on child temperament capture different child characteristics—at least in rather stressless interaction situations that seem to reflect a high variability in child behaviour. Note that, in accordance with this interpretation, the parent-reported child temperament could be validated in an experimentally induced stress situation (still face paradigm in which the mother is instructed to not react to the child within a few minutes; see Freund, 2018a, b).

**Stability of Quality Differences in Maternal Interaction Behaviour** In contrast to the low stability of the children’s interaction behaviour, study results showed a rather high stability for individual differences in maternal behaviour across situations (Vogel, 2020). Using the data from the ViVA validation study, at least moderate correlations were found for sensitive, for stimulating, and for warm maternal behaviour; whereas maternal intrusiveness and detachment seemed to depend more on situational effects (see Table 2.2; Vogel, 2020, for a more detailed description).

This converges with the notion that negative interaction behaviour such as detachment and intrusiveness are not the lower end of positive interaction behaviour. Note, however, that the sample in this study was rather small and homogeneous with respect to the socio-economic and educational status of families. Nonetheless, this might even lead to an underestimation of the stabilities of individual differences in maternal interaction behaviour across interaction situations. Overall, results suggest that at least (more or less) positive maternal interaction behaviour assessed in a short semi-standardized play situation might be used as a meaningful indicator for the quality of maternal interaction behaviour.

In line with this assumption, various analyses of NEPS-SC1 data document rather high stabilities of global measures of maternal interaction quality across the first three measurement waves and thus the first 2 years of the children’s lives (Freund et al., 2019). For instance, Freund et al. (2019) aggregated four items measuring the quality of maternal interaction behaviour—namely, sensitivity to child’s non-distress, stimulation, positive regard, and emotionality. When analysing the cross-lagged effects between this global measure of the quality of maternal interaction behaviour and the parent-reported negative affectivity of the child, the stability of maternal behaviour turned out to be rather high (.55 between wave 1 and 2 and wave 2 and 3 respectively; see Freund et al., 2019, p. 128).

However, when considering various single scales (compared to an aggregated global indicator) for assessing the quality of maternal interaction behaviour, the stability across waves in the NEPS is considerably lower (Attig & Weinert, 2020; see Table 2.3).

This may be due not only to the fact that single scales are less reliable than aggregated measures, but also to the possibility that mothers adapt their behaviour to their child’s development differently across waves (see also next section).

**Table 2.2** Stabilities of maternal interaction behaviour across situations (correlations between a dyadic play situation and a feeding or diaper-changing situation)

		1	2	3	4	5	6	7
Playing and								
(a) Feeding ( <i>n</i> = 31)								
(b) Diaper changing ( <i>n</i> = 33)								
1. Sensitivity to non-distress	Feeding	.29	.02	-.20	.39*	.30	-.24	.17
	Diaper changing	.36*	-.16	-.20	.25	.38*	-.21	.25
2. Intrusiveness	Feeding	-.06	-.13	.32	-.01	.00	-.11	.01
	Diaper changing	-.05	.10	.11	.20	-.04	-.20	.06
3. Detachment	Feeding	-.06	.03	.12	-.35	-.30	.23	-.24
	Diaper changing	-.50**	.20	.13	-.36*	-.47**	.36*	-.43*
4. Stimulation	Feeding	.30	-.14	-.33	.51**	.42*	-.30	.31
	Diaper changing	.40*	-.36*	-.02	.42*	.41*	-.32	.46**
5. Positive regard	Feeding	.44*	-.27	-.24	.31	.57**	-.07	.33
	Diaper changing	.36*	-.31	-.01	.39*	.68**	-.29	.51**
6. Negative regard	Feeding	-.01	-.16	.17	-.03	-.10	-.01	-.16
	Diaper changing	-.37*	.09	-.08	-.24	-.40*	.33	-.24
7. Emotionality	Feeding	.37*	-.20	-.21	.51**	.56**	-.32	.46**
	Diaper changing	.37*	-.32	-.12	.34	.60**	-.27	.63**

Correlations adopted from Vogel (2020)

Note: Insufficient cases for calculating sensitivity to distress. \*  $p < .05$ , \*\*  $p < .01$ . Corresponding items are coloured grey

**Table 2.3** Stability of individual differences in maternal interaction behaviour across assessment waves

	1	2	3	4	5	6
1. Sensitivity w1	1					
2. Sensitivity w2	.16***	1				
3. Sensitivity w3	.15***	.25***	1			
4. Stimulation w1	.27***	.14***	.06**	1		
5. Stimulation w2	.18***	.34***	.14***	.34***	1	
6. Stimulation w3	.21***	.16***	.25***	.22***	.30***	1

Correlations adopted from Attig and Weinert (2020)

*Note.* Maternal sensitivity, maternal stimulation in mother–child interaction in waves 1 to 3 (i.e., at the age of 7, 17, and 26 months). \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

### 2.2.3 *Micro-analytic Validation of the Macro-analytic Rating System of the NEPS and Differentiating Dimensions of Interaction Behaviour*

**Interrelation Between Micro- and Macro-analytically Assessed Measures of Interaction Quality** Results indicate that the micro- and macro-analytic coding systems (i.e., the assessment) of the various constructs cover slightly different, though associated facets of maternal behaviour, because the associations on the bivariate level were low to moderate (e.g., micro-analytically assessed ‘emotional support’ is slightly associated with macro-analytically assessed ‘sensitivity to non-distress’ [wave 1:  $r = .28$ ,  $p < .001$ ; wave 2:  $r = .30$ ,  $p < .001$ ]; and micro-analytically assessed ‘stimulation’ is moderately associated with macro-analytically assessed ‘cognitive-verbal stimulation’ [wave 1:  $r = .46$ ,  $p < .001$ ; wave 2:  $r = .43$ ,  $p < .001$ ]). However, when considering a global concept of positive parenting behaviour by aggregating the respective items of the micro-analytic instrument (i.e., emotional support, [verbal] stimulation) and the respective items of the macro-analytic instrument (i.e., sensitivity to non-distress, positive regard, stimulation, emotionality) separately into a composite measure indicating global quality of maternal interaction behaviour, associations between micro- and macro-analytically coded quality measures are clearly higher (wave 1:  $r = .64$ ,  $p < .001$ ; wave 2:  $r = .60$ ,  $p < .001$ ; see Linberg et al., [in press](#)).

**Dimensions of Maternal Supportive Behaviour: Distinguishable Though Related in Early Mother–Child Interaction** The question whether the theoretically derived dimensions of maternal supportive behaviour can be separated empirically can be answered on two levels: (a) on the level of individual time intervals – that is, whether emotionally supportive mothers also interact in a cognitively stimulating way in each action sequence and (b) on the level of each

mother–child dyad. On the interval level, it is notable that in nearly 75% of the captured interaction sequences, both stimulation and emotionally supportive behaviour are demonstrated. This means that most actions of the mothers are both emotionally supporting and, at the same time, cognitive-verbally stimulating. Yet, in the first year of life, emotional support occurs far more frequently without stimulation than the other way around (Linberg, 2018). However, when aggregating the observations on each sensitivity dimension for each mother–child dyad across the whole observation period, only a moderate association is found ( $r = .32$ ,  $p < .001$ ). Even when additionally taking into account the macro-analytically acquired information on mother–child interaction, it can be seen that the two dimensions are separable, with a two-factor solution leading to a better model fit compared to a single-factor solution (two-factor model:  $\chi^2 = 91.65$ ,  $p < .001$ , CFI = 0.95, SRMR = 0.03, RMSEA = 0.10; one-factor-model:  $\chi^2 = 190.78$ ,  $p < .001$ , CFI = 0.90, SRMR = 0.04, RMSEA = 0.14; see Linberg, 2018).

Using a different analytical approach, Huang et al.'s (2022) results also point to the usefulness of separating different dimensions of early parenting behaviour into socio-emotionally supportive (sensitivity to non-distress, positive regard, emotionality) and cognitive-verbally stimulating (general and language stimulation). Using NEPS-SC1 data (i.e., the macro-analytic coding), this analysis also showed a significantly better fit for a model differentiating these dimensions within a two-factor model compared to a one-factor global quality model. Thus, despite some overlap, mothers seem to differ in their socio-emotionally supportive versus their cognitive-verbally stimulating interaction behaviour, and these differentiable dimensions of parental interaction behaviour may impact differentially on different domains of child development (see Sect. 2.2.4).

In addition to this still rather global differentiation between emotionally supportive and cognitive-verbally stimulating behaviour, a wide range of different facets or dimensions of positive parenting behaviour have been suggested (at least from the age of 2 years onwards) that may differ in their impact on child development. For example, one might differentiate between parental responsiveness, scaffolding behaviour as defined above, instructional behaviour including explanations that direct the child's attention and offer new perspectives, open-ended questions, and the complexity of language input. It has yet to be resolved empirically whether parental interaction behaviour is to be described by rather general qualitative measures or whether these differentiated concepts are an indication for separable dimensions of interaction behaviour with potentially different impacts across child development and developmental domains that have important implications for intervention (see, e.g., Möwisch et al., 2022).<sup>8</sup>

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<sup>8</sup>In the near future, the ViVA project will be offering additional measures covering different concepts of maternal interaction behavior in mother–child interaction at the age of 26 months (wave 3).

### 2.2.4 *Impact of Quality of Mother–Child Interaction on Child Development*

Obviously, when considering differences in the global quality of maternal interaction behaviour (or differences in specific aspects or dimensions of parental interaction behaviour), it is of major interest whether these differences impact on child development. In particular and as already mentioned, dyadic interaction situations are always shaped by both interaction partners from early on (e.g., Bornstein et al., 2008; Linberg, 2018). As a result, profound associations between maternal and child behaviour in mother–child interaction situations have been documented (Attig & Weinert, 2018; Weinert et al., 2017). In line with such findings, more fine-grained analyses of the NEPS-SC1 data by Linberg (2018) using logistic regression analyses showed that children’s positive mood, compared to a less positive mood, led to a 1.39 higher chance of an emotionally supportive response by the mother within the actual interaction situation. Yet, cross-lagged panel analyses across two assessment waves of NEPS-SC1 demonstrated that the children’s positive mood at 7 months of age did not relate significantly to later emotional support of the mother at 17 months of age. Instead, maternal emotional support at the age of 7 months seems to slightly affect children’s positive mood at the age of 17 months ( $\beta = .10, p < .01$ ; Linberg, 2018; for further cross-lagged effects between the quality of maternal interaction behaviour and children’s temperament and the moderating role of cumulative risk factors, see Freund et al., 2019).

Because many studies have shown significant effects of the quality of maternal interaction behaviour on various facets of child development, in the following, we shall focus on three important results that add to and differentiate this overall picture: (a) whether there is a distinctive impact of specific dimensions of maternal interaction behaviour on different domains of child development already in the early phases of child development; (b) whether the impact of specific quality dimensions of maternal interaction behaviour changes across the early years of child development. Finally, we shall also consider; and (c) whether the quality of early mother–child interaction mediates the effect of socioeconomic background on child development.

**Differential Effects of Separable Dimensions of Maternal Interaction Behaviour** As already described, Linberg (2018) as well as Huang et al. (2022) have shown maternal interaction behaviour to be more differentiated than global quality measures presume. In fact (see Sect. 2.2.3), models that separate, for example, socio-emotionally supportive and cognitive-verbally stimulating behaviour of mothers in mother–child interaction fit the interaction data better than one global construct of positive interactional parenting behaviour. Importantly, these dimensions of maternal interaction behaviour also impact differentially on both child behaviour and child development. For instance, Linberg (2018) found that, within a mother–child interaction situation, maternal scaffolding behaviour seems to influence the child’s action level (but not the child’s emotional well-being), whereas her emotionally supportive behaviour seems to influence the child’s emotional well-

being (but not to the same extent the child's level of action). These differential effects are particularly evident for maternal scaffolding behaviour. Logistic multilevel analyses have demonstrated that maternal scaffolding behaviour is related to a 10.71 higher chance of the child playing on a higher (i.e., more elaborate) level of action thereafter (OR = 10.71,  $p < .001$ ), whereas no higher chance of emotional well-being was observed after the mother has displayed scaffolding behaviour (OR = 1.03, *ns*; NEPS-SC1-data; Linberg, 2018).

Of course, these effects on actual child behaviour in parent–child interactions may suggest, but do not document, differential effects on child development. Nonetheless, other analyses do substantiate this conclusion. For instance, using structural equation modelling with the NEPS-SC1 data, Huang et al. (2022) showed that the cognitive-verbally stimulating behaviour of mothers predicted the language skills of their children at the age of 2, whereas the socio-emotionally supportive behaviour of the mothers predicted the children's prosocial behaviour as well as their peer relationships at the age of 3.

Furthermore, as already mentioned, Linberg (2018) demonstrated that early maternal emotional support is slightly associated with children's positive mood in the subsequent wave (even after controlling for autoregressive effects). Additional analyses showed that this is not the case for maternal stimulation behaviour. In particular, children's later positive mood was not predicted by maternal stimulation, but by maternal emotional support. However, the level of action—meaning elaborated play during the interaction—was related to neither maternal emotional support nor to maternal stimulation from the previous assessment wave. This suggests that it is meaningful to differentiate between facets of maternal interaction behaviour from early on. Nevertheless, simple relations may not be expected, because mothers may adapt to a child's level of competence or temperament (see also Freund et al., 2019).

**Changing Effects of Different Facets of Maternal Interaction Behaviour on Child Development** Whereas most studies average across many facets of maternal interaction behaviour (i.e., use a global quality measure; NICHD, 2002a, b) or do not consider different measurement points, Attig and Weinert (2020) analysed the effects of separate process characteristics of the home learning environment—assessed longitudinally at three different time points—on children's early language outcomes. Process characteristics were derived from different theoretical accounts such as attachment theory (maternal responsive sensitivity<sup>9</sup>; Ainsworth, 1973; Bowlby, 1969) and socio-cultural theories (scaffolding and cognitive-verbally stimulating behaviour; Bruner, 1983; Vygotsky, 1978) with respect to mother–child interactions, as well as from literacy research (frequency of joint picture book reading). Using NEPS-SC1 data and structural equation

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<sup>9</sup>Note that responsive sensitivity is not identical to socio-emotional support, because the latter is usually indicated by a compound measure also including, for example, positive regard and emotionality.

modelling (SEM), findings showed that, across three measurement points within the first 2 years of life, nearly all included process characteristics predicted children's vocabulary as well as their grammatical skills at the age of 2 years. Whereas maternal responsive sensitivity predicted children's language skills already from the very first measurement point at the age of 7 months, the effect of stimulating behaviour of the mothers in early mother–child interactions increased across waves as well as compared to the effect of maternal responsive sensitivity (see also Valloton et al., 2017, for converging results on the increasing impact of maternal stimulation behaviour). In addition, early joint picture book reading impacted on children's language outcomes from early on. Note that effects of earlier waves were not just mediated by differences in the quantity or quality of interactional behaviour in later waves, but, in many cases, also exerted an additional direct effect on children's early language outcomes (Attig & Weinert, 2020).

Overall, we find differentiated and partially changing effects of various facets of parenting behaviour on early child outcomes. In particular, various theoretically derived and empirically validated facets of mothers' interactional behaviour seem to affect different domains of child development, and they do not prove to be highly interrelated.

### **2.3 Effects of Social Inequality and Cumulative Risk Factors on Maternal Interaction Quality**

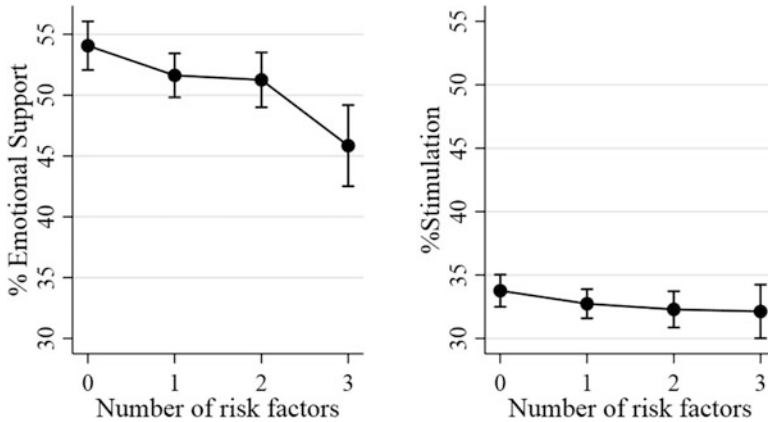
Obviously, parent–child interactions could be influenced by many factors such as child behaviour, child temperament, and/or the child's developmental status (Attig & Weinert, 2018; Bornstein et al., 2007; Kochanska & Aksan, 2004; Linberg, 2018; Masur et al., 2013; Weinert et al., 2017), as well as by characteristics of the mother herself (e.g., personality; Vogel, 2020) and structural aspects of the family such as living in a partnership, number of siblings, and/or the socio-economic status and/or migration background of the family (Bradley et al., 2001a, b; Gudmundson, 2012; Weinert et al., 2017).

Following family stress and family investment models (Conger & Donnellan, 2007; Haveman & Wolfe, 1994), parental behaviour in parent–child interactions is supposed to be influenced by various stress-related and socio-economic factors such as parental education, family income, and/or parental occupation. In more detail, these models state that a comparatively higher socio-economic status (SES; e.g., higher education, lower economic hardship) impacts—among others—on family processes, and that families with higher SES may be more able to provide their children with a high-quality home learning environment compared to families with a lower SES. Indeed, research has shown that family SES is associated with quality measures of parent–child interaction (Attig & Weinert, 2018, 2020; Bradley et al., 2001a, b; Gudmundson, 2012; Linberg, 2018; Weinert et al., 2017).

Using NEPS-SC1 data, Weinert et al. (2017) documented that the educational level of the mother may affect the quality of her interaction behaviour already in the very first year of a child's life. Not surprisingly, the same holds true in the second year of life: again, higher educated mothers showed a higher global quality of interaction behaviour in dyadic interactions with their child compared to lower educated mothers (Attig & Weinert, 2018). Note, however, that in both studies, the explained variation is rather small (Attig & Weinert, 2018; Weinert et al., 2017). Nonetheless, both analyses showed that the effect of maternal education remained significant even when considering other influential factors in the models such as maternal psychological stress, maternal age at birth, children's positive and negative mood in mother-child interaction, children's social interest, activity level, sustained attention to objects during parent-child interaction, their temperament (negative affectivity, orienting/regulatory capacity), status of sensorimotor development, child age, and sex. Whereas interactional child behaviour was substantially associated with the quality of maternal interaction behaviour, it hardly reduced the effect of maternal education on the quality of her interaction behaviour particularly in the first year of children's lives (Attig & Weinert, 2018; Weinert et al., 2017).

In a similar vein, again using NEPS-SC1 data, Attig and Weinert (2020) analysed the potentially changing associations between family SES (including maternal education, parental occupational status, and equivalized family income) and mothers' interaction behaviour across the first 2 years of the children's lives. Mixed-effect regression models showed a significant main effect of SES on the mothers' responsive sensitivity as well as on their cognitive-verbal stimulation behaviour (.25 and .12 respectively). Further, the analysis indicated changes in the association between SES and maternal stimulation behaviour across the first 2 years, suggesting an increasing impact of SES on maternal stimulation behaviour as children grow older. In contrast, the statistical interaction between SES and maternal responsive sensitivity assessed across three measurement points was non-significant, indicating no substantial change in the association of SES and maternal responsive sensitivity in mother-child interaction over time. Thus, SES effects changed differentially across age and different facets of maternal behaviour. Because SES as well as maternal interaction behaviour—among other factors—influence child development (e.g., Attig & Weinert, 2020; Fernald et al., 2013; Hart & Risley, 1995; Law et al., 2019; Weinert & Ebert, 2013; Weinert et al., 2017; see also Sect. 2.2.4 of this chapter), such results help to better understand differences in the early learning environments of children, and how, for example, disadvantaged families can be supported in promoting the early development of their children.

**Effects of Cumulative Risk Factors on the Quality of Maternal Interaction Behaviour in Early Mother-Child Interactions** As already mentioned, theoretical assumptions on how child and context characteristics (such as low parental education, low family income, or a difficult temperament of the child) affect the quality of maternal behaviour in mother-child interactions (maternal sensitivity) usually assume that unfavourable expressions of these characteristics reduce maternal resources and thus lead to stress. This, in turn, impacts negatively on maternal



**Fig. 2.1** Linear prediction of percentage of emotional support and stimulation at 7 months (wave 1). (Adopted from Linberg, 2018, p. 114)

interaction behaviour (Conger & Donnellan, 2007). Although every single unfavourable characteristic might lead to a reduction of parents' positive interaction behaviour, study results hint to the assumption that only a certain threshold of stress, indicated by the accumulation of unfavourable characteristics or conditions, reduces positive parenting behaviour (Jenkins et al., 2003; Whittaker et al., 2011). Using wave 1 of the NEPS-SC1 study, Linberg (2018) demonstrated that, by combining risk factors such as unfavourable characteristics of the child, the mother, and the context (e.g., difficult temperament of the child, low maternal education, low household income) into a risk index. One or two risk factors predicted only a slightly reduced maternal emotional support (one risk factor:  $\beta = -0.5$ ,  $p < .05$ ; two risk factors:  $\beta = -.05$ ,  $p > .10$ ). Yet, three or more risk factors were associated significantly with reduced emotional support ( $\beta = -.11$ ,  $p < .001$ ). However, the same effect is not observed for maternal stimulation behaviour in mother-child interaction. Here, the presence of none, one, or even more risk factors seems to make only a very small and non-significant difference (Fig. 2.1).

These findings are especially interesting in light of the previously mentioned results indicating that SES impacts increasingly on maternal stimulation behaviour across waves (but remains stable with respect to her responsive sensitivity, Attig & Weinert, 2020). Whether the pattern could be replicated in risk samples or when taking additional factors into account deserves further investigations.

In a similar vein, also drawing on NEPS-SC1 data, Freund et al. (2017) showed cumulating and, additionally, non-additive effects of different risk factors. Using a global concept of maternal interaction quality (including maternal sensitivity to non-distress, her stimulation behaviour, positive regard, and emotionality in mother-child interaction), the analysis showed that a difficult temperament in the child (namely high negative affectivity) did not affect the quality of maternal interaction behaviour if the number of other risk factors (e.g., low education, low income, low

maternal age at the birth of the child, low weight of the child at birth, etc.) was low (0–2). Yet if three or more risk factors accumulated, the impact of a difficult child temperament on the quality of maternal interaction behaviour was substantial. In particular, study results showed that the global quality of maternal interaction behaviour decreased as the number of risk factors increased ( $\eta^2 = 0.021$ ,  $p < .001$ ); yet, with three or more cumulative risk factors, it dropped substantially when interacting with a child with a difficult temperament compared to a child with low negative affectivity (Cohen's  $d = 0.60$ ,  $p < .001$ ; see Freund et al., 2017, p. 203–204). This suggests the conclusion that even if a child shows relatively high negative affectivity, mothers manage to show a quality of interaction behaviour comparable to that when the child's temperament is less demanding—as long as the number of other risk factors is not too high. However, as risk factors accumulate, a difficult child temperament impacts strongly on the quality of maternal interaction behaviour.

**SES Effects on Child Development: Mediated Only Partially by the Quality of Mother–Child Interaction** As many studies have shown, both proximal process characteristics of the home learning environment as well as more distal structural variables such as SES impact on child development (Bornstein, 2002; Hart & Risley, 1995; Melhuish et al., 2008; Weinert et al., 2010). For instance, the above-mentioned analyses by Attig and Weinert (2020) considered the predictive effect of both structural and process characteristics on children's early vocabulary and grammar skills at the age of 2 years. Results showed that even when including all the described process characteristics (maternal responsivity, her cognitive-verbally stimulating behaviour, as well as the frequency of early joint picture book reading), family SES still predicted both language facets directly—despite the association of the process characteristics with SES as well as with early language outcomes. This hints to the assumption that the assessed process characteristics did not (or only partially) mediate the effect of SES. An explicit investigation of the mediating effect of maternal language-stimulating interaction behaviour at the age of 17 months (i.e., verbal stimulation during episodes of joint attention) on the children's expressive vocabulary at 26 months of age with the same dataset (NEPS-SC1) by Linberg et al. (2020) also showed that the assessed language-stimulating interaction behaviour did not mediate the effect of maternal education on vocabulary development, because it accounted for only 9% of the effect. Because, for example, the educational framework of the home learning environment (Kluczniok et al., 2013) assumes that structural characteristics affect educational processes, and educational processes impact, in turn, on child development, it is up to future research to investigate which mechanisms could explain the effect of SES on early child language.

At this point, it is important to note that the interrelations between various influential factors in the very early phases of child development are not particularly high. This hints at a differentiated picture of environmental effects from early on that needs much more research (e.g., Attig & Weinert, 2019, 2020; see also Table 2.3).

## 2.4 Quality and Effects of External Early Childcare: Validation of the NEPS-SC1 Report Measure and Effects on Early Socio-emotional Child Development

In early childhood, not only the home learning environment but also early childhood educational settings (ECEC) play an important role in child development. In 2020, up to 35% of all children under the age of 3 attended ECEC (i.e., centre- or family-based external childcare) in Germany (German Federal Statistical Office, 2020). Various studies have demonstrated that the quality of these settings is associated with children's cognitive and socio-emotional skills (see Anders, 2013; Gorey, 2001, for overviews); and it has been suggested that extrafamilial childcare might compensate for quality restrictions in the home learning environment.

Therefore, the quality of early external childcare is a crucial variable in early childhood studies. Yet, its measurement is challenging, because reports by the key actors might be inaccurate or biased. A report by educators implies that they evaluate their own work, parents are not present during daily routines in ECEC (and thus not able to report on the actual quality), and the children are mostly too young to provide valid information. Hence, external observations are often considered as the 'gold standard' in measuring ECEC quality (Bäumer & Rossbach, 2016; Spieß & Tietze, 2002). Nevertheless, as such measures are costly and time-consuming, large-scale studies such as NEPS often have to rely on (short) questionnaires from educators that assess selected aspects as proxies for or indicators of ECEC quality.

**Validation of the Report Measure** To evaluate the accuracy of these educator-reported indicators of ECEC quality (particularly those used in the NEPS-SC1), Linberg et al. (2019b) used both questionnaire and standardized established instruments for observing external childcare quality (environment rating scales: ITERS and FCCERS) in a small sample of centre- ( $n = 65$ ) and family-based ( $n = 47$ ) childcare facilities (see Appendix, Table 2.A2 for sample description).<sup>10</sup> Results indicated that up to 43% of the observed variance in toddler childcare quality could be explained by staff-reported quality measures assessed via questionnaires. When the staff-reported indicators served as a rough classification of ECEC quality (e.g., in the categories poor, mediocre, good quality), most ECEC settings (75% of the centre-based and 83% of the family-based settings) were classified correctly by staff-reported indicators.

**Effect of Early Extra-Familial Childcare on Early Socio-emotional Outcomes** Yet, when considering the effects of early external childcare on child development, international study results point to potentially negative associations between time spent in those ECEC settings in the first 3 years of a child's life and

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<sup>10</sup>This validation study was conducted within the project ViVA (educational subproject; grant to H.-G. Rossbach) by Anja Linberg and Jan-David Freund.

children's socio-emotional outcomes (indicated by problem behaviour with peers and prosocial behaviour). Nonetheless, because international study results are controversial and inconsistent across countries (e.g., Loeb et al., 2004; Votruba-Drzal et al., 2010), it remains unclear whether or to what extent these international results transfer to the German ECEC system. To empirically evaluate this issue as well as the role of the home learning environment and child characteristics in these effects, Linberg, Burghardt, et al. (2019a) used NEPS-SC1 data and demonstrated that irrespective of global parental sensitivity, more years spent in centre-based ECEC under the age of 3 related significantly to comparatively lower rates of problem behaviour with peers. With respect to child characteristics, particularly children with a moderately difficult temperament seemed to profit from attending more years in centre-based ECEC in terms of their prosocial behaviour. Note however, that in Germany, the intensity (i.e., hours per day) of the use of external childcare is only moderate compared to other countries, and this may explain some of the controversial results. In addition, although controlled in the models, there is an association between early use of external childcare and family background (SES, migration status) in Germany that calls for further investigation.

## 2.5 Some Concluding Remarks

To sum up, the different analyses and studies presented in this chapter underpin the importance for child development of the quality of early learning environments. Results support and extend previous findings on the interrelation between families' educational and socio-economic resources and the quality of the early home learning environment, as well as on the effects of both structural and process variables on child development. Yet the mechanisms that may explain SES effects in infancy and toddlerhood still have to be unravelled. Most notably, the results suggest that—from early on—positive parenting behaviour should be differentiated into distinct facets with potentially differential effects on the various domains of child development. This has important practical implications, because these facets are only moderately interrelated. Further, the presented results confirm how important longitudinally assessed measures are for analysing early child development and education. It is up to future research to show whether and which facets of parenting behaviour change dynamically, which remain rather stable across measurement points, and what role they play in fostering (or restricting) developmental progress in the various domains of child development in interaction with the extrafamilial learning environments in cribs, preschools, and schools. Because the NEPS-SC1 is being followed up longitudinally, some of these questions could be addressed with this study. And as a last point, it should be mentioned that most of the results presented here focused on the quality of mother–child interactions. It will be up to further studies to investigate whether the same patterns also hold true for father–child interactions.

## Appendix

**Table 2.A1** Sample characteristics of the ViVA validation study on mother–child interactions across different situations (Vogel, 2020) and on the validity of short scales used in the NEPS-SC1 (see also Freund, 2018a, b)

<i>n</i> = 50 Variable	Frequency (%)
Sex child	52.9% male, 47.1% female
Siblings	47.1%
Relationship status parents	92.2% in a relationship, 3.9% single parent
Education mother	2.0% no graduation, 5.9% <i>Hauptschulabschluss</i> , 9.8% secondary school level 1, 21.5% higher education level, 58.8% university education
Migration status mother	88.2% born in Germany
External care at 7 months	15.4%
Household income	9.8% < 2000€, 56.9% 2000€–4000€, 31.4% > 4000€ Mean (standard deviation)
Age child	7.4 (0.7) months
Age mother	32.3 (5.6) years
Birthweight	3326.0 (672.1) gram
Years of education mother	11.9 (1.7)
HISEI	57.3 (15.4)

**Table 2.A2** Sample characteristics of the ViVA validation study of ECEC quality measures from the NEPS-SC1

Variable	Frequency (%)	
	Centre-based ECEC ( <i>n</i> = 65)	Family-based ECEC ( <i>n</i> = 47)
Children with disabilities	0.46%	1.42%
Children with migration background (country of birth of the child or at least one parent)	14.4%	14.3%
	Mean (standard deviation)	
Group size	12.9 (3.55)	5.64 (2.47)
Age range ( $\Delta$ oldest and youngest child in the group)	1.84 (0.419)	2.56 (3.13)
Professional training (0: No professional training in the childcare sector, 1: Childcare workers [lower secondary school leaving certification with 2-year training], 2: educators [lower secondary school leaving certification with 5-year training] 3: Training on university level)	1.98 (0.28)	0.68 (0.96)

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