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# *The Parent Factor in Toddlers' Self-Regulation – Parental Co-Regulation, Beliefs, and the Effectiveness of a Parent Training*

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# Abstract

Self-regulation is one of the hallmarks in early childhood and develops in direct social interaction between the child and the caregiver (Kopp, 1982). Toddlerhood demarcates the beginning of a period of rapid growth in child self-regulation (Garon, Bryson, & Smith, 2008). This dissertation focuses on the parent factor in toddlers' self-regulation and addresses three major questions. First, how do parents' co-regulation behaviour and self-efficacy beliefs relate to toddlers' self-regulation and problem-solving performance? Second, which factors may affect parents' co-regulation behaviour in toddlerhood? And third, how may parental co-regulation behaviours and associated beliefs be promoted at an early stage? To address these questions, a quasi-experimental intervention study has been conducted, including parents of full-term and preterm born two-year old toddlers, and has resulted in three empirical papers that are presented in this dissertation.

Concerning the first question, Paper 1 provides evidence for direct (but no indirect) effects from parents' negative co-regulation practices and domain-specific self-efficacy beliefs to toddlers' inhibitory control (parent-report) six weeks later. Complementing these findings, the second paper analyses the contribution of parents' cold co-regulation behaviour (scaffolding) to the parent-child problem-solving performance. Different levels of parental scaffolding are assessed (use of scaffolding means, scaffolding intentions, and process variables) that significantly and differentially relate to the parent-child problem-solving performance. With respect to the second question, Paper 2 also examines determinants of parental scaffolding, precisely how parent (parenting stress), child (preterm birth, cognitive development), and context factors (socioeconomic status, the type of problem-solving task) relate to parents' scaffolding behaviour. The findings suggest that parental scaffolding differs depending on child cognitive development and the task at hand, but not child birth status, parenting stress, or family socioeconomic status. Finally, and regarding the third question, in Paper 3 evidence is provided that a training of parental co-regulation (especially the combination of scaffolding and sensitivity) may enhance parents' beliefs about co-regulation and the promotion of learning the most, both in parents of full- and preterm born toddlers.

Taken together, this dissertation complements previous research on the parent factor in the development of self-regulation in early childhood. The results underline the importance of taking into account the mental level of the caregiver, meaning self-efficacy beliefs, as well as child and context factors when analysing this interplay. The findings are discussed in light of the existing evidence and prevailing theories, and provide an outlook for further directions. The thesis also offers critical implications for the preventive work and clinical practice.

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# List of Scientific Publications

This dissertation is based on the following publications, which are attached in the Appendices.

**Appendix A - Publication 1**

**Gärtner, K. A.,** Vetter, V. C., Schäferling, M., Reuner, G., & Hertel, S. (2018a). Inhibitory control in toddlerhood – the role of parental co-regulation and self-efficacy beliefs. *Metacognition and Learning*, *13*(3), 241–264. doi: 10.1007/s11409-018-9184-7

**Appendix B - Publication 2**

**Gärtner, K. A.,** Vetter, V. C., Schäferling, M., Reuner, G., & Hertel, S. (2018b). "How do we solve this puzzle?" – Parental scaffolding during problem-solving in toddlerhood. Manuscript submitted for publication (date of submission: 29.10.2018).

**Appendix C - Publication 3**

**Gärtner, K. A.,** Vetter, V. C., Schäferling, M., Reuner, G., & Hertel, S. (2018c). Training of parental scaffolding in high-socio-economic status families: How do parents of full- and preterm-born toddlers benefit? *British Journal of Educational Psychology*, 88, 300-322. doi:10.1111/bjep.12218

# 1 Introduction

*__What__ parents do with their children*
*is more important than __who__ parents are.*

(Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004, p. v)

Imagine the three year old Lia who wants to build a block tower. She must have a plan that requires many sequential movements of picking up and stacking the blocks in a precise arrangement in order to reach her goal. She also needs to cautiously release successive blocks onto the tower, thus slowing down or inhibiting her motions. And when her sister tackles over the tower, she needs to control her impulse to hit her and manage her anger and frustration in face of the toppled tower.

Situations like these are ubiquitous to children's daily life and require self-regulation, meaning the internal regulation of "affect, attention, and behaviour to respond effectively to both internal and environmental demands" (Raffaelli, Crockett, & Shen, 2005, p. 54). The development of self-regulation is one of the hallmarks in early childhood and has been associated with a range of academic, socio-emotional, and health-related outcomes (e.g., Allan, Hume, Allan, Farrington, & Lonigan, 2014; Holmes, Kim-Spoon, & Deater-Deckard, 2016; McClelland et al., 2007; Nigg, 2017; Rhoades, Greenberg, & Domitrovich, 2009). It is even more important than socio-economic status (SES) or IQ in predicting adult's physical health, wealth, life satisfaction, substance dependence, criminal offending outcomes, and parenting of the next generation more than 30 years later (Fergusson, Boden, & Horwood, 2013; Moffitt et al., 2011; Poulton, Moffitt, & Silva, 2015). Understanding the development of self-regulation and its correlates in 'normal' developing and 'at risk' children is essential to prevent adverse trajectories associated with self-regulatory deficits. One group at risk for an adverse development of self-regulation and associated outcomes are preterm born children (Brydges et al., 2018; Lemola, 2015; Montagna & Nosarti, 2016).

The focus of this dissertation lies on the parent factor in toddlers' self-regulation. While the first paper addresses the interplay of parental co-regulation, parental beliefs and child self-regulation in 'typically' developing full-term born toddlers, the second and third paper also include a high-risk group, namely preterm born toddlers and their parents. Starting with a theoretical and empirical overview on the concept of self-regulation (Chapter 2.1), its development in 'typically' developing children, as well as preterm born children (Chapter 2.2), Chapter 3 focuses on the parent factor in child self-regulation. I will highlight the role of parental co-regulation for children's development of self-regulation (Chapter 3.1) and address influencing factors (i.e., parental self-efficacy and preterm birth; Chapter 3.2), before dealing with how parent training may promote positive parenting practices and parental beliefs in toddlerhood (Chapter 3.3). The aims, research questions, and the study design of this dissertation will be summarized in Chapter 4. After a description of the empirical papers that form the heart of this dissertation (see Appendices A, B, and C) in Chapter 5, I will discuss the findings in light of their theoretical and practical implications, as well as future directions (Chapter 6 and 7).

# 2 Self-Regulation

## 2.1 The Concept of Self-Regulation

Researchers who are interested in the development of self-regulation have been faced with several challenges. Apart from the diversity of measures (Duckworth & Kern, 2011), one of the most demanding is the lack of conceptual clarity. Over the past several decades, scientists from different sub-disciplines within psychology have investigated self-regulation from a temperamental (*effortful control*; Rothbart, 1989), neuropsychological (*executive functions*; Barkley, 2001; Diamond, 2006; Diamond, 2013), affective (*emotion regulation*; J. J. Gross, 2014), and motivational (*self-control*; Baumeister & Vohs, 2007) perspective. As a consequence, self-regulation has become an umbrella term, making the consolidation of findings across fields difficult (Nigg, 2017). Calls for and attempts to formulate an integrative framework have multiplied in recent years (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Diamond, 2013; Liew, 2012; McClelland & Cameron, 2012; Nigg, 2017; Welsh & Peterson, 2014; Zhou, Chen, & Main, 2012), yet no consensus has been reached.

For the purpose of this dissertation, self-regulation is used and defined as "a purposeful mental activity that serves to modify ongoing cognitive, emotional or motivational target processes in order to adapt to a given situation" (Pauen, 2016). These target processes are predominantly bottom-up, meaning reactive, automatic processes elicited by external stimuli or specific tasks, and are up- and down-regulated via deliberate, top-down self-regulatory mechanisms and strategies[1], resulting in adaptive behavioural self-control (Nigg, 2017; Pauen, 2016). For instance, in face of the toppled tower, Lia will have to up-regulate cognitive target processes (e.g., directing her attention towards building a new tower; remembering the sequence of the blocks), down-regulate her emotions (e.g., anger towards her sister, and frustration that she needs to start all over again), and/or up-regulate a motivational target process (e.g., the wish of being praised for her efforts of building a new tower), which leads her to display a more adaptive behaviour (i.e., building a new block tower, instead of giving up and putting on a hurt face). Up- and down-regulation can be achieved using self-regulatory strategies, such as focusing certain aspects, reframing, self-instructions, or proactive planning, that most certainly all involve executive functions (EF) (Nigg, 2017; Pauen, 2016).

Just like the term self-regulation, EF are elusive to define (Jurado & Rosselli, 2007; Miyake & Friedman, 2012). In general, however, EF describe the top-down cognitive abilities that are important for organizing and processing information, for planning and problem-solving, and for guiding thought, emotion and action in goal-directed behaviour (Blair & Ursache, 2011; Nigg, 2017). While there has been an ongoing debate on the 'unity' and 'diversity' of EF, most researchers agree nowadays that EF represent separable but interrelated components (Friedman & Miyake, 2017; Miyake & Friedman, 2012; Miyake et al., 2000). These include *updating* (i.e., constantly monitoring and manipulating information that is stored in working memory), *inhibition* (i.e., deliberately suppressing and overriding of dominant or prepotent responses), and *shifting* (i.e., flexibly switching between tasks or mental sets) (Miyake & Friedman, 2012). Inhibition may be seen as the core component that is presumably contained completely within the common EF ability, while working memory and shifting are each assumed to have a specific component besides the common EF factor (Friedman, Miyake, Robinson, & Hewitt, 2011; Garon, Smith, & Bryson, 2014; Miyake & Friedman, 2012). Furthermore, EF are theorized to develop in a hierarchical manner, with more simple skills that develop during the first three years (i.e., inhibitory control and working memory) underlying more complex EF components, such as shifting, that develop later (Garon et al., 2008; Garon et al., 2014). Notably, although EF are important for adaptive self-regulation, the two concepts should not be equated: while EF are cognitive capacities that enable the use of self-regulatory strategies that eventually lead to adaptive changes

[1] The focus of the present thesis lies on top-down self-regulation, meaning deliberate processes served by cortical structures, in contrast to bottom-up self-regulation, meaning automatic, reactive processes (e.g., fear) served by subcortical structures (Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Nigg, 2017).

(modulations) of internal states (i.e., self-regulation), there are situations that require EF (e.g., solving a mental math problem) but not self-regulation per se (Nigg, 2017).

In sum, self-regulation refers to a self-initiated change in cognitive, emotional or motivational target processes that occurs via deliberate top-down self-regulatory processes, involving EF, eventually resulting in adaptive behaviour. Given the vital role of self-regulation in our everyday lives, understanding how these skills emerge and advance from infancy throughout childhood is critical to facilitating their development and deployment in a range of contexts (Calkins, 2011).

## 2.2 The Development of Self-Regulation

There is a general consensus that self-regulatory abilities evolve early in life and improve rapidly during toddlerhood and preschool, with progress observable even beyond adolescence (Best & Miller, 2010; Carlson, 2005; Garon et al., 2008; Hendry, Jones, & Charman, 2016; Hughes, 2011; Kloo & Sodian, 2017; Kochanska, Murray, & Harlan, 2000). The tremendous advancements, especially during early childhood, are assumingly driven by an interaction of brain maturation processes in the frontal lobe (Romine & Reynolds, 2005; Stuss & Alexander, 2000), as well as environmental factors, for example family SES (Lengua et al., 2015; Sturge-Apple et al., 2016), and parenting practices (Fay-Stammbach, Hawes, & Meredith, 2014; Razza & Raymond, 2013; Valcan, Davis, & Pino-Pasternak, 2017).

According to developmental models of self-regulation (Kopp, 1982; Pauen, 2016), early self-regulation develops in direct social interaction between the child and the caregiver (see Chapter 3.1). During the first year of life, infant regulation is primarily characterized by reactive behaviours elicited from external stimuli or environments (e.g., thumb-finger sucking as soothing behaviour). Between 12 and 18 months of age, children become capable of control, which describes their emerging awareness of social demands and their ability to comply with parental requests (Kopp, 1982). By setting limits or expressing expectations, parents may challenge and support their child to practice such control. By around 24 months, children become able to display self-control, which encompasses compliance and the ability to delay and inhibit a specific behaviour due to another's request or according to the social expectations, even in the absence of parents or other external monitors (Kochanska, Coy, & Murray, 2001; Kopp, 1982). The preschool period then is marked by children's increasing abilities to memorize and recall rules and social standards, to inhibit a proponent response and to control their impulses, as well as to shift their attention flexibly, thus rapid improvements in EF occur (Garon et al., 2008). Children now have the cognitive capacity that is needed for adaptive internal self-regulatory performance, which they begin to show by around 36 months. They are able to flexibly control and adaptively modify ongoing cognitive, emotional or motivational target processes in order to meet changing situational demands (Kopp, 1982; Pauen, 2016).

Individual differences in child self-regulation and EF are presumably explained by genetic factors, sociodemographic risk, socialization experiences, as well as pre- and perinatal factors (Backer-Grøndahl & Nærde, 2017; Clark & Woodward, 2015; Eisenberg, Duckworth, Spinrad, & Valiente, 2014; Friedman et al., 2008; Fuglestad et al., 2015; G. M. Lawson, Hook, & Farah, 2018; Leve et al., 2013). As will be explained in the following section, one group that displays a high risk for an adverse development of self-regulation and associated outcomes are preterm born children (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Brydges et al., 2018; Lemola, 2015; Montagna & Nosarti, 2016).

### 2.2.1 Risk factor: Preterm birth

Approximately 9% of infants are born prematurely (before 37 complete weeks of gestation) (S. Beck et al., 2010; Goldenberg, Culhane, Iams, & Romero, 2008), with comparable numbers reported in Germany (IQTIG, 2016; Pöschl, 2017). Due to advances in neonatal intensive medicine and care, in the last 20 years an increase in the survival rates of preterm born infants, at steadily decreasing gestational age, as well as a decrease in neonatal morbidity has been documented (Grisaru-Granovsky et al., 2014; Saigal & Doyle, 2008). However, the long-term developmental trajectories after preterm birth remain very heterogeneous (Yaari et al., 2017). Although strong everyday functioning is reported even among pre-schoolers born very preterm (< 32 weeks gestation) and/or born with very low birth weight (< 1500 g) (Andersson, Martin, Strand Brodd, & Almqvist, 2017), detrimental long-term sequelae following extremely (< 28 weeks gestation, birthweight < 1000 g) or very preterm birth are well documented and evidenced by a substantially heightened prevalence of attention deficit disorders, learning difficulties, behavioural and socio-emotional problems (Aarnoudse-Moens et al., 2009; Arpi & Ferrari, 2013; Eryigit-Madzwamuse, Baumann, Jaekel, Bartmann, & Wolke, 2015; Johnson et al., 2016; Johnson & Marlow, 2016; Lemola, 2015; Montagna & Nosarti, 2016). Developmental risks increase as gestational age at birth decreases (Sansavini et al., 2011; Yaari et al., 2017), but even among moderate-to-late (≥ 32 weeks gestation, birthweight ≥ 1500 g) preterm children, evidence for disadvantageous long-term consequences expands (de Jong, Verhoeven, & van Baar, 2012; Quigley et al., 2012; Reuner, Hassenpflug, Pietz, & Philippi, 2009).

The vulnerability of preterm children for these more global cognitive, behavioural, and socio-emotional problems may be explained by early attention and self-regulation deficits (Aarnoudse-Moens et al., 2009; Brydges et al., 2018; Davis & Burns, 2001; Mulder, Pitchford, Hagger, & Marlow, 2009; van de Weijer-Bergsma, Wijnroks, & Jongmans, 2008). For instance, Reuner, Weinschenk, Pauen, and Pietz (2014) demonstrated that gestational age indirectly affected global cognitive performance at 7 months of age, and this effect was mediated through infants' focused attention (assessed concurrently at 7 months). Similarly, Lawson and Ruff (2004) showed that very preterm born infants' focused attention was predictive of mother-reported problems in hyperactivity/inattention at age 4/5 years and cognitive abilities at 2, 3, and 4/5 years of age. Poehlmann et al. (2010) reported a link between preterm children's effortful control at 36 months of age with concurrent mother-reported attention problems and symptoms of ADHD. Furthermore, lower effortful control at 24 months was associated with less optimal cognitive scores concurrently and prospectively one year later (see also Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012).

Research in the last decade has focused on factors associated with these adverse developmental outcomes described in the preterm population. Among others, the immaturity of the brain as well as neonatal distress and pain have been identified as major risk factors (Grunau et al., 2009; Montagna & Nosarti, 2016; Ortinau & Neil, 2015; Treyvaud et al., 2009; Tu et al., 2007; Voigt et al., 2013), with parental mental health and parenting practices potentially moderating the effect of these early adverse events by acting either as protective or exacerbating factors (Montagna & Nosarti, 2016).

# 3 The Parent Factor in Child Self-Regulation

## 3.1 Parental Co-Regulation

From a socio-cultural perspective (e.g., Vygotsky, 1978) and according to developmental models of self-regulation (Kopp, 1982; Pauen, 2016), it is assumed that parents fulfil a co-regulatory function in early childhood, promoting young children's development of self-regulation by attempts to modify children's thoughts, behaviour or emotions according to the expectations and values of a particular context (Colman, Hardy, Albert, Raffaelli, & Crockett, 2006; Kurki, Järvenoja, Järvelä, & Mykkänen, 2016; Pauen, 2016; Volet, Summers, & Thurman, 2009). By gradually internalizing the experienced co-regulatory strategies, children then become more and more capable of regulating themselves. Internalization is thus considered to be the main mechanism that transforms co-regulation into self-regulation (Demetriou, 2000).

When studying parental co-regulation, it is important to consider both positive and negative dimensions, as these may have distinct effects on child development (Blair et al., 2011). As suggested by Bechtel, Strodthoff, and Pauen (2016), *positive co-regulation* describes the way parents engage and support their child in cognitively and emotionally challenging situations. This includes displaying positive affect, acting responsively and sensitively to the child's needs, and providing the necessary scaffolds to encourage and comfort the child appropriately in order to avoid or reduce frustration, to help the child achieve her goal and to promote autonomy. In contrast, *negative co-regulation* is defined by harsh, controlling, hostile and intrusive parenting behaviours (e.g., threatening, frowning or shouting at the child), which undermine the child's autonomy and are likely to be displayed in situations where the child refuses to comply and/or gets upset with the parent (Bechtel et al., 2016).

While the concepts of positive and negative co-regulation predominantly relate to the quality of parenting practices, they do not specify their regulatory targets. Aligned with the distinction of hot and cold self-regulation (e.g., Peterson & Welsh, 2014; Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011; Zelazo & Cunningham, 2007), it could be assumed that parental co-regulation may also address *hot* (emotional, motivational) and *cold* (cognitive) target processes (Pauen, 2016). In that sense, responsive and sensitive parenting, meaning the warm acceptance of the child's needs and interests, as well as prompt and contingent responses to child signals (Landry, Smith, & Swank, 2006), represents predominantly hot co-regulation and supports the child in regulating emotional and motivational states. In contrast, cold co-regulation is assumed to be largely aimed at cognitive processes (e.g. directing the child's attention) and could be best described by parental *scaffolding* (Wood, Bruner, & Ross, 1976). As illustrated in the next chapter, parental scaffolding (i.e., cold co-regulation) becomes especially relevant in instructional settings and problem-solving situations, where the primary targets of regulation are cognitive processes (e.g., attention)[2].

[2] It should be noted that hot and cold co- and self-regulation processes often may interact. For instance, cold co-regulation strategies (e.g., directing the child's attention to important aspects of a task) may modulate the motivational/emotional state of a child (e.g., increasing interest), while hot co-regulation strategies (e.g., encouraging the child to keep on trying) may also be necessary in order to keep the child's attention and enable

Research on the interplay of parental co-regulation and child self-regulation has advanced over the last decade, with ample evidence from correlational and longitudinal studies, including observational and parent-report measures, suggesting a direct and indirect link between the different dimensions of parental co-regulation and children's emerging self-regulation in early childhood (Bernier, Carlson, & Whipple, 2010; Devine, Bignardi, & Hughes, 2016; Fay-Stammbach et al., 2014; Hughes & Devine, 2017; Lucassen et al., 2015; Matte-Gagné & Bernier, 2011). Importantly, recent findings also point to bidirectional influences, indicating that child self-regulation may predict change in parenting quality (Blair, Raver, Berry, & Family Life Project, 2014; Eisenberg et al., 2010; Merz, Landry, Montroy, & Williams, 2017). However, the majority of the present studies have explored unidirectional effects from parents' co-regulation to child's development of self-regulation.

In a recent meta-analysis, Valcan and colleagues (2017) systematically analysed the role of positive (hot and cold) and negative co-regulation behaviours in the development of EF in children aged 0 to 8 years and found significant associations in the expected direction: while hot (sensitive and responsive) and cold parental co-regulation (scaffolding) predicted better EF, negative parenting practices were associated with lower EF. Notably, associations between cold parental co-regulation and EFs were significantly moderated by child age, with younger children showing a stronger effect size. Early childhood thus represents a critical period during which parental scaffolding seems especially influential and corresponding interventions might be most effective in facilitating promotive parenting practices in order to prevent children from adverse developmental trajectories (see Chapter 3.3).

Acknowledging the strong contribution of parental scaffolding for young children's developing self-regulation skills, the following chapter focuses on this parenting dimension more thoroughly.

### 3.1.1 Parental scaffolding

The concept of scaffolding, which Wood and colleagues (1976) introduced in their seminal work more than 40 years ago, describes a set of interventions, such as structuring and reasoning, with which parents may teach and model effective regulatory skills (Chang, Shaw, Dishion, Gardner, & Wilson, 2015) and "enable the child to solve a problem, carry out a task or achieve a goal, which would be beyond his unassisted efforts" (Wood et al., 1976, p. 90). Problem-solving requires a large amount of EF (Landry, Miller-Loncar, Smith, & Swank,

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the child to solve a challenging task (van de Pol, Volman, & Beishuizen, 2010). In the present dissertation, however, cold co-regulation and scaffolding refer to the modulation of cognitive processes.

2002; Zelazo, Carter, Reznick, & Frye, 1997). Since these skills are still evolving in early childhood (Garon et al., 2008), parents may enlighten the cognitive load imposed by the task by taking over those parts that their child is not yet able to perform. Thus, instead of keeping the plan in mind, monitoring the problem-solving process, evaluating their options and deciding which one is the best choice, the child may devote his/her cognitive resources to complementing the step rather than first figuring out what the step is (Eason & Ramani, 2017). This may enable children to internalize the observed strategies and, as EF progressively develop, become more independent and better problem solvers and self-regulated learners (Landry et al., 2002). In support of this assumption, the evidence suggests that parental scaffolding predicts better EF in toddlerhood and preschool age (Bernier et al., 2010; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012), and is also related to better self-regulated learning in school-aged children (Neitzel & Stright, 2003; Pino-Pasternak, Whitebread, & Tolmie, 2010; Zhang & Whitebread, 2017).

However, during the last decades, the concept of scaffolding has been applied to diverse contexts in developmental, educational and cognitive psychology, and operationalized in several ways for research purposes (Granott, 2005; Leith, Yuill, & Pike, 2018; van de Pol et al., 2010), resulting in a conglomerate of definitions and measures of scaffolding (Mermelshtine, 2017). For instance, researchers have analysed the relation of parental scaffolding and the development of child self-regulation and problem-solving skills by focusing on process variables (e.g., contingency management or autonomy support) (Bernier et al., 2010; Carr & Pike, 2012; Matte-Gagné, Bernier, & Lalonde, 2015), the cognitive and emotional support (Neitzel & Stright, 2003), or the overall quality of scaffolding (Hammond et al., 2012), making the integration and consolidation of findings challenging.

Hence, for the present dissertation, I refer to an integrative framework provided by van de Pol et al. (2010). The authors distinguish scaffolding *intentions* (what is scaffolded) and scaffolding *means* (how is scaffolding taking place). For instance, during a joint problem-solving task, parents may intend to support and regulate their child's metacognitive (i.e., monitoring the problem-solving process), cognitive (i.e., structuring the task), or affective activities (i.e., recruitment, frustration control) by giving feedback, hints, instructions, or explanations, by asking questions, or demonstrating unique features of the task. The combination of a scaffolding means with a scaffolding intention then construes a scaffolding strategy. However, whether such strategy qualifies as scaffolding depends also on whether it is applied *contingently* and whether it is part of the process of *fading* and *transfer of* *responsibility* in order to promote the child's learning and regulation (Leith et al., 2018; Mermelshtine, 2017; van de Pol et al., 2010).

## 3.2 Determinants of Parental Co-Regulation and Links to Child Self-Regulation

A question that arises when studying parenting behaviours is "Why do parents parent the way they do?" (Belsky, 1984, p. 83). In order to answer this question, Belsky (1984) was one of the first researchers proposing a theoretical model of the determinants of parenting behaviours, emphasizing context, parent, as well as child characteristics. For instance, with regard to the context, low SES and associated risks (e.g., residential instability, neighbourhood problems, family conflict and disorganization) have been shown to negatively relate to parental scaffolding, maternal warmth, and limit setting, and also indirectly effecting children's self-regulation (Lengua et al., 2014). Concerning child characteristics, for instance, temperamental dispositions (e.g., high negative emotionality) have been shown to relate to less supportive parenting behaviours (especially in low-income families; Neitzel & Stright, 2004; Paulussen-Hoogeboom, Stams, Hermanns, & Peetsma, 2007), and also lower self-regulation skills (Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007). Preterm birth represents another child characteristic that might exert an effect on parents' co-regulation behaviours (see Chapter 3.2.2).

Studies that have focused on parent characteristics, such as parenting stress or parental mental health problems, have reported negative links with parents' scaffolding behaviour, inductive discipline and maternal warmth, and, as a consequence lower child self-regulation and more behaviour problems (Choe, Olson, & Sameroff, 2013; Hoffman, Crnic, & Baker, 2006). In addition, parenting cognitions have been assumed to play a key role for parenting practices and child development. According to the so called three-term 'standard model' parenting cognitions are presumed to engender parenting practices, and, ultimately, affect children's development and adjustment (Bornstein, Putnick, & Suwalsky, 2018).

Acknowledging that parenting behaviours highly depend upon and are influenced by a variety of context, parent, and child characteristics (see Bornstein, 2016 for a recent review on the empirical status quo), in the following the focus lies on parental self-efficacy beliefs as well as preterm birth as two major factors presumably involved in parental co-regulation behaviours and child development.

### 3.2.1 Parental self-efficacy as a factor involved in parental co-regulation

*Parental self-efficacy* refers to "parents' perceived ability to positively influence the behaviour and development of their children" (Coleman & Karraker, 2003, p. 128). It is assumed that parents are more apt to employ positive parenting practices if they have the confidence that their behaviour will indeed have a positive effect on their child. By contrast, parents who feel that they have no control over or cannot achieve anything in their child's life or environment are less likely to engage in promotive strategies (Ardelt & Eccles, 2001). In his self-efficacy theory, Bandura (1977, 1989) argues that domain-specific measures of self-efficacy are more precise predictors of actual behaviour compared to rather general beliefs, and a profound body of evidence from outside the parenting domain supports this assumption (e.g. K. H. Beck & Lund, 1981; Lent, Brown, & Gore, 1997; Multon, Brown, & Lent, 1991; Pajares & Miller, 1995; Wang & Richarde, 1988).

To date, systematic research exploring differential associations among domain-general (i.e., competence expectations that are not linked to particular parenting tasks or parenting domains but to the parenting role in general) and domain-specific levels of parental self-efficacy (i.e., focusing on one parenting domain, such as discipline or promotion of learning) and parent and child outcomes is rare. In a first study, Coleman and Karraker (2003) found that especially parents' domain-specific self-efficacy beliefs predicted toddler's cognitive development and adjustment. However, neither domain-general nor domain-specific beliefs were linked to the quality of maternal practices. In contrast, Sanders and Woolley (2005) showed that parents' specific, but not domain-general or global measures of self-efficacy, predicted parents' self-reported discipline strategies and were most strongly related to mother-reported child behaviour problems. Hence, the current findings on the link between parents' domain-specific and -general self-efficacy beliefs and parent and child behaviours are mixed, but provide subtle evidence for parents' domain-specific beliefs being a stronger predictor than domain-general ones.

Furthermore, throughout the existing literature, there is a tendency to focus on child behaviour and externalizing problems, often including high-risk or clinical samples (Jones & Prinz, 2005; Jusiene, Breidokiene, & Pakalniskiene, 2015; Murdock, 2013; Sanders & Woolley, 2005; Weaver, Shaw, Dishion, & Wilson, 2008), at the expense of exploring self-regulatory processes, such as inhibitory control, that may underlie these problems. Gaining a thorough picture of the interplay of parental self-efficacy, parental co-regulation and child self-regulation is of particular relevance and may have important implications for the design of interventions. Hence, research is strongly needed that explores systematically the effects of the different levels of parental self-efficacy on parenting practices as well as on child self-regulation.

### 3.2.2 Preterm birth as a factor involved in parental co-regulation

Preterm birth represents an extremely stressful and disturbing event for parents. Numerous parents experience increased stress, anxiety and depressive symptoms up to seven years later (Gray, Edwards, O'Callaghan, Cuskelly, & Gibbons, 2013; Schappin, Wijnroks, Uniken Venema, & Jongmans, 2013; Treyvaud et al., 2010; Treyvaud, Lee, & Doyle, 2014). As stated above, research has shown that these factors may hinder promotive parenting practices, which in turn may effect child self-regulation and behaviour problems (Choe et al., 2013; Hoffman et al., 2006). Specific parental behaviours of concern that have been observed among parents of preterm born children include increased intrusiveness and control, frequently re-directing their child, and failure to recognize and adjust contingently to their child’s cues (Camerota, Willoughby, Cox, & Greenberg, 2015; Clark, Woodward, Horwood, & Moor, 2008; Forcada-Guex, Pierrehumbert, Borghini, Moessinger, & Muller-Nix, 2006; Guralnick, 2012; Potharst et al., 2012). With regard to parental scaffolding, the evidence is mixed. Some authors report that mothers of preterm born toddlers and pre-schoolers use less scaffolding (Erickson et al., 2013) and more simple strategies, for example, labelling the child’s actions or simply testing knowledge in contrast to offering different opinions and reasons, respectively more complex strategies (Donahue & Pearl, 1995; Lowe, Erickson, MacLean, Schrader, & Fuller, 2013). They also appear less supportive of and more interfering with their child’s autonomy than parents of term born children (Potharst et al., 2012). However, others observed no such differences (e.g., Landry, Smith, Swank, & Miller-Loncar, 2000; Lowe et al., 2014). These heterogeneous findings might possibly be due to conceptual (e.g., the lack of a unified definition) as well as methodological issues (e.g., common measures of parental scaffolding).

More research on how preterm birth and associated factors influence parental scaffolding is strongly needed and may be particularly relevant for the design and evaluation of preventive intervention programs in preterm aftercare.

## 3.3 Training of Parental Co-Regulation

In view of the relevance children’s self-regulation skills have for later academic, socio-emotional and health-related outcomes, it is of major social and political interest to promote their development at an early stage, and to prevent children from adverse trajectories associated with self-regulatory deficits. As emphasized before, parents play a significant role in the development of children’s self-regulation skills. Hence, the question arises how favourable parental co-regulation practices and beliefs can be promoted in order to establish a developmental environment for the child as optimal as possible.

The need for evidence-based preventive parenting interventions has been widely recognized and has resulted in a broad range of parenting programmes in Germany as well as internationally (for an overview see Bundeszentrale für gesundheitliche Aufklärung, 2011). The majority of these programmes, for example, Triple P – Positive Parenting Program (Sanders, Kirby, Tellegen, & Day, 2014), or STEP – Systematic Training for Effective Parenting (Marzinzik & Kluwe, 2007), focus on the parent-child interaction and parenting in a global fashion and target a wide age-range of children (e.g., Triple P: 2 – 18 years; Early Childhood STEP: 0 – 6 years), thus are not aimed at promoting child self-regulation specifically but child psychosocial development more generally.

From a clinical perspective, preventive parenting interventions become particularly relevant for preterm born children and their parents. With approximately 9% of infants in Germany born prematurely (IQTIG, 2016), the prevalence of preterm birth is high. Preterm born children not only display a heightened risk for self-regulation deficits and associated adverse developmental trajectories (see Chapter 2.2.1), they also seem to be disproportionally vulnerable to the effects of negative or insensitive parenting (Camerota et al., 2015; Jaekel, Pluess, Belsky, & Wolke, 2015), while benefitting more from more optimal and sensitive parenting (Camerota et al., 2015). In addition, psychological symptoms of stress or depression are often reported by mothers of preterm born children (Treyvaud et al., 2010; Treyvaud et al., 2014) and may not only hinder positive co-regulation practices, meaning sensitive parenting and effective scaffolding (Choe et al., 2013; Hoffman et al., 2006; see Chapter 3.2.2), but also diminish parents' sense of competence (Pennell, Whittingham, Boyd, Sanders, & Colditz, 2012). Indeed, various studies (D. Gross & Rocissano, 1988; McGrath, Boukydis, & Lester, 1993) have reported reduced feelings of parental self-efficacy among mothers of preterm children (although see Pennell et al., 2012). Hence, parenting interventions that promote these co-regulation practices and beliefs might prevent long term disruptions in the parent-child relationship that could exacerbate potential self-regulation deficits (Dilworth-Bart, Poehlmann-Tynan, Taub, Liesen, & Bolt, 2018).

Ample evidence indicates that training may facilitate sensitive and responsive parenting in parents of full- and preterm born children (Bakermans-Kranenburg, van Ijzendoorn, & Juffer, 2003; Evans, Whittingham, Sanders, Colditz, & Boyd, 2014; Landry, Smith, Swank, & Guttentag, 2008; Newnham, Milgrom, & Skouteris, 2009). However, interventions that target cold co-regulation practices, namely scaffolding, are still rare. In addition, the majority of the preventive parenting programmes in preterm aftercare have focused on parenting in infancy (Brecht, Shaw, St. John, & Horwitz, 2012; Puthussery, Chutiyami, Tseng, Kilby, & Kapadia, 2018; Ramey et al., 1992), while follow-up training in toddlerhood has received less attention. The toddler years demarcate the beginning of a period of rapid growth in child self-regulation (e.g., Garon et al., 2008) and represent a particular sensitive period for the effects of parents' cold co-regulation, meaning scaffolding (Valcan et al., 2017), during which a corresponding training might yield the largest effects (Landry et al., 2008).

From a methodological as well as theoretical perspective, since ample evidence suggests that changing beliefs and attitudes is an important step towards changing behaviour (Ajzen, 2011; Webb & Sheeran, 2006), it has been argued that interventions should not only target parenting practices directly, but also aim to enhance parents' self-efficacy beliefs, intentions as well as knowledge about child development (Ajzen, 2011; Benzies, Magill-Evans, Hayden, & Ballantyne, 2013; Wittkowski, Dowling, & Smith, 2016). Group-based interventions have been shown to represent an effective way to strengthen parental self-efficacy and beliefs in parents of term and preterm children (Benzies et al., 2013; Wittkowski et al., 2016). In addition, Wyatt Kaminski and colleagues (2008) demonstrated in their meta-analysis that especially parenting programs that focus on positive parent-child interactions and emotional communication, and that require parents to practice new skills with their child, yield the largest effects on parent and child outcomes. Furthermore, there is growing evidence for the effectiveness of brief parenting interventions (i.e., with fewer than eight sessions) in reducing dysfunctional parenting (Tully & Hunt, 2016) and promoting sensitive parenting in early childhood (Bakermans-Kranenburg et al., 2003).

In conclusion, parenting interventions in toddlerhood that promote not only positive co-regulation practices, meaning sensitive interactions and effective scaffolding, but also parental beliefs, are presumably both feasible and inexpensive, but expected to have lasting effects on both the parent-child relationships as well as early cognitive and self-regulatory skills (Lowe et al., 2014; Lowe et al., 2013). Such programs hence represent a promising venue for preterm aftercare.

# 4 Aims, Research Questions, and Study Design

The present dissertation draws attention to the parent factor in toddlers' self-regulation and addresses three major questions. First, how do parents' co-regulation behaviour and self-efficacy beliefs relate to toddlers' self-regulation and problem-solving performance? Second, which factors may affect parents' co-regulation behaviour in toddlerhood? And third, how may parental co-regulation behaviours and associated beliefs be promoted and supported at an early stage?

With regard to the **first question**, parental self-efficacy has been shown to predict parenting practices and child developmental outcomes, yet no study has empirically examined the link from parental self-efficacy to child self-regulation, and precisely inhibitory control as a core component, in early childhood. In addition, systematic research examining differential associations of parents' domain-general and domain-specific self-efficacy beliefs with child outcomes is scarce. Thus, in Paper 1 it was explored how parents' domain-specific and domain-general self-efficacy beliefs, as well as positive and negative co-regulation behaviours predicted toddler's inhibitory control. Furthermore, based on the so-called three term standard model of 'parenting cognitions → parenting practices → child adjustment' (Bornstein et al., 2018), it was examined whether the association between parental self-efficacy and child inhibitory control was mediated via parental co-regulation. Furthermore, in Paper 2 the link from parents' cold co-regulation behaviour (i.e., parental scaffolding) to toddlers' self-regulation was addressed in a more applied setting, namely during problem-solving. The second paper was aimed to not only contribute empirically and theoretically to this field, but also methodologically. For this purpose, based on van de Pol and colleagues (2010) integrative scaffolding framework, an observational instrument was developed and applied that captured the different levels of parental scaffolding (i.e., scaffolding means, scaffolding intentions, and process variables of scaffolding). The guiding question was how these levels of parental scaffolding differentially related to the parent-child problem-solving performance in toddlerhood.

Concerning the **second question**, research has shown that parenting behaviours highly depend upon and are influenced by a variety of context, parent, and child characteristics (Bornstein, 2016). However, the degree to which these factors affect parental scaffolding in toddlerhood remains largely in question. Based on Belsky's (1984) model of the determinants of parenting, the second paper of this dissertation aimed to examine how parent (e.g., parenting stress), child (e.g., preterm birth, cognitive development), and contextual characteristics (e.g. SES, type of problem-solving task) would contribute to the different levels of parental scaffolding.

Finally, and with respect to the **third question**, ample evidence exists on the effectiveness of parental sensitivity training, especially during infancy, while research evaluating parental scaffolding interventions in toddlerhood is still scarce. Assuming that a high sense of parental self-efficacy and positive beliefs about parental co-regulation and learning may stimulate and motivate parents to use promotive co-regulation behaviours, the third paper of this dissertation was aimed to examine whether a training of parental scaffolding alone or combined with a sensitivity training would effectively enhance associated parental beliefs in parents of full- and preterm born toddlers.

To answer these research questions, data was collected from October 2015 until December 2017 within the scope of the FILU-F project (original German title: *Selbstregulation bei Frühgeborenen fördern – Entwicklung und Evaluation eines Unterstützungsangebots für Eltern frühgeborener Kinder*), a quasi-experimental intervention study with a 2 x 3 pre-/post-test design with a three-month follow-up interval[3]. Parents with a two-year-old full-term or preterm born toddler (age corrected for prematurity) participated in the study and were randomly assigned to one of three treatment groups: 1) basic training scaffolding, 2) combined training scaffolding + sensitivity, 3) stress-management training (control group). The training consisted of four weekly sessions that lasted three hours each. Participating parents and their children were recruited in Heidelberg and the Rhine-Neckar Metropolitan Region. A multi-method approach was applied to collect information on the parent- and the child level, including questionnaires, performance-based measures of inhibitory control, as well as parent-child interactions during free play and problem-solving. The problem-solving tasks referred to in this dissertation included two age-appropriate tasks (randomly assigned) where children was given 10 minutes time to sort different blocks or pieces according to two dimensions (colour and shape, or colour and size). Parents were instructed to support their child but to not solve the task themselves.

Data were assessed at three measurement points (T1 = pre-test, T2 = post-test, T3 = three-month follow-up). Table 1 gives an overview of the measures and assessment points that are relevant for the present dissertation (for a complete overview of all measures applied in the project please refer to Table 1 in Appendix A).

[3] Due to the timely data collection and the specific research questions, the three publications presented in this thesis are based on different subsamples of the total sample.

Table 1

*Applied measures and assessment points*

| | T1 | Intervention | | | T2 | T3 |
|---|---|---|---|---|---|---|
| | | Session 1 | Session 2-3 | Session 4 | | |
| Anamnesis + SES | X | | | | | |
| Self-efficacy, beliefs (self-report) | | X | | X | | X |
| IMMA 1-6[a] | X | | | | X | X |
| BRIEF-P[b] | X | | | | X | X |
| PSI[c] | X | | | | | |
| Cognitive development (child)[d] | X | | | | | |
| Self-regulation (child)[e] | X | | | | X | |
| Parent-child-interaction | X | | | | X | |

*Note.* T1 = pre-test, T2 = post-test, T3 = three-month follow-up; [a]IMpuls-MAnagement vom Kleinkind- bis zum Vorschulalter (Pauen, Hochmuth, Schulz, & Bechtel, 2014); [b]Behavior Rating Inventory of Executive Function-Preschool Version (Daseking & Petermann, 2013); [c]Parenting Stress Index (Tröster, 2011); [d]Bayley Scales of Infant and Toddler Development III (Reuner & Rosenkranz, 2014); [e]Snack Delay/Sun-Moon (Voigt et al., 2012).

# 5 Summary of Empirical Findings

In the following section, I will summarize the empirical findings of the three papers that are at the core of this dissertation. The description of these papers will be limited to the essential aspects of the aims, methodology and results. For further details regarding design, methods, and statistics, please refer to the original manuscripts (Appendices A, B, and C).

## 5.1 Gärtner, Vetter, Schäferling, Reuner, & Hertel (2018a)

In order to contribute to the first major research question of this dissertation, the first aim of this paper was to examine how domain-specific and domain-general self-efficacy beliefs, as well as positive and negative co-regulation behaviours assessed at pre-test (T1) predicted toddler's inhibitory control six weeks later (T2). Second, it was explored whether parental co-regulation mediated the link between parents' domain-specific self-efficacy and child inhibitory control. Based on previous research, it was expected that parents' negative and positive co-regulation practices at T1 would predict child inhibitory control at T2 (i.e., lower negative co-regulation and higher positive co-regulation should be related to higher inhibitory control) (H1). Furthermore, domain-specific self-efficacy beliefs were expected to be a stronger predictor of child inhibitory control than domain-general self-efficacy beliefs (H2). In addition, the joint contribution of parental co-regulation and self-efficacy beliefs was examined, exploring whether self-efficacy beliefs (and especially domain-specific) would contribute significantly to child inhibition, when controlled for parental co-regulation (H3). Finally, regarding the mediation effect, it was assumed that the effect from parents' domain-specific self-efficacy to child inhibitory control would be (partially) mediated by parents' co-regulation behaviour (H4).

Parents' positive and negative co-regulation and domain-specific and domain-general self-efficacy beliefs were assessed at T1 via the IMMA 1-6 and a self-developed questionnaire. Children's inhibitory control at T2 was measured with the Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version (BRIEF-P), as well as a Snack Delay task[4]. Children's cognitive development at T1 was assessed with the Cognitive Scale of the Bayley-III and served as a covariate in the analyses.

Results are based on complete data from 83 parent-child dyads (children were between 24-35 months of age). The findings indicate that parents' negative (but not positive) co-regulation (H1) as well as domain-specific (but not domain-general) self-efficacy beliefs (H2)

[4] Data from the Snack Delay task could not be included in the final analyses due to children scoring at ceiling.

significantly predicted child's inhibitory control (BRIEF-P) six weeks later. Parents' domain-specific self-efficacy contributed to child inhibitory control, even when controlled for parental co-regulation practices (H3). With regard to the mediation from parents' domain-specific self-efficacy to child inhibitory control via parents' negative co-regulation (H4), unexpectedly the data did not support a (partially) indirect effect but rather pointed towards two independent direct effects.

The present paper adds important evidence on the interplay of parental self-efficacy, co-regulation and (parent-reported) inhibitory control. Direct effects from parental co-regulation and self-efficacy beliefs to child inhibitory control were observed, though no indirect pathway from parental self-efficacy via parental co-regulation to child inhibitory control. At this point, no conclusions can be drawn on the direction of effects due to the short time interval between pre- and post-test. Transactional influences from the parent to the child and vice versa are very likely. Longitudinal research, including observational measures or third party reports, is needed to complement these findings.

## 5.2 Gärtner, Vetter, Schäferling, Reuner, & Hertel (2018b)

In order to further contribute to the first major research question of this dissertation, one aim addressed in the second paper was to examine the contribution of parental scaffolding (i.e., cold co-regulation) to the dyadic parent-child problem-solving performance. Based on van de Pol and colleagues' (2010) integrative scaffolding framework, an observational instrument was developed and applied that captured the different levels of parental scaffolding (i.e., scaffolding means, scaffolding intentions, and process variables of scaffolding). The guiding questions focused on how the levels of parental scaffolding differentially related to parent and child's problem-solving performance in toddlerhood and whether the link from parents' use of scaffolding means on the dyadic task performance would be mediated via parents' scaffolding intentions (i.e., cognitive and metacognitive support). Based on van de Pol et al. (2010), positive effects from parents' use of scaffolding means, scaffolding intentions, as well as process variables on the parent-child problem-solving performance were expected. Furthermore, parents' use of scaffolding means was assumed to be indirectly related to the problem-solving performance, mediated via parents' scaffolding intentions.

With respect to the second overarching question of this dissertation, the second aim addressed in this paper was to explore determinants of parental scaffolding. Precisely, it was examined how parent (parenting stress), child (preterm birth, cognitive development), and contextual characteristics (SES, the type of problem-solving task) contributed to the different levels of parental scaffolding in toddlerhood. Since research on the determinants of parental scaffolding is still scarce and sometimes heterogeneous, this question was predominantly from exploratory nature, with the exception of parenting stress and family SES. It was expected that parenting stress would be negatively related to parental scaffolding, whereas a positive link was assumed for family SES.

Results are based on data from 91 full-term and 42 preterm parent-child dyads, with children’s (corrected) age between 23 to 35 months. Parent-child dyads worked together on one of two problem-solving tasks (randomly assigned, 10 minutes time-cap). Their interactions were analysed with a self-developed high-inference rating scheme reflecting the three levels of parental scaffolding via five scales (i.e., use of scaffolding means, cognitive and metacognitive support, transfer of responsibility and contingency management). In addition, the dyadic parent-child task performance (successful vs. unsuccessful) was assessed. Child’s cognitive development was measured with the Bayley-III, and parenting stress with the German version of the Parenting Stress Index.

Concerning the first question, results revealed direct effects from parents’ scaffolding intentions (cognitive and metacognitive support), and transfer of responsibility on the dyadic task performance, as well as indirect effects from parents’ scaffolding means to the dyadic task performance, mediated via parents’ scaffolding intentions (cognitive and metacognitive support). With respect to the second question, it was observed that parents’ scaffolding behaviour (particularly the scales cognitive support and transfer of responsibility) varied as a function of child’s cognitive development and the task the parent-child dyads worked on. No effects resulted for preterm birth, parenting stress or SES when controlling for the remaining predictors.

The study contributes significantly to previous research by showing that the levels of parental scaffolding differentially relate to and augment the parent-child dyadic task performance. Future studies should investigate how parental scaffolding in toddlerhood predicts child’s independent problem-solving performance in subsequent tasks, and whether child’s EF might take a moderating role. In addition, the findings suggest that parents’ scaffolding behaviour differs depending on child and contextual factors. Longitudinal research on the determinants of parental scaffolding is highly needed in order to gain a more integral picture.

## 5.3 Gärtner, Vetter, Schäferling, Reuner, & Hertel (2018c)

Related to the third guiding question of this dissertation, the aim of this paper was to analyse the effectiveness of a training of parental co-regulation in parents of full- and preterm born two-year-old toddlers. A basic scaffolding training and a combined scaffolding + sensitivity training were compared to an active treatment control group (stress management). It was examined whether the basic and combined treatments would increase parents' domain-specific self-efficacy regarding scaffolding and their beliefs about parental co-regulation and the promotion of learning (BCL) more than the control treatment would. No such differences were expected for parents' domain-general self-efficacy, since parents' strengths and resources within the parenting domain were covered in all treatment groups. It was further analysed whether parents of preterm and full-term children benefitted equally from the training conditions. This last research question was exploratory in nature.

A total of 87 parents of full-term and 35 parents of preterm toddlers (24– 35 months of age, corrected for prematurity) participated. The training consisted of four weekly sessions that lasted three hours each. Parents were randomly assigned to the three treatment groups. Results presented within this paper are limited to the questionnaire data. Parents reported on their self-efficacy beliefs as well as BCL before (pre-test) and after training (post-test), as well as at the three-month follow-up assessment.

The findings reveal that parents' BCL changed significantly stronger from pre- to post-test in the combined training than in the control group. In addition, parents' domain-specific and (though only marginally significant) domain-general self-efficacy beliefs increased significantly from pre- to post-test and follow-up in all treatment groups. Furthermore, the data suggest that parents of full-term and preterm born children benefitted equally from the basic and the combined treatment with regard to the reported change in BCL.

The need for preventive programmes in preterm aftercare is highly emphasized. Results indicate that particularly the combined training of parental scaffolding and sensitivity could enhance BCL in parents of full-term and preterm born children. This finding represents an important step and a prerequisite to motivating parents to use the learned strategies. Assuming that this training is able to yield improvements on the behavioural level as well, this strategy will be an important venue for preterm aftercare.

# 6 General Discussion

This dissertation focused on the parent factor in toddlers' development of self-regulation. Although it is generally acknowledged that parents play a key role in children's development of self-regulation, numerous questions still remain unanswered. The present dissertation aimed to shed light onto the following overarching questions. First, how do parents' co-regulation behaviour and self-efficacy beliefs relate to toddlers' self-regulation and problem-solving performance? Second, which factors may affect parents' co-regulation behaviour in toddlerhood? And third, how may parental co-regulation behaviours and associated beliefs be promoted at an early stage?

Taken together, the results of the presented set of papers complement previous research in several ways. First, concerning the link between parental co-regulation behaviours, self-efficacy beliefs and toddler's self-regulation and problem-solving performance, evidence was provided that parents' negative co-regulation practices and domain-specific self-efficacy beliefs were independently associated with toddlers' inhibitory control (parent-report) six weeks later (Paper 1). In addition, parents' cold co-regulation (scaffolding) significantly and differentially related to the parent-child problem-solving performance, with parents' scaffolding intentions (i.e., cognitive and metacognitive support), as well as transfer of responsibility (though negatively related) being the strongest predictors, and parents' use of scaffolding means exerting an indirect influence via parents' scaffolding intentions (Paper 2). Second, and with respect to the factors that might contribute to parents' co-regulation behaviours, the findings suggest that parents' cold co-regulation behaviour (namely scaffolding) differs depending on child's cognitive development, as well as the task at hand, but not child's birth status, parenting stress or family SES (Paper 2). Third, regarding the promotion of parental co-regulation practices and beliefs, Paper 3 provides evidence that a training of parental co-regulation (especially the combination of scaffolding and sensitivity) may enhance parents' beliefs about co-regulation and learning the most, both in parents of full-term as well as preterm born toddlers.

In the following, the key findings of the three empirical papers will be discussed in light of their theoretical and practical implications. Strengths and methodological limitations will be elaborated and an outlook on future directions will be given, before closing with a general conclusion.

## 6.1 Theoretical Implications

### 6.1.1 Parental co-regulation, self-efficacy beliefs, and child self-regulation

Parents' co-regulatory function for children's development of self-regulation has been emphasized in developmental models of self-regulation (e.g., Kopp, 1982) and has stimulated much research over the last decades. Parents' co-regulation strategies may generally be classified according to their quality (i.e., positive vs. negative), as well as their co-regulatory target (i.e., hot, emotional processes vs. cold, cognitive processes). In the present dissertation, one major aim was to observe the interplay of parents' positive and negative co-regulation practices with a core component of child self-regulation, namely inhibitory control, as well as the contribution of parents' cold co-regulation strategies in an applied setting of child self-regulation, namely during a challenging problem-solving task. Furthermore, it is the first study that has differentially addressed the role of parents' self-efficacy beliefs in toddler's development of self-regulation.

As expected based on theoretical models (Kopp, 1982; Pauen, 2016) and the empirical evidence (Kochanska & Knaack, 2003; Lucassen et al., 2015; Merz et al., 2016; Valcan et al., 2017), the present data suggest that parents who reported to use more negative co-regulation strategies also described their child as being less controlled. Unexpectedly, and in contrast to recent meta-analytic findings (Valcan et al., 2017), no such relation was observed between parents' positive co-regulation behaviour and child inhibitory control. Possibly, parents in the presented study mostly provided 'good enough' parenting, making a significant correlation less likely to appear (Karreman, van Tuijl, van Aken, & Deković, 2006). Complementing these findings, analyses of parents' cold co-regulation strategies in a more applied setting, namely during problem-solving with their child, revealed that parents' scaffolding intentions (i.e., cognitive and metacognitive support) were the strongest predictors of the parent-child problem-solving performance and mediated the effect from parents' use of scaffolding means to the problem-solving performance. These results are in accordance with van de Pol and colleagues' (2010) integrative scaffolding framework. Presumably, an effective scaffolding strategy results from the combination of a scaffolding means with a scaffolding intention (van de Pol et al., 2010). Supporting this assumption, the presented findings indicate that if parents used questions, hints, instructions, and feedback in order to assist their child on a cognitive and/or metacognitive level, this augmented their dyadic problem-solving performance. Besides the use of scaffolding means and scaffolding intentions, however, the fading of support and transfer of responsibility represent key characteristics of scaffolding (Leith et al., 2018; van de Pol et al., 2010). The fact that in the present study parents' transfer of responsibility was negatively related to the parent-child problem solving performance was hence unexpected and also in contrast to previous research. For instance Grolnick, Gurland, DeCourcey, and Jacob (2002) reported that dyads with more autonomy-supportive mothers performed better on a problem-solving task than dyads with less autonomy-supportive mothers. However, scaffolding describes an adaptive process, meaning that the rate of fading and transfer of responsibility should be oriented towards the child's level of development and competence (van de Pol et al., 2010). Concerning the present findings, it might be the case that if parents faded out their support too much, they overtaxed their child, which eventually resulted in unsuccessful problem-solving.

In partial conclusion the presented findings emphasize parents' co-regulatory function in toddlers' developing self-regulation skills and support the assumption that parents' cold co-regulation practices may enlighten the cognitive load imposed by a task, enable the child to internalize the observed strategies, and allow the child to become an independent problem solver and self-regulated learner (Landry et al., 2002).

This dissertation further contributes to the currently prevailing theories and research on children's development of self-regulation and parents' co-regulation by not only focusing the behavioural level of the parent, but also taking into account the mental level, meaning parents' self-efficacy beliefs. Hence, the study described in Paper 1 is the first that has analysed the link from parental co-regulation practices and self-efficacy beliefs to toddlers' self-regulation, precisely inhibitory control, considering not only domain-general but also domain-specific beliefs. The fact that parents' domain-specific self-efficacy was a better predictor of child inhibitory control than domain-general beliefs is in accordance with Bandura's self-efficacy theory (Bandura, 1977, 1989), and adds to the current (though still limited) research exploring differential effects in the parenting domain (e.g., Coleman & Karraker, 2003; Sanders & Woolley, 2005). In contrast to the hypothesis that was based on the three term standard model of 'parenting cognitions → parenting practices → child adjustment' (Bornstein et al., 2018), only two independent effects (but no indirect) were observed from parents' domain-specific self-efficacy and negative co-regulation to child inhibitory control. However, this supports Jusiene and colleagues' (2015) findings, who also reported that parental self-efficacy was an independent predictor of child attention and behaviour regulation problems above the influence of parenting practices. It is also in accordance with Ardelt and Eccles' (2001) theoretical model of parental self-efficacy, who propose, besides an indirect effect via promotive parenting practices, a direct effect from parental self-efficacy to child development. Hence, this dissertation presents a first and important step into exploring the distinct associations among parents' self-efficacy beliefs, parenting practices and child self-regulation.

### 6.1.2 Factors involved in parental co-regulation

Inspired by Belsky's (1984) model of the determinants of parenting, the second guiding question of this dissertation addressed factors that might be involved in parents' co-regulation behaviour in toddlerhood. These factors included child (birth status and cognitive development), context (SES, problem-solving tasks), and parent characteristics (parenting stress). Getting a deeper understanding of how these factors interact with and influence parents' co-regulation practices is not only relevant for theory development but also brings about important practical implications (see Chapter 6.2).

With regard to the child characteristics, the fact that child's cognitive development, but not preterm birth, was associated with parents' cognitive support and transfer of responsibility enriches the current (and heterogeneous) evidence on potential differences in parental scaffolding among parents' of full-term and preterm born children (e.g., Donahue & Pearl, 1995; Erickson et al., 2013; Lowe et al., 2013). The findings speak against the hypothesis of a 'prematurity stereotype' operating in parents of preterm children (e.g., Lowe et al., 2013) but rather suggest that the parental support varies as a function of child's cognitive development. Hence, it may be interpreted as reflecting parents' responsive adaptation, meaning their 'fine-tuning' to their child's needs. In addition, the finding that parents provided more cognitive support the higher the child's cognitive development is in accordance with child-driven effects on parents' scaffolding behaviour that have been reported in previous studies (e.g., Eisenberg et al., 2010). However, ample evidence suggests that parents' scaffolding behaviour in infancy and toddlerhood also predicts better general cognitive abilities and higher cognitive functions (i.e., EF) in toddlers and preschool children (Bernier et al., 2010; Hammond et al., 2012; Mermelshtine & Barnes, 2016; Smith, Landry, & Swank, 2000). Hence, in the presented study, parents' earlier scaffolding might as well have affected children's current cognitive abilities.

Concerning context characteristics, results point to an influence of the proximal environment (the type of task) but not the distal environment (family SES). Generally, parents who worked on the slightly more difficult problem-solving task with their child used more scaffolding means and transferred less responsibility to their child. Hence, they seemed to adapt their support not only depending on their child's cognitive development but also in face of the more challenging task. These findings are in accordance with theoretical models of scaffolding (van de Pol et al., 2010), whose authors emphasize the adaptive nature of scaffolding. Effective scaffolding implies that the support that is provided is adapted to the child's level of development and competence, meaning his or her 'zone of proximal development' (van de Pol et al., 2010; Vygotsky, 1978). This entails strengthening the support in face of a more challenging task, while fading it out the easier the task becomes or the more competence the child gains.

Unexpectedly and in contrast to previous research on contextual factors (e.g., Lengua et al., 2014), family SES did not affect parents' scaffolding behaviour. A likely reason might be the homogeneous and selective sample with primarily well-educated parents from a high socio-economic background.

Concerning the parent characteristics, no effect from parenting stress on parental scaffolding was observed. This might possibly be due to a methodological artefact, meaning the restricted variance in parenting stress. Although in the presented paper, parents of preterm born children reported significantly higher levels of parenting stress than parents of full-term born children, the average was still in the normal range, thus not clinically significant. Previous studies that demonstrated a negative link from parenting stress to parents' scaffolding behaviour based their evidence on highly distressed and depressed mothers (e.g., Hoffman et al., 2006). Hence, a different pattern might have resulted if parents that were more severely distressed had also participated in the present study. Another reason might be that parenting stress possibly exerts a stronger influence on parents' hot compared to cold co-regulation practices. Further research is needed to answer these questions.

In sum, in accordance with previous research (Bornstein, 2016) and Belsky's (1984) model of the determinants of parenting, the findings suggest that parents' scaffolding behaviour is context-specific, meaning that parents adapt their support according to the task at hand, and varies as a function of child's cognitive development. Complementing the current research on parental scaffolding among parents of full-term and preterm born children, the results indicate no specific effect of preterm birth on parents' scaffolding behaviour. While recent evidence points towards a differential susceptibility of preterm children to parents' sensitive and insensitive parenting (e.g., Camerota et al., 2015), it remains open whether this also applies to parents' scaffolding behaviour. Future studies could address this issue more thoroughly.

### 6.1.3 Training of parental co-regulation

In view of the vital role that parents play in the development of children's self-regulation skills, the third major question of this dissertation addressed how favourable parental co-regulation practices and beliefs could be promoted at an early stage in order to establish a developmental environment for the child as optimal as possible. Preventive parenting interventions are particularly important for preterm born children who face a high risk of self-regulatory deficits and concomitantly adverse developmental pathways. While ample evidence (e.g., Bakermans-Kranenburg et al., 2003; Evans et al., 2014) exists on the effectiveness of parental sensitivity training, especially during infancy, parental scaffolding interventions in toddlerhood are scarce. Hence, the third aim of this dissertation was to examine whether a training of parental scaffolding alone or combined with a sensitivity training would effectively enhance associated parental beliefs in parents of full-term and preterm born toddlers, when compared to a stress-management control group.

From a methodological perspective, according to Kirkpatrick's model (2008), training programmes should be evaluated based on four levels. These include reaction (level 1), learning (respectively beliefs; level 2), behaviour (level 3), and results (level 4). Although not the central part of this dissertation, first preliminary evidence indicates that parents' reactions towards the training (level 1) were very favourable, with highly positive ratings in all treatment groups (Gärtner, Vetter, Reuner, & Hertel, 2017). The focus of this dissertation was placed on the second level of evaluation, respectively the change in parents' beliefs due to the intervention. The findings of Paper 3 provide compelling evidence for a significantly stronger increase in parents' beliefs about co-regulation and learning from pre- to post-test in the combined treatment compared to the stress-management control group. Importantly, the findings suggest that parents of full-term and preterm born children benefitted equally from the combined as well as the basic scaffolding training regarding their beliefs about co-regulation and learning. With respect to parents' self-efficacy beliefs, an increase in parents' domain-specific as well as domain-general self-efficacy beliefs was observed from pre- and post-test to follow-up, with no significant differences among treatment conditions. Given that parents' strengths and resources had been covered in all treatment groups, this had been expected for parents' domain-general self-efficacy beliefs, but not for their domain-specific beliefs. However, since parents' domain-general and domain-specific self-efficacy beliefs were moderately correlated, it is conceivable that their' perceived parenting competence in general exerted an influence on their domain-specific self-efficacy, and hence attenuated differential effects for experimental and control treatment groups.

In conclusion, social psychologists have long argued that a person's beliefs together with a person's perceived behavioural control form the intention to perform certain behaviours and account for a large proportion of behavioural variance (Ajzen, 2011; Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016; Webb & Sheeran, 2006). Indeed, research suggests that changing beliefs and attitudes is an important move towards changing behaviour (Ajzen, 2011; Webb & Sheeran, 2006). Hence, the presented findings represent a crucial first step towards motivating parents to use and apply the learned co-regulatory strategies. Still, at this point it remains open whether the change in beliefs is accompanied by a change in parental scaffolding behaviour and child behaviour as well.

## 6.2 Practical Implications

The findings of this dissertation contribute not only empirically to the rising field of self-regulation research in early childhood but also offer critical implications for the preventive work and clinical practice.

Previous research has shown that parental co-regulation behaviours, self-efficacy beliefs and child self-regulation are bidirectionally related (Blair et al., 2014; Merz et al., 2017; Meunier, Roskam, & Browne, 2011; Roskam & Meunier, 2012), and influence and stabilize each other over time (Ardelt & Eccles, 2001; Bechtel et al., 2016). The presented findings, that parents' negative co-regulation behaviour and domain-specific self-efficacy beliefs were independently associated with toddlers' inhibitory control, imply that fostering a sense of competence in parents, as well as reducing negative co-regulation practices, might positively affect their child's development of self-regulation, and prevent the creation and stabilization of a vicious cycle. Hence, parenting interventions that are implemented in early childhood should aim to enhance parental self-efficacy beliefs and reduce negative parenting practices before they become more entrenched and harder to change (Wittkowski et al., 2016). The presented parent training programme (especially the combined treatment) offers a promising venue to strengthen parents' beliefs and self-efficacy, thus represents a first important step into this direction.

The fact that parents provided less cognitive support the lower the child's cognitive functioning (Paper 2) appears at first intriguing, since one might have expected to see more support the lower the child's competence. The training of parental scaffolding, during which the scaffolding means and intentions, as well as the process of fading out and transferring responsibility are conveyed in a comprehensible manner (see Paper 3), may be especially relevant and beneficial for these parents in order to adapt their support appropriately to their child's 'zone of proximal development' (Vygotsky, 1978). Since the second paper referred to data from the first assessment point, it will be interesting to see how these parents benefit from the training in terms of a change in their actual scaffolding behaviour and whether this will also affect the parent-child problem-solving performance. In addition, given the highly positive reactions among parents of preterm and full-term born toddlers regarding the training program, and since parents' beliefs about co-regulation and learning increased the most in the combined treatment (with no differences observed among parents of full- and preterm children), implementing and disseminating this training program in preterm aftercare might offer a promising and cost-efficient way in order to promote positive parenting practices and buffer the adverse effects of preterm birth.

## 6.3 Strengths and Limitations

A major strength of this dissertation is that the parent factor in toddlers' self-regulation was analysed from various perspectives and in different settings. For instance, core self-regulatory components (i.e., child inhibitory control) were combined with co- and self-regulation in an applied setting (i.e., problem-solving), different aspects of parents' co-regulation practices (positive vs. negative, hot vs. cold) were addressed, and a clinical perspective was adopted by including a sample of preterm born children and their parents. In addition, a multi-method approach was applied in this dissertation. Hence, observational as well as parent-report measures were included in order to collect information on the parent and the child level. This dissertation also makes significant theoretical as well as methodological contributions to the current field of parental scaffolding in early childhood. The developed rating scheme of parental scaffolding provides a useful tool to distinguish the different levels of parental scaffolding and to assess their unique contributions to child outcomes. Although for the presented work the rating scheme was administered to parent-child interactions in toddlerhood, it should be equally applicable to interactions among preschool or school-age children and their parents. Applying the rating scheme in a longitudinal setting will allow the analysis of the stability or change in parents scaffolding behaviour and its relation to child problem-solving and self-regulation throughout early and later childhood (for differential associations from infancy to preschool see for instance Landry et al., 2000). Finally, the training programme was evaluated in a randomized controlled trial with an active treatment control group and three measurement points, allowing causal inferences regarding the effectiveness of the training. Including full- and preterm born children and their parents made it further possible to analyse the effectiveness of the parent training not only in parents of ‘normally’ developing but also in parents of ‘at risk’ children, who might face a special burden.

With respect to the methodological limitations that could be addressed in future studies, first, it must be noted that the results of the first and third paper are based on parent report. Although this provides a cost- and time-effective insight into parent and child behaviour that is ecologically valid and may avoid context-specific fluctuations (Hendry et al., 2016; Rothbart & Mauro, 1990), one of the shortcomings of parent-report measures includes the potential bias due to the influence of social desirability or limited accuracy of memories of events (Hendry et al., 2016; Saudino, 2003; Seifer, 2003). The reported findings could be complemented by including the available observational data of parents’ scaffolding behaviour, and by adding third party reports and reliable behavioural tasks on child self-regulation in prospective studies. Second, the results of the first and second paper were predominantly based on cross-sectional data (with only six weeks in between T1 and T2 in Paper 1). Hence, with the data at hand, no valid conclusions on the direction of effects can be drawn. Bidirectional influences from parenting practices (Blair et al., 2014; Eisenberg et al., 2010; Merz et al., 2017) and parental self-efficacy (Meunier et al., 2011; Roskam & Meunier, 2012) to child self-regulation and cognitive development, and vice versa, are very likely and it is plausible to assume that they stabilize each other over time (Ardelt & Eccles, 2001; Bechtel et al., 2016). Longitudinal or experimental studies could provide more insight into the direction of effects. For instance, the experimental manipulation of parents’ goal orientation (Grolnick et al., 2002) or self-efficacy beliefs (Mouton & Roskam, 2015) could shed light on whether and how these factors affect parents’ scaffolding behaviour as well as child problem-solving and self-regulation in early childhood. Third, and with regard to the second paper, it must be noted that only the dyadic but not the child’s independent problem-solving performance was assessed. Although previous research indicates that the dyadic parent-child task performance and the child’s success during the parent-child interaction are related to the child’s independent performance in a subsequent task (Conner, Knight, & Cross, 1997; Grolnick et al., 2002), from the data at hand, no such conclusion can be drawn. Future studies might consider assessing children’s independent task performance in a following task. Forth, the sample of the study was highly selective. Little variance was observed with regard to family SES and parenting stress, which might have restricted the presented findings. Future studies could try to reach parent-child dyads from more diverse socio-economic backgrounds and also take into consideration the influence of associated cumulative risk factors, such as residential instability, neighbourhood problems, or family conflict (e.g., Lengua et al., 2014).

Finally, the attrition rate at the follow-up assessment in Paper 3 was relatively high (especially in the control treatment), possibly due to the very time-consuming follow-up questionnaires that had been administered to the participants in an online format at home. Hence, the findings regarding the stability of the treatment effects need to be interpreted cautiously.

## 6.4 Future Directions

This dissertation provides a first and highly relevant step into exploring the parent factor in toddlers' self-regulation more thoroughly and points out possible venues for future research. The first refers to the interplay of parents' hot and cold co-regulation practices and child's self-regulation and problem-solving. Van de Pol and colleagues (2010) acknowledge that parents' scaffolding intentions may not only be of cognitive and metacognitive, but also affective nature. Hence, there may be instances where hot co-regulation comes into play (e.g., keeping the child's interest in the task, managing frustration). In order to get a more integral picture of this interplay, next steps might include appending a scale for parents' affective support to the developed rating scheme. That way it could be examined how parents' affective support, besides their cognitive and metacognitive support, contributes to the problem-solving process, and whether the basic scaffolding and combined scaffolding and sensitivity training differentially affect parents' cognitive, metacognitive, and affective scaffolding intentions.

With regard to the context factors that might impact parents' scaffolding behaviour, household chaos could be examined more thoroughly. In chaotic households, parent-child interactions occur in an environment that features high levels of noise, crowding and disorganization and that lacks a sense of order, predictability and safety (Evans, Eckenrode, & Marcynyszyn, 2010; Hardaway, Wilson, Shaw, & Dishion, 2012). Stimulating learning environments where parents provide effective scaffolding might thus be rare. While it has been shown that household chaos is related to negative parenting practices (e.g., low responsivity and harsh or inconsistent parenting; Coldwell, Pike, & Dunn, 2006; Corapci & Wachs, 2002; Dumas et al., 2005; Valiente, Lemery-Chalfant, & Reiser, 2007), its association with parental scaffolding remains in question. In addition, concerning child characteristics, the role of child EF during (dyadic and independent) problem-solving could be examined, since recent findings point to a moderating influence of child EF on the interplay of parental scaffolding and parent-child problem-solving (Eason & Ramani, 2017).

It would further be of interest to analyse the interplay of parental self-efficacy and child self-regulation more thoroughly, for instance, in a sample of preterm born children and their parents. Since previous studies indicate lower levels of parental self-efficacy in parents of preterm born children (D. Gross & Rocissano, 1988; McGrath et al., 1993), parental self-efficacy might additionally contribute to the frequently observed self-regulatory deficits among preterm born children. Indeed, additional analyses with the current sample of the FILU-F project suggest that the parents of preterm born children ($n_{PT}$ = 63) report significantly lower domain-general ($F(1,164) = 14.57$, $p < .001$) and (though only marginally significant) domain-specific self-efficacy beliefs ($F(1,164) = 3.81$, $p < .10$), as well as lower child inhibitory control (BRIEF-P rating; $F(1,171) = 8.30$, $p < .01$) than the parents of full-term toddlers ($n_{FT}$ = 110). Surprisingly though, child's inhibitory control does not correlate with either parents' domain-specific and domain-general self-efficacy, or parents' positive and negative co-regulation behaviours in the preterm sample. This is in contrast to the findings reported for the sample of full-term born children in Paper 1. Further analyses are strongly needed to explore these differential relations more thoroughly, possibly taking the degree of prematurity (i.e., extremely, very, moderate-to-late) into account as a potential moderator. In addition, since links from parental self-efficacy to child attention and behaviour regulation as well as externalizing problems have been reported in several previous studies (Jusiene et al., 2015; Yaman, Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2010), and based on the evidence that a lack of inhibitory control is associated with and assumed to underlie these problems (Schoemaker, Mulder, Deković, & Matthys, 2013), it could be explored whether inhibitory control mediates the link from parental self-efficacy to child externalizing behaviour.

Concerning the described parent training of parental co-regulation, prospective studies could also explore whether parents with high-risk preterm children (e.g., extremely preterm born) and/or parents with low SES benefit equally from the training. It could be argued, since these parents' might face a double burden, that they express special needs that might require an adaptation of the program. Recent evidence indicates that social risk plays an important role in the response to early intervention on a range of child and parental outcomes (Spittle, Treyvaud, Lee, Anderson, & Doyle, 2018). Analysing differential treatment effects, respectively which parents benefit the most, becomes particularly relevant with regard to the dissemination of the programme and its implementation in preterm aftercare. One way to reach at-risk (i.e., economically disadvantaged) families could be to add home visits to the training programme (Nievar, Van Egeren, & Pollard, 2010). Home visiting may eliminate transportation costs and issues of childcare, while giving the provider a more extensive knowledge of family background (Nievar et al., 2010). Indeed, a recent meta-review on the effectiveness of early intervention programmes for parents of preterm infants suggests that interventions with both home and facility based components show the most frequent positive impact across outcomes (Puthussery et al., 2018).

Finally, the role of mothers' and fathers' parenting practices and self-efficacy beliefs in early childhood has been taken into consideration only recently (Meuwissen & Carlson, 2015; Murdock, 2013; Roskam, Meunier, & Stievenart, 2016). More research in this field is highly warranted in order to gain a more integral picture of the role that parents play in children's development of self-regulation.

# 7 General Conclusion

This dissertation aimed at complementing previous research on the role that parents play in the development of self-regulation in early childhood by analysing the interplay of parents' co-regulation behaviour and self-efficacy beliefs with toddlers' self-regulation and problem-solving performance, by examining factors that might be involved in parents' (cold) co-regulation behaviour, and by exploring the effectiveness of a training of parental co-regulation. The dissertation contributes from a theoretical, methodological, as well as practical perspective to the currently rising field of self-regulation research in early childhood. The findings emphasize the need to take the mental level of the caregiver into account in order to gain a better picture of the interplay of parental co- and child self-regulation in early childhood. In addition, the developed rating scheme of parental scaffolding provides a useful tool to differentially analyse the contribution of parents' cold co-regulation practices to child outcomes. Finally, the training of parental co-regulation yields a change in parents' beliefs, thus provides a first step towards motivating parents to use and apply the learned co-regulatory strategies. Assuming that the training is able to yield improvements on the behavioural level as well, this strategy will be an important venue for preterm aftercare.

To close, I shortly want to return to Lia, the girl from the introduction. Her ability to regulate her inner states and behaviour is still in its roots in early childhood, and there will certainly be many situations where Lia reaches her limits and depends upon her parents' assistance to overcome her difficulties. Whether her parents scaffold her during such challenging tasks (Paper 2), whether they are encouraging instead of threatening (Paper 1), and whether they feel confident in supporting her (Paper 1), will most certainly influence her evolving self-regulation and problem-solving skills. The results of this dissertation illustrate little bits and pieces of this interplay, but a lot more is to discover. For instance, we do not know yet how her parents' self-efficacy beliefs and co-regulation behaviours influence Lia's self-regulation and problem-solving skills on the long term, whether this interplay might differ when observing her sister, who was born three months early, or whether her parents might benefit from a co-regulation training not only in terms of stronger beliefs (Paper 3), but also in terms of promotive co-regulation behaviour. The present thesis underlines the importance of taking into account the parent factor, as well as child and contextual characteristics that might influence the development of self-regulation and associated skills in early childhood. It thus contributes significantly to the mosaic of the rising field of self-regulation research and offers critical implications for the preventive work and clinical practice.

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# Appendix A – Publication 1

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Running head: INHIBITORY CONTROL IN TODDLERHOOD

# Inhibitory Control in Toddlerhood – the Role of Parental Co-Regulation and Self-Efficacy Beliefs

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## Abstract

Inhibitory control is considered a core component of self-regulation. Tremendous advances in early childhood have been attributed to brain maturation processes as well as environmental influences, such as parental co-regulation. Parental self-efficacy represents a key correlate of parenting behaviors and is associated with child outcomes. However, research on the interplay of parental co-regulation, parental self-efficacy and child's inhibitory control in early childhood is scarce.

In this study we explore to what extent parents' positive (PCR) and negative co-regulation (NCR) and domain-specific (DSSE) and domain-general (DGSE) self-efficacy beliefs assessed at pretest (T1) predict toddlers' inhibitory control six weeks later (T2). Furthermore, we examine whether NCR mediates the link between DSSE and parent-reported inhibitory control.

Results are based on data from 90 parent-child dyads (children's age: 24 – 35 months). Parents' PCR, NCR, DSSE and DGSE are assessed via questionnaire. Children's inhibitory control is measured via the Inhibition Scale of the Behavior Rating Inventory of Executive Functions (BRIEF-IN) and a Snack Delay task.

Multiple regression analyses reveal that parents' NCR and DSSE, but not PCR and DGSE, significantly predict BRIEF-IN at T2 (controlling for covariates). The indirect effect from parents' DSSE on BRIEF-IN via NCR is not confirmed by the data. No associations are observed regarding children's performance in the Snack Delay task.

The present study adds new and important evidence that parents' DSSE and NCR independently predict (parent-reported) inhibitory control in toddlerhood. Parenting interventions should thus not only address parenting practices but target parental self-efficacy beliefs as an important factor, too.

Keywords: *self-regulation, inhibition, parenting, co-regulation, self-efficacy*

Inhibitory Control in Toddlerhood –
the Role of Parental Co-Regulation and Self-Efficacy Beliefs

One of the hallmarks in early childhood is the development of self-regulation, which describes “the internally-directed capacity to regulate affect, attention, and behavior to respond effectively to both internal and environmental demands“ (Raffaelli, Crockett, & Shen, 2005, p. 54). Since there is substantial overlap regarding terms (e.g., executive functions, effortful control, self-control), definitions, components and measurements, researchers have argued for an integrative framework for the study of self-regulation in early childhood (Diamond, 2016; Gagne, 2017; Liew, 2012; Nigg, 2017; Zhou, Chen, & Main, 2012). *Inhibition* or *inhibitory control* is considered a core self-regulatory component in these conceptualizations (Gagne, 2017; Zhou et al., 2012) and refers to the ability to deliberately withhold or override a dominant, prepotent (habitual) or automatic response in order to resist distraction or temptation and to achieve a desired goal (Diamond, 2006; Kloo & Sodian, 2017; Miyake et al., 2000).

Inhibition skills are critical in children’s daily life and associated with a range of developmental outcomes. While high inhibitory control in early childhood predicts later school readiness, math and literacy ability, academic achievement, and social-emotional competence (Allan, Hume, Allan, Farrington, & Lonigan, 2014; Blair & Razza, 2007; Liew, 2012; Razza & Raymond, 2013; Valiente et al., 2013; Zelazo & Müller, 2007), difficulties are associated with more internalizing and externalizing problems (Eisenberg et al., 2005; Kim, Nordling, Yoon, Boldt, & Kochanska, 2013; Kochanska & Knaack, 2003; Lengua et al., 2015; Murray & Kochanska, 2002), and specifically related to ADHD symptoms (Berlin, Bohlin, & Rydell, 2004; Campbell & von Stauffenberg, 2009; Paloyelis, Asherson, & Kuntsi, 2009; Schachar, Tannock, Marriott, & Logan, 1995). Evidence suggests that children’s inhibitory control even predicts physical health, substance dependence, and criminal offending outcomes more than 30 years later (Moffitt et al., 2011).

Given the substantial role early inhibition skills seem to play in academic, socio-emotional, and health-related outcomes, there is growing interest in how these skills emerge and develop from infancy throughout childhood.

Evidence from studies using simple delay or conflict inhibition tasks (e.g., Carlson & Moses, 2001; Kloo & Sodian, 2017; Kochanska, Murray, & Harlan, 2000; Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012), as well as parent report, such as the *Early Childhood Behavior Questionnaire* (ECBQ) (Putnam, Gartstein, & Rothbart, 2006) or the *Behavior*

*Rating Inventory of Executive Functions Preschool Version* (BRIEF-P) (Gioia, Espy, & Isquith, 2003; Isquith, Gioia, & Espy, 2004), indicate that inhibitory abilities evolve early in life and advance rapidly during toddlerhood and preschool (Carlson, 2005; Garon, Bryson, & Smith, 2008; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996; Kochanska et al., 2000), with individual differences being relatively stable from two to five years (Kloo & Sodian, 2017).

These tremendous improvements of inhibitory control especially in early childhood have been attributed to brain maturation processes in the frontal lobe (Romine & Reynolds, 2005; Stuss & Alexander, 2000). Furthermore, evidence points to an enhanced neuronal plasticity of the prefrontal circuits underlying inhibition and self-regulation, indicating a particular susceptibility to environmental influences during early childhood (Kolb & Gibb, 2011; Kolb et al., 2012; Mackey, Raizada, & Bunge, 2013).

From a socio-cultural perspective, it is assumed that the development of self-regulation, and concomitantly inhibitory control, is accompanied and driven by a transition from initially external co-regulation of the caregiver to more internal self-regulation of the child (Bernier, Carlson, & Whipple, 2010; Kopp, 1982). The parent, as the more capable other, guides and shares regulatory processes, and through this enables the child to gradually internalize these strategies and to become capable of regulating herself. Hence, parenting practices are thought to serve as more proximal factors contributing to individual differences in children's developing self-regulation and inhibitory control (Bechtel, Strodthoff, & Pauen, 2016; Fay-Stammbach, Hawes, & Meredith, 2014; Merz, Landry, Montroy, & Williams, 2017; Valcan, Davis, & Pino-Pasternak, 2017).

**Parenting practices and child inhibitory control**

When examining the interplay of parenting quality and child inhibitory control, it is important to consider both positive and negative dimensions of the construct, as these may have distinct effects on child development (Blair et al., 2011).

Research has advanced over the last decade, with ample evidence from cross-sectional and longitudinal studies, including observational and parent-report measures, suggesting a link between dimensions of parenting quality and children's emerging inhibitory control in early childhood (Bernier et al., 2010; Lucassen et al., 2015; Matte-Gagné & Bernier, 2011; Valcan et al., 2017).

Positive parenting commonly involves the warm acceptance of the child's needs and interests, sensitive responses to child signals, as well as the contingent adaptation of support during challenging situations (Amicarelli, Kotelnikova, Smith, Kryski, & Hayden, 2018;

Landry, Smith, & Swank, 2006). This may provide the child with experiences of successfully impacting the social environment, enhance her autonomy and improve her confidence in her evolving self-regulatory abilities (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; Merz et al., 2016).

A profound body of research has linked more responsive and sensitive parenting in the first three years to higher child inhibitory control in the toddler and preschool age (Kochanska et al., 2000; Lucassen et al., 2015; Merz et al., 2017; Merz et al., 2016; Razza & Raymond, 2013). In addition, growing evidence suggests a direct (Chang, Shaw, Dishion, Gardner, & Wilson, 2015; Lengua, Honorado, & Bush, 2007) as well as indirect link, mediated through child verbal abilities (Chang et al., 2015; Matte-Gagné & Bernier, 2011), from parents' early scaffolding to child inhibitory control. The concept of scaffolding (Wood, Bruner, & Ross, 1976), which is closely related to and often synonymously used with autonomy support (Bernier et al., 2010) or proactive parenting (Chang et al., 2015), includes a set of techniques, such as structuring and reasoning, with which parents may teach and model effective regulatory skills to their child (Chang et al., 2015).

In contrast, negative parenting, characterized by a constellation of harsh, controlling and intrusive behaviors, may undermine the child's autonomy and interfere with the development of effective self-regulation strategies by reducing both the opportunity and motivation to engage in effective co-regulatory experiences (Blair et al., 2011; Colman, Hardy, Albert, Raffaelli, & Crockett, 2006; Ispa et al., 2004).

With regard to the empirical evidence, intrusive, harsh and controlling behavior, power assertion as well as the use of directive language have been found to be negatively associated with child inhibitory control (Kochanska & Knaack, 2003; Lucassen et al., 2015; Merz et al., 2016).

The above studies highlight the variety of findings and the lack of definitional clarity and consistency among conceptualizations of parenting practices across studies. Valcan and colleagues (2017) recently conducted a meta-analysis to systematically analyze the role of parenting practices in the development of executive functions in children aged 0 to 8 years. With regard to child inhibitory control, they found significant associations in the expected direction: while positive and instructional parenting behaviors predicted higher inhibition skills, negative practices were associated with lower inhibition.

Taking into consideration the above conceptualizations and findings on parenting practices, it may be summarized that parents fulfil a co-regulatory function especially in early childhood, promoting young children's development of self-regulation and inhibitory control by attempts to scaffold and modify children's thoughts, behavior or emotions according to the expectations and values of a particular context (Colman et al., 2006; Kurki, Järvenoja, Järvelä, & Mykkänen, 2016; Pauen, 2016; Volet, Summers, & Thurman, 2009).

In line with the stated work and following Bechtel et al. (2016), we conceptualize *positive co-regulation* as the way parents support their child in cognitively and emotionally challenging situations. This includes displaying positive affect, acting responsively and sensitively to the child's needs, and providing the necessary scaffolds to encourage and comfort the child appropriately in order to avoid or reduce frustration, to help the child achieve her goal and to promote autonomy.

In contrast, *negative co-regulation* is defined by harsh, controlling, hostile and intrusive parenting behaviors (for example, threatening, frowning or shouting at the child), which are likely to be displayed in situations where the child refuses to comply and/or gets upset with the parent.

**Parental self-efficacy, parenting practices and child inhibitory control**

A question that arises when studying parental behaviors is "Why parents parent the way they do?" (Belsky, 1984, p. 83). A profound body of research has highlighted parental cognitions, and particularly *parental self-efficacy beliefs,* as key correlates of parenting practices (Bornstein, Putnick, & Suwalsky, 2018; Coleman & Karraker, 1998; Jones & Prinz, 2005; Roskam & Meunier, 2012; Sanders & Woolley, 2005), and also closely related to child outcomes, such as child externalizing behavior, socio-emotional competence, and academic achievement (for a review see Jones & Prinz, 2005).

The concept of self-efficacy was firstly introduced by Bandura (1977, 1982) to describe a person's expectation of personal mastery and perception of exercising influence over his or her action to produce a desired outcome. Applying Bandura's theory to the parenting domain, parental self-efficacy is defined as "parents' perceived ability to positively influence the behavior and development of their children" (Coleman & Karraker, 2003, p. 128). In the literature, three formulations of self-efficacy can be distinguished: 1) task-specific beliefs, i.e., related to discrete tasks within the domain of parenting, 2) domain-specific beliefs, i.e., focusing on one parenting domain, such as discipline or promotion of learning, and 3) domain-general beliefs, i.e., global competence expectations that are not linked to particular parenting tasks or parenting domains but to the parenting role in general (Coleman & Karraker, 2003; Jones & Prinz, 2005; Sanders & Woolley, 2005). Bandura (1977, 1989) suggested that domain-specific measures of self-efficacy were more precise predictors of actual behavior compared to rather global beliefs, and a profound body of evidence in areas other than parenting supports this assumption (e.g. Beck & Lund, 1981; Lent, Brown, & Gore, 1997; Multon, Brown, & Lent, 1991; Pajares & Miller, 1995; Wang & Richarde, 1988).

In the parenting domain, however, systematic research exploring differential associations among these levels of conceptualization and parent and child outcomes is still rare. In a first attempt, Coleman and Karraker (2003) related domain-general and domain-specific measures of self-efficacy beliefs to parent and child outcomes. They found that domain-specific but not domain-general self-efficacy beliefs were predictive of toddler's cognitive development, assessed with the Mental Scale of the Bayley Scales of Infant Development (Bayley, 1993), as well as toddlers' overt behavior in a laboratory setting (e.g., affection towards mother, compliance, etc.), while not linked to maternal competence (a joint measure of mother's supportive presence and quality of assistance). Maternal competence, however, significantly related to toddler's cognitive performance and adaptive behavior, a link that has been well established in the existing literature on parenting quality and child behavior (Landry, Smith, Swank, Assel, & Vellet, 2001; Lugo-Gil & Tamis-LeMonda, 2008; Tucker-Drob & Harden, 2012). Sanders and Woolley (2005) further showed that parents' task-specific, but not domain-general or global measures of self-efficacy predicted parents' self-reported discipline strategies (laxness and over-reactivity) and were most strongly related to parent-reported child behavior problems.

Apart from the lack of systematic research on domain-general and -specific self-efficacy beliefs in the parenting domain, research looking at the relation of parental self-efficacy to children's development of self-regulation in early childhood, and particularly inhibitory control, is just as scarce.

In a recent longitudinal study, Jusiene, Breidokiene, and Pakalniskiene (2015) followed the developmental trajectories of mother reported regulatory problems from toddlerhood to preschool age, and found that maternal self-efficacy beliefs significantly predicted children's emotion regulation and attention and behavior regulation problems. The higher maternal self-efficacy, the more likely children displayed lower or decreasing regulatory problems. Although a limitation to these findings is the use of parent-report measures only, which could reflect parents' consistent and subjective ratings of themselves and their child as less efficacious (Jusiene et al., 2015), these findings highlight the importance of taking into account parental self-efficacy beliefs when exploring children's self-regulation. Throughout the existing literature on the link between parental self-efficacy and children's self-regulatory behavior, there is a tendency to focus on behavioral and externalizing problems, often including high-risk or clinical samples (Murdock, 2013;

Sanders & Woolley, 2005; Weaver, Shaw, Dishion, & Wilson, 2008), at the expense of exploring self-regulatory processes, such as inhibitory control, that may underlie these problems.

**Study aims**

The aim of the present study was to analyze the interplay of parental co-regulation, parental self-efficacy and child inhibitory control in typically developing two year old toddlers. More precisely, we focused on two main research questions.

The first question addressed how parents' self-reported co-regulation behaviors and self-efficacy beliefs assessed at time 1 (T1) differentially predicted children's inhibitory skills six weeks later (T2).

Based on prior research, we expected negative and positive parenting practices at T1 to predict child inhibitory control at T2 (i.e., lower negative co-regulation and higher positive co-regulation should be related to higher inhibitory control) (H1). Furthermore, we expected domain-specific self-efficacy beliefs to be a stronger predictor of child inhibitory control than domain-general self-efficacy beliefs (H2), since previous research had shown that specific but not domain-general measures of self-efficacy related to child outcomes (Coleman & Karraker, 2003; Sanders & Woolley, 2005). Finally, we examined the joint contribution of parental co-regulation and self-efficacy beliefs at T1 to child inhibitory control at T2, exploring whether self-efficacy beliefs (and especially domain-specific) would contribute significantly to child inhibition, when controlled for parental co-regulation (H3).

Regarding the second main research question, previous studies have indicated that parental self-efficacy may operate as a transactional variable. For example, parents with low levels of parental self-efficacy may encounter more difficulties with parenting, leading to frustration and possibly non-optimal child outcomes, which again may further diminish their self-efficacy in a feedback loop (Jones & Prinz, 2005).

Hence, with our second question, we explored whether parents' domain-specific self-efficacy beliefs exerted an indirect influence on children's inhibitory skills, mediated via parents' co-regulation. We assumed that the effect from parents' domain-specific self-efficacy to child inhibitory control would be (partially) mediated by parents' co-regulation behavior (H4).

In order to tap into what is unique to toddler's inhibitory control beyond general cognitive functioning (Bernier et al., 2010), and involving recent findings of differential effects of maternal and paternal parenting practices and self-efficacy on child inhibitory control and behavior problems (Lucassen et al., 2015; Murdock, 2013), we controlled for child cognitive ability and parents' gender in all analyses.

## Methods

### Sample

The sample of this study included 103 full-term children and their parents, who were recruited in the southwest of Germany via local newspaper, day care centers, information letters, pediatricians, hospitals, and parents' associations.

Thirteen of these parent-child dyads (12.6%) dropped out from the study before the second assessment point, resulting in a total of 90 parent-child dyads that completed pre- and posttest sessions. Parents who dropped out were slightly younger ($F(1,100) = 3.05$, $p = .08$)[1] and had a lower socio-economic status ($F(1,100) = 1.90$, $p = .17$), while their children were comparable regarding age, gender, as well as cognitive development (all $p > .20$). Children were between 24 and 35 months of age ($M = 27.24$ months at T1, $SD = 3.09$; 40.0% female). Only one parent (mostly the primary caregiver) participated in the study ($M = 35.44$ years, $SD = 4.29$; 86.5% female)[2]. Parents who did not speak German were excluded from study participation. Families' socioeconomic status (SES) was computed based on parent's school education, professional education, recent professional status and family income following the procedure suggested by Winkler and Stolzenberg (2009) and averaging scores for mothers and fathers to create a family-based measure of SES (Voigt et al., 2012). With scores of 3 to 8 indicating low, 9 to 14 moderate, and 15 to 21 high SES, participating families were on average from the upper social class ($M = 16.51$, $SD = 3.40$).

### Procedure

Data was collected within the scope of a quasi-experimental intervention study (pre-post-test-design with three months follow-up) from October 2015 until July 2017 (for more information on the intervention see [BLINDED]).

Based on a multi-method approach, data on parent- and child-level were assessed via questionnaires and observational measures one to two weeks before (T1) and after (T2) training (with at least six weeks in between T1 and T2), as well as at three months follow up[3].

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[1] Significance level was adjusted to $\alpha = .20$ for comparisons among background characteristics to enhance power and reduce type II error (Bortz, 1999, p. 121; Schäfer, 2016)

[2] One mother had twins and participated with both children. She completed all questionnaires separately for both children and was therefore included in the analyses.

[3] Due to the high attrition rate at follow up, this paper refers only to data from pretest (T1) and posttest (T2).

The focus of the present study lied on the association between parental co-regulation (T1) and parental self-efficacy (T1) with child inhibitory control six weeks later (T2). See Table 1 for an overview of all measures and assessment points.

The pre- and post-test sessions with the parent and the child took place in a laboratory setting at the university hospital and/or university. Most questionnaires were sent to families in an online format one to two weeks before the appointment for testing. One questionnaire (including items on parental self-efficacy), was administered to all parents at the beginning of the first and at the end of the last treatment session. Assessment of observational measures took about one and a half hours and started with the Cognitive Scale of the Bayley Scales of Infant and Toddler Development, 3rd edition (Reuner & Rosenkranz, 2014), followed by parent-child interactions and finally the inhibitory control tasks (a delay of gratification and a go/no-go task). The study protocol was approved by the Institutional Review Board of the University Hospital and written informed consent was obtained from all parents.

**Measures**

In order to answer the research questions, data from two assessment points (T1 and T2) were included in the analyses. On the parental level, this affected parental self-efficacy and parental co-regulation at T1, while on the child level, parent-report and behavior-based measures of inhibitory control from T2 were incorporated[4].

Items for the questionnaire scales regarding parental self-efficacy and parental co-regulation were rated on a six-point Likert scale, ranging from “strongly disagree (1)” to “strongly agree (6)”, and were averaged for each scale to build a mean score.

**Parental self-efficacy (T1).** Parents’ *domain-general self-efficacy* (DGSE) was assessed with three items from the Parenting Self-Efficacy Questionnaire (Kliem, Kessemeier, Heinrichs, Döpfner, & Hahlweg, 2014). Items included statements like “I am able to find a solution for any problem with my child.” (Cronbach’s α =.67).

To collect information on parents’ *domain-specific self-efficacy* (DSSE), four items were developed from the literature in order to collect information on parents’ perceived ability to positively support and co-regulate their child during challenging activities (Coleman &

[4] It was controlled in prior analyses that training participation did not affect parents’ ratings of child inhibitory control (BRIEF-IN) at T2. Bivariate correlation coefficients for the BRIEF-IN measure at T1 and T2 were overall $r$ = .77, and ranged from $r$ = .71 – 83 for the three treatment groups. Test-retest stability in this study is thus comparable to the test–retest stability coefficient of $r$ = .90 reported in the BRIEF-P professional manual for the Inhibition Scale (Daseking & Petermann, 2013; Gioia et al., 2003).

Karraker, 2003; Pino-Pasternak & Whitebread, 2010). Example items included: "I am able to explain things to my child, so he/she is able to understand." (Cronbach's α = .71)[5].

**Parental co-regulation (T1).** Parents reported on their positive and negative co-regulatory behavior using the revised version of the *IMpulse-MAnagement from Infancy to Preschool* questionnaire (IMMA 1-6; Bechtel et al., 2016; Pauen, Hochmuth, Schulz, & Bechtel, 2014). *Positive co-regulation* (PCR) consisted of six items that assessed how parents support their child in cognitively and emotionally challenging situations. This includes displaying positive affect, acting responsively and sensitively to the child's needs, and providing the necessary scaffolds to encourage and comfort the child appropriately in order to avoid or reduce frustration, to help the child achieve her goal and to promote autonomy. Items included statements like "If my child is frustrated when trying to reach a goal, I encourage him/her to keep trying" (Cronbach's α = .82). *Negative co-regulation* (NCR) was operationalized by 12 items that described harsh, controlling, hostile and intrusive parenting behavior (for example, threatening, frowning or shouting at the child) displayed in situations where the child refuses to comply and/or gets upset with the parent. An example is "If my child does not accept my request, I force my child to comply." (Cronbach's α = .83).

**Inhibitory control (T2).**

***Parent-report.*** The German version of the *Behavior Rating Inventory of Executive Functions – Preschool Version* (BRIEF-P) was used as a parent-report measure of children's executive functions, and particularly inhibitory control (Daseking & Petermann, 2013). It contains 63 items within five related but non-overlapping theoretically and empirically derived clinical scales that assess preschoolers' (2–5 years) ability in different aspects of executive functions: Working memory, plan/organize, inhibition, emotional control, and shifting.

The scale *Inhibition* (BRIEF-IN) contains 16 items that describe children's ability to control impulses and stop/modulate their behavior (e.g., "Has trouble putting the brakes on his/her actions"). Parents rated the items on a three point scale (1 – "never" to 3 "frequently"). Raw scores were summed and transformed into a standard T-score (*M* = 50, *SD* = 10) using

[5] Results of a confirmatory factor analysis confirmed the two dimensions of parental self-efficacy, with a two-factor model with DGSE and DSSE (CFI = .93, SRMR = .05, RMSEA = .09, 90% CI [0.00, 0.15]) providing an acceptable to good (Weston & Gore, 2006), and considerably better, model fit than a one factor model (CFI = .82, SRMR = .07, RMSEA = .13, 90% CI [0.08, 0.19]).

the age- and gender-appropriate normative data. As the BRIEF-P represents a clinical inventory to detect self-regulatory problems in early childhood, higher BRIEF-IN scores indicate lower inhibitory control. The internal consistency of the BRIEF-IN was .90 in our study.

***Behavior-based task.*** In addition to parent-report, we conducted a standardized *Snack Delay* task with the children (Kochanska et al., 2000; Voigt et al., 2012). The child, with the hands under the table, waited for the experimenter to ring a bell before retrieving a chocolate candy from under a transparent cup (five trials, with delays of 10, 20, 30, 15, 60 sec., respectively). In mid-delay, the experimenter lifted the bell but did not ring it. Before each trial, the experimenter restated the rule, 'Wait until I ring the bell!'. Children's behavior was coded using a scale ranging from 11 – 'no approach at all' to 1 – 'eating the treat' (Voigt et al., 2012). Extra points were given in each trial if the child managed to keep the hands under the table during the first half (1 point) or during the whole trial (2 points). Two independent raters coded the videos and interrater reliability was calculated based on 12 videos. Interrater reliability (weighted Cohen's kappa) was .73 for children's approaching behavior, and .95 for the hand codes, indicating good to excellent agreement (Cicchetti, 1994). Following Kochanska and Knaack (2003) and Voigt et al. (2012), all five trial scores were averaged into one single task score (Cronbrach's $\alpha$ = .80).

**Cognitive development (T1).** The Bayley Scales of Infant and Toddler Development, 3rd edition (Reuner & Rosenkranz, 2014) is a widely used standardized observational measures of general cognitive, motor and verbal development of infants and toddlers aged 1 – 42 months. For the purpose of our study, we administered the Cognitive Scale (COG) only. The derived norm-referenced standard scores ($M$ = 100, $SD$ = 15) were used as a covariate in the statistical analyses.

## Results

Statistics were performed with IBM SPSS 24.

### Missing data

Among the variables of interest for this study, there was missing data in parent-report ($n$ = 7, 7.8%) and the *Snack Delay* task ($n$ = 7, 7.8%). Reasons for the missing values on the observational measures were noncompliance, problems with comprehension of the instruction, parental intervention during task administration, or technical problems with the equipment. Parents with incomplete questionnaire data were comparable to parents with complete data regarding age, gender, and SES (all $p$ > .20).

**Preliminary analyses**

The Snack Delay task score was significantly left skewed[6] and transformed using log transformation (reflecting the Snack Delay task score first) (Tabachnick & Fidell, 2014). Higher transformed Snack Delay scores (LogSD) now indicate lower performance in the Snack Delay task. Table 2 shows raw and transformed descriptive data on study variables.

Bivariate correlations among sociodemographic factors and study variables are presented in Table 3. Parents' sex was significantly associated with PCR as well as DSSE (with mothers reporting higher scores), while child's COG was inversely related to parents' BRIEF-IN and NCR (i.e., the lower child's COG, the more inhibitory problems and NCR were reported by parents). Parents' sex and child's COG were thus included as covariates in the following analyses.

Table 4 shows the bivariate correlations between parenting practices, self-efficacy beliefs and child inhibitory control, as well as the partial correlations when accounting for parents' sex and child COG. Since no significant correlations were observed for children's LogSD with any of the study variables, it was excluded from further statistical analyses.

**How do parental co-regulation behaviors and self-efficacy beliefs predict child inhibitory control?**

To answer the first research question and to test the hypotheses (H1 – H3), multiple regression analyses were performed using listwise deletion. Child inhibitory problems at T2 (BRIEF-IN) served as the dependent variable. In the first step (Model 1), parents' sex and child's COG were included as covariates. Next, parenting practices and/or self-efficacy beliefs were entered into the equation. All continuous predictors were centered by subtracting the group mean. Results are displayed in Table 5.

**H1: Parental co-regulatory behaviors (NCR and PCR) predict child inhibitory control.** Parents' PCR and NCR were included in the regression (Model 2) to analyze the contribution of parental co-regulation to child inhibitory control (BRIEF-IN) while controlling for parents' sex and child COG.

Table 5 shows that the model predicted 20.0% of the variance in BRIEF-IN, with parental co-regulation contributing a unique 8.0% ($p < .05$) over and above what is explained by parents' sex and child cognitive functioning. The regression coefficients indicate that while

[6] Based on the recommendations made by Tabachnick and Fidell (2014), a z-test (i.e., skew/standard error of skew) was used to determine whether the degree of skew for the parent report and behavior based study variables used in the regression models was significantly different from zero.

NCR uniquely related to BRIEF-IN when PCR was accounted for ($b$ = 4.84, $p$ < .05), PCR did not relate to BRIEF-IN when NCR was controlled ($b$ = -2.45, ns).

**H2: Parents' DSSE is a stronger predictor of child inhibitory control than DGSE.** In order to test the second hypothesis, in Model 3 parents' self-efficacy beliefs (DGSE and DSSE) were entered in the equation following the covariates.

Table 5 shows that the model predicted 22.0% of the variance in BRIEF-IN, with parental self-efficacy contributing a unique 10.0% ($p$ < .01) over and above what is explained by parents' sex and child cognitive functioning. The regression coefficients indicate that while DSSE uniquely related to child inhibitory control when DGSE was accounted for ($b$ = -5.04, $p$ < .05), the reverse was not the case ($b$ = -0.76, ns).

**H3: Parental self-efficacy beliefs contribute to child inhibitory control over and above parental co-regulation and covariates.** In Model 4, parental co-regulation (NCR and PCR) and self-efficacy beliefs (DGSE and DSSE) were entered simultaneously to the regression equation, in addition to parents' sex and child COG as covariates.

Table 5 shows that the model predicted 27.0% of the variance in BRIEF-IN, with parental self-efficacy contributing a unique 6.0% ($p$ < .05) over and above what is explained by parents' sex, child cognitive functioning and parental co-regulation. However, the regression coefficients indicate that not only DSSE ($b$ = -4.45, $p$ < .05) but also NCR ($b$ = 4.11, $p$ < .05) uniquely related to child inhibitory control when accounting for the remaining variables, while PCR ($b$ = -1.11, ns) and DGSE ($b$ = -0.22, ns) did not predict BRIEF-IN in this joint model.

**Does parental co-regulation mediate the link between parents' DSSE and child inhibitory control?**

To verify whether the data were consistent with statistical mediation, we used Baron and Kenny's (1986) procedure. Since prior analyses (see partial correlations, Table 4) had revealed no significant relation between parents' PCR and BRIEF-IN, we only tested the potentially mediating role of parents' NCR in the relation between DSSE and child's inhibitory control (BRIEF-IN), controlling for parents' sex and child's COG. The results of the regression analyses are presented in Table 6.

**H4: Mediation analysis (DSSE → NCR → BRIEF-IN).** The first regression model revealed that parents' DSSE was related to BRIEF-IN ($\beta$ = -.33, $p$ < .01), thereby substantiating the first condition for mediation. However, parents' DSSE was not significantly related to parents' NCR ($\beta$ = -.17, $p$ > .05) in Model 2, thus not meeting the second condition of Baron and Kenny's requirements for statistical mediation. The third model showed that parents' sex, child's COG, parents' DSSE and NCR jointly accounted for 26.2% of the variance in parent-reported inhibitory problems. Both NCR and DSSE remained significant predictors when entered simultaneously. The data do not support a mediating role of parents' NCR in the relation between DSSE and child's inhibitory control (BRIEF-IN), but rather independent effects of the two parenting variables.

## Discussion

The aim of the present study was to analyze the interplay of parenting practices, parental self-efficacy and child inhibitory control in typically developing two year old toddlers. Two main research questions were addressed and findings will be summarized and discussed in order.

First, we explored how parental co-regulation behaviors and self-efficacy beliefs predicted child inhibitory control. In line with studies that point to the adverse impact of negative parenting practices on child inhibition (Kochanska & Knaack, 2003; Lucassen et al., 2015; Merz et al., 2016), our results revealed that parents who reported to use more NCR strategies also described their child as being less controlled. Bechtel and colleagues (2016) reported similar findings from their observation with the IMMA 1-6 questionnaire. They found parents' reported NCR behavior to be correlated with indicators of lower child self-regulation (e.g., less compliance). Although our findings are based on two different measurement points, the time interval is too narrow as to draw causal inferences on the direction of effects. As recent research points out, bidirectional influences from parenting on child self-regulation and vice versa are very likely (Blair, Raver, Berry, & Family Life Project, 2014; Eisenberg et al., 2010; Merz et al., 2017) and it might be the case that NCR and a lack of self-regulation stabilize each other over time (Bechtel et al., 2016). Interventions targeting parental co-regulation may be promising in order to reduce negative parenting practices and break the vicious circle.

Contradicting our initial hypothesis, parents' PCR did not significantly predict child inhibitory control when accounted for NCR and covariates. This means that parents who reported positive parenting practices may or may not have had children with good inhibition skills. Our results are therefore only partially in accordance with Valcan and colleague's (2017) meta-analytic findings of a stable relation between both positive and negative parenting practices and child inhibition. However, in another meta-analysis on parenting practices and child self-regulation (Karreman, van Tuijl, van Aken, & Deković, 2006), the authors found no significant associations between parental responsiveness and positive control with child inhibition, either. In accordance, in Bechtel and colleagues' study (2016) no significant correlations between higher self-regulation skills (in terms of child compliance) and parents' PCR behavior emerged. As Karreman et al. (2006) discuss, a plausible reason could be that parents mostly provided good enough parenting, making a significant correlation between the mentioned parent and child variables less likely to appear. This might also apply to our findings. While there was reasonable variance in parent-reported PCR, ratings were high on average, with the lowest ratings still reflecting "good enough" parenting. Given the rather homogenous sample of typically developing toddlers and families from primarily high socio-economic background, other factors, i.e., negative parenting, might have contributed more to the variance in children's inhibitory problems. Future studies, including families with more diverse SES, might address this issue.

In accordance with our second hypothesis, parents' DSSE resulted to be a stronger predictor of child inhibitory control than was DGSE. This is congruent with findings from Coleman and Karraker (2003) and Sanders and Woolley (2005), who report DSSE but not DGSE to be significantly related to several child variables. It also supports Bandura's (1977, 1989) assumption that domain-specific measures of self-efficacy, when compared to global assessments, are likely to be more precise predictors of actual behavior.

Regarding the joint contribution of parental co-regulation and self-efficacy beliefs to child inhibitory control, our results add to Jusiene and colleague's (2015) observation of a unique contribution of parental self-efficacy beliefs to the developmental trajectories of mother reported regulatory problems in early childhood, over and above mothers' supportive behavior. In the present study, parents' DSSE (but not DGSE) explained a significant and unique amount of variance of parent-reported inhibitory problems, when accounting for parenting practices and covariates. Our findings thus extend previous evidence that parental self-efficacy (and domain-specific in particular) is not only related to regulatory and externalizing problems in general (e.g. Jusiene et al., 2015; Sanders & Woolley, 2005), but more specifically to parent-reported inhibitory problems, too.

The second research question in this study sought to determine an indirect effect from parents' DSSE on child inhibitory control, (partially) mediated via parents' NCR. However, the observed data did not support this indirect pathway but rather pointed towards independent effects of the two parenting variables. It is important to note, though, that the measures of both the predictor (DSSE) and the mediator (NCR) were obtained almost concurrently (with only one week apart). This could have produced biased results, since the predictor was supposed to cause the mediators and should therefore be measured earlier (Meunier, Roskam, & Browne, 2011). Further longitudinal research is required to yield reliable findings and draw causal inferences on the direction of effects.

As Bornstein and colleagues (2018) acknowledged recently, this three-term "standard model" of parental cognition, parenting practices and child adjustment has seldom been confirmed empirically. They provide empirical evidence for a cascade but not a mediation path from parenting cognitions to supportive parenting to child externalizing behavior.

Together with our findings of independent effects of parental self-efficacy and NCR to child inhibitory control, this may have meaningful implications for the design of interventions. There is a consensus that interventions should not only be evaluated based on overt behavioural change but also take into consideration associated attitudes and self-efficacy beliefs (e.g. Ajzen, 2011; Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016; Wittkowski, Dowling, & Smith, 2016), since these may form the intention to perform certain behaviours and account for a large proportion of behavioural variance (Ajzen, 2011; Bandura, 1982, 1998; Steinmetz et al., 2016; Webb & Sheeran, 2006). In order to use more PCR and less NCR strategies, a parent would need a positive belief towards the behaviour's likely consequences (e.g., positive parenting may promote my child's development) and feel confident that he/she has the requisite skills to perform the behaviour.

In a recent review, Wittkowski et al. (2016) examined the impact of group-based interventions on parental self-efficacy in parents of preschool children. Overall, the majority of the studies included in the review found a significant positive effect, regardless of whether a task-specific of domain-general measure of parental self-efficacy was employed. However, the strongest effect sizes were reported for domain-specific measures of self-efficacy. Assuming that parental self-efficacy represents an important predictor of actual parenting behavior and based on our finding that parents' DSSE was directly related to parent-reported inhibitory control in our study, group-based interventions might be a promising approach in order to promote parenting practices and prevent children from adverse development.

**Limitations**

The associations between parents' self-efficacy and parental co-regulation with child inhibitory control were observed only for the BRIEF-P measure of inhibition, thus limiting generalization of our findings. Children's Snack Delay performance did not relate to either parenting practices or parental self-efficacy beliefs.

Although the BRIEF-P is assumed to be ecologically valid (Espy, Sheffield, Wiebe, Clark, & Moehr, 2011; Sherman & Brooks, 2010) and the delay of gratification task a common measure to assess child inhibitory control (Kloo & Sodian, 2017; Kochanska et al., 2000; Merz et al., 2016; Voigt et al., 2012), it is conceivable that both measures tap on different aspects of inhibition (Mahone & Hoffman, 2007). While the BRIEF-P represents a clinical inventory of executive functions, measuring more general day-to-day self-regulation abilities and focusing on the detection of regulatory problems, the Snack Delay task is a performance-based measure, that might assess rather domain-specific aspects of inhibition in constrained circumstances (Mahone & Hoffman, 2007; Spiegel, Lonigan, & Phillips, 2017).

As pointed out by Coleman and Karraker (2003), associations between self-efficacy and child behavior tend to be most salient under stressful situations, where toddlers are more prone to exhibit oppositional behavior and require more active parental effort to elicit compliance and persistence, which again may influence parents' self-efficacy beliefs. The laboratory context might thus not be conducive to evoking toddlers' typical at-home behaviors. A number of parents expressed surprise at how cooperative their children were and how successfully they delayed the gratification. As Toplak, West, and Stanovich (2013) pointed out in a recent review comparing performance-based to rating-based measures of executive functions, these methods might capture different aspects of self-regulation (i.e., optimal vs. typical performance). Thus, they may provide distinct information on children's regulatory abilities and should be treated complementary rather than interchangeably. Low convergence, especially between the BRIEF-P and behavioral executive function tasks, is in accordance with prior findings (Mahone & Hoffman, 2007; Spiegel et al., 2017). Again, this highlights the importance of collecting data using a multi-methodological approach to get a more thorough picture of children's inhibitory and self-regulatory abilities (Duckworth & Kern, 2011).

Although our findings imply that both NCR and DSSE exert a direct influence on children's inhibitory problems, it is important to note that these results are based on parent-report and on two measurement periods over a very short time interval only. More assessment points and data from different sources (e.g., third-party reports or observational assessments) would be needed to draw more general conclusions in this regard. In the current study, it could be the case that parents who felt less efficacious in their parenting role also perceived their child as being "harder to handle" and as displaying more regulatory problems, which might have affected parents' BRIEF-IN ratings. On the other hand, a more "problematic" view of their child's behavior might have led parents to doubt their skills and feel less efficacious in their parenting role (Jones & Prinz, 2005; Jusiene et al., 2015). From the present study it is not possible to disentangle these options. First evidence from a recent longitudinal study, although based on parent-report, too, points towards a direct influence of parental self-efficacy beliefs on children's trajectories of regulatory problems, over and above parenting practices (Jusiene et al., 2015). However, a reciprocal relation is very likely. To date a few previous studies have investigated bidirectional influences between parenting quality and preschool children's self-regulation and inhibitory control (Blair et al., 2014; Eisenberg et al., 2010; Merz et al., 2017), though not including parental self-efficacy. More longitudinal research is needed to address this issue in depth.

Unexpectedly, children's Snack Delay performance did not correlate with either parental co-regulation, self-efficacy beliefs or parent-reported inhibitory problems.

A reason might be that the variance was restricted due to a ceiling effect in children's performance. The majority of the children scored very high on the Snack Delay task and displayed no or very little difficulty in waiting for the desired treat. We originally incorporated a second measure of inhibition (a go no-go "sun-moon" task, see Voigt et al., 2012) in our study design to obtain a more thorough picture of children's inhibitory skills. However, data of this task was not included in our analyses, since validity was restricted due to a high amount of children failing to reach the comprehension criterion.

Several factors might have contributed to children scoring at ceiling at the Snack Delay task: First, children were on average slightly older (with an age span ranging from 24 to 35 months) than children in prior studies that applied the same task (e.g. Voigt et al., 2013; Voigt et al., 2012). More variance in children's performance might be expected if younger (i.e., 24 months) infants participated. However, in the original study by Kochanska et al. (2000), the task had also been applied to 22 and 33 months-old toddlers, with no ceiling effect being reported in either sample (see also Spinrad, Eisenberg, & Gaertner, 2007). Second, the sample included primarily children with moderate to high SES and high-educated parents. As prior studies have shown, parents' SES and education are significant predictors of children's delay of gratification abilities (Lawson, Hook, & Farah, 2018; Lengua et al., 2015; Sturge-Apple et al., 2016). Including children from a more diverse socio-economic and educational background might increase variance in the Snack Delay task performance, too (e.g., Merz et al., 2016). Third, the experimenter was present during the whole task (although turned away from and not facing the child during the waiting intervals) and instructed the child prior to each trial to 'Wait, until I ring the bell!'. More than tapping on children's inherent ability to inhibit and suppress a prepotent and desired response (i.e., touching and eating the treat), children's performance might as well reflect children's compliance with the experimenter, which is assumed to develop earlier and prior to actual self-regulation (Kochanska, Coy, & Murray, 2001; Kopp, 1982).

**Implications**

The presented findings expand current research on the interplay of parental self-efficacy beliefs and child's developing inhibition skills and may inform future directions in this area of research.

The first point addresses the assessment of parental co-regulation using parent-report. While this is a widely used and accepted approach to gather information in an inexpensive way, our current findings should be complemented by observational data to address and account for potential shortcomings and limits of parent-report measures, i.e., potential bias due to the influence of social desirability or limited accuracy of memories of events (Hendry, Jones, & Charman, 2016; Saudino, 2003; Seifer, 2003). Our available data of parent-child interactions during problem solving is currently being analyzed and will complement the presented findings in the future.

In addition**,** the study variables on the parent- and child-level were assessed only six weeks apart at two different occasions. As stated before, transactional effects are very likely to occur. Therefore, the need for longitudinal studies, including more than two assessment periods, is highly emphasized. It is further of interest to examine more thoroughly how parental self-efficacy interacts with parent- and child variables, as there is research showing that maternal knowledge on child development may moderate the effect of parental self-efficacy on parenting behavior (Grimes, 2012; Hess, Teti, & Hussey-Gardner, 2004).

Furthermore, and as already has been suggested by Coleman and Karraker (1998; 2003), the differential effects regarding parents' DSSE and DGSE observed in this study should be followed up by future research, systematically examining the distinct contributions to parent- and child variables.

In conclusion, the present study adds new and important evidence for a link between parent-reported self-efficacy, parenting behavior and child outcomes, especially inhibitory problems. Given the substantial role early inhibition skills play in a range of academic, socio-emotional and health-related outcomes, there is a strong interest and need to promote these skills and prevent children from an adverse development. Preventive parenting programs should thus not only address parenting practices but target parental self-efficacy as an important factor, too (Sanders & Woolley, 2005; Wittkowski et al., 2016).

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**Compliance with Ethical Standards**

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The authors declare that they have no conflict of interest

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Table 1

*Assessment points and applied measures.*

| | T1 | Intervention | | | T2 | Follow-Up |
|---|---|---|---|---|---|---|
| | | Session 1 | Session 2-3 | Session 4 | | |
| Anamnesis + SES | X | | | | | |
| Self-efficacy (self-report) | | X | | X | | X |
| IMMA 1-6[b] | X | | | | X | X |
| CBCL 1.5 – 5[ac] | X | | | | X | X |
| BRIEF-P[d] | X | | | | X | X |
| ECBQ[ae] | X | | | | X | X |
| SBE-2-KT[af] | X | | | | | |
| PSI[ag] | X | | | | | |
| Training evaluation[a] | | | | X | | |
| Cognitive development (child)[h] | X | | | | | |
| Inhibition tasks (child)[i] | X | | | | X | |
| Parent-child-interaction[a] | X | | | | X | |

*Note.* [a]Not reported in this study; [b]IMpuls-MAnagement in Toddlers and Preschoolers (Pauen, Hochmuth, Schulz, & Bechtel, 2014); [c]Child Behavior Checklist 1.5-5 (Achenbach & Rescorla, 2000); [d]Behavior Rating Inventory of Executive Function – Preschool Version (Daseking & Petermann, 2013); [e]Early Childhood Behavior Questionnaire (Putnam, Gartstein, & Rothbart, 2006); [f]Parental language assessment (von Suchodoletz & Sachse, 2011); [g]Parenting Stress Index (Tröster, 2011); [h]Bayley Scales of Infant and Toddler Development III (Reuner & Rosenkranz, 2014); [i]Snack Delay/Sun-Moon (Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012).

Table 2

*Raw and transformed descriptive data of study variables.*

| | M | (SD) | Min | Max | Skew | (SE Skew) | z |
|---|---|---|---|---|---|---|---|
| COG | 99.51 | (13.80) | 60.00 | 135.00 | -0.10 | (0.24) | -0.42 |
| BRIEF-IN[a] | 49.62 | (11.05) | 32.00 | 81.00 | 0.58 | (0.26) | 2.26* |
| Snack Delay[b] | 11.14 | (2.11) | 3.60 | 13.00 | -1.53 | (0.26) | -5.79*** |
| LogSD[b] | 0.82 | (0.66) | 0.00 | 2.34 | 0.40 | (0.26) | 1.50 |
| NCR[c] | 3.49 | (0.61) | 2.08 | 5.00 | 0.05 | (0.24) | 0.21 |
| PCR[c] | 4.72 | (0.55) | 3.00 | 5.83 | -0.24 | (0.24) | 0.97 |
| DGSE[d] | 4.16 | (0.78) | 1.67 | 6.00 | -0.29 | (0.24) | -1.21 |
| DSSE[d] | 4.33 | (0.68) | 2.75 | 6.00 | -0.05 | (0.24) | -0.21 |

*Note*. [a]3 missing values; [b]7 missing values; [c]4 missing values; [d] 0 missing values; *$p$ < .05 ***$p$ < .001 (two-tailed tests)

COG = child cognitive functioning; BRIEF-IN = Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version; LogSD = log transformed Snack Delay scores; NCR = negative co-regulation; PCR = positive co-regulation; DGSE = domain-general self-efficacy; DSSE = domain-specific self-efficacy.

Table 3

*Bivariate correlation coefficients for socio-demographic and study variables.*

| | BRIEF-IN | LogSD | NCR | PCR | DGSE | DSSE |
|---|---|---|---|---|---|---|
| Age (P) | -.04 | -.12 | -.05 | .01 | -.02 | .07 |
| Sex (P) | -.14 | -.01 | .08 | .29** | .05 | .27* |
| SES | -.16 | -.13 | -.06 | .01 | -.03 | .02 |
| Sex (C) | -.09 | -.02 | -.14 | -.07 | .12 | -.02 |
| Age (C) | .04 | -.18 | .08 | .03 | .00 | .07 |
| COG | -.27* | -.17 | -.31** | .15 | -.03 | .07 |

*Note*. ** $p < .01$, * $p < .05$ (two-tailed tests);

P = Parent, C = Child; COG = child cognitive functioning; SES = families' socio-economic status; BRIEF-IN = Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version; LogSD = log transformed Snack Delay scores; NCR = negative co-regulation; PCR = positive co-regulation; DGSE = domain-general self-efficacy; DSSE = domain-specific self-efficacy.

Table 4

*Bivariate (and partial) correlations (while controlling for parents' sex and child cognitive functioning) between study variables.*

| | LogSD | NCR | PCR | DGSE | DSSE |
|---|---|---|---|---|---|
| BRIEF-IN | .17 (.13) | .32** (.28**) | -.24* (-.16) | -.21* (-.23*) | -.40*** (-.37***) |
| | [80] | [83] | [83] | [87] | [87] |
| LogSD | | .10 (.06) | -.15 (-.14) | .04 (-.05) | -.04 (-.02) |
| | | [79] | [79] | [83] | [83] |
| NCR | | | -.15 (-.14) | -.22* (-.24*) | -.17 (-.17) |
| | | | [86] | [86] | [86] |
| PCR | | | | .10 (.09) | .34** (.27**) |
| | | | | [86] | [86] |
| DGSE | | | | | .45*** (.46***) |
| | | | | | [90] |

*Note.* Valid *n* are shown in square brackets. BRIEF-IN = Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version; LogSD = log transformed Snack Delay scores; NCR = negative co-regulation; PCR = positive co-regulation; DGSE = domain-general self-efficacy; DSSE = domain-specific self-efficacy.

***$p$ < .001, **$p$ < .01, *$p$ < .05 (one-tailed tests).

Table 5

*Multiple regression analyses with BRIEF-IN as the dependent variable and parents' sex, COG, NCR, PCR, DSGE and DSSE as predictors.*

| | Model 1 | | | | Model 2 | | | | Model 3 | | | | Model 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *b* | (*SE*) | β | *t* | *b* | (*SE*) | β | *t* | *b* | (*SE*) | β | *t* | *b* | (*SE*) | β | *t* |
| Constant | 55.59 | (3.34) | | 16.65 | 55.22 | (3.38) | | 16.34 | 52.82 | (3.32) | | 15.92 | 53.33 | (3.37) | | 15.82 |
| Parent's sex | -6.29 | (3.56) | -.19 | -1.77⁺ | -5.87 | (3.63) | -.17 | -1.62 | -3.13 | (3.56) | -.09 | -0.88 | -3.72 | (3.63) | -.11 | -1.02 |
| COG | -0.25 | (0.09) | -.29 | -2.75** | -0.17 | (0.09) | -.19 | -1.81⁺ | -0.22 | (0.09) | -.25 | -2.49* | -0.16 | (0.09) | -.18 | -1.74⁺ |
| NCR | | | | | 4.84 | (2.01) | .26 | 2.41* | | | | | 4.11 | (2.00) | .22 | 2.05* |
| PCR | | | | | -2.45 | (2.15) | -.12 | -1.14 | | | | | -1.11 | (2.16) | -.06 | -0.51 |
| DGSE | | | | | | | | | -0.76 | (1.56) | -.05 | -0.49 | -0.22 | (1.56) | -.02 | -0.14 |
| DSSE | | | | | | | | | -5.04 | (1.90) | -.31 | -2.66* | -4.45 | (1.93) | -.27 | -2.30* |
| | $R^2$ = .12** | | | | $R^2$ = .20** | | | | $R^2$ = .22** | | | | $R^2$ = .27** | | | |

*Note*. $^{**}p < .01$, $^{*}p < .05$; $^{+}p < .10$ (two-tailed tests), $n = 83$

COG = child cognitive functioning; BRIEF-IN = Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version;

NCR = negative co-regulation; PCR = positive co-regulation; DGSE = domain-general self-efficacy; DSSE = domain-specific self-efficacy.

Table 6

*Regression analyses of parents' NCR mediating the relation between DSSE and parent-reported inhibitory problems (BRIEF-IN) when controlling for parents' sex and child's COG.*

| Model | Dependent variable | Predictors | $R^2$(%) | β |
|---|---|---|---|---|
| 1 | BRIEF-IN | Parents' sex | 21.6 | -.09 |
| | | COG | | -.25* |
| | | DSSE | | -.33** |
| 2 | NCR | Parents' sex | 12.1 | .14 |
| | | COG | | -.27* |
| | | DSSE | | -.17 |
| 3 | BRIEF-IN | Parents' sex | 26.2 | -.12 |
| | | COG | | -.19 |
| | | DSSE | | -.29** |
| | | NCR | | .23* |

*Note*. *$p < .05$, **$p < .01$ (two-tailed tests); $n = 83$

COG = child cognitive functioning; BRIEF-IN = Inhibition Scale of the Behavior Rating Inventory of Executive Functions – Preschool Version; NCR = negative co-regulation; DSSE = domain-specific self-efficacy.

# Appendix B – Publication 2

This is the submitted version of the following article:

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Running head: "HOW DO WE SOLVE THIS PUZZLE?"

# "How do we solve this puzzle?" – Parental Scaffolding during Problem-Solving in Toddlerhood

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**Abstract**

The study examines determinants of parental scaffolding (SCA) and how SCA affects the parent-child problem-solving performance. The sample includes 133 parents with a full-term or preterm born two-year old toddler (corrected age). Parents' SCA during one of two (randomly assigned) problem-solving tasks (PST) is rated on five scales (*use of SCA means, cognitive support, metacognitive support, transfer or responsibility, contingency management*). Concerning the determinants of SCA, the child's cognitive development (assessed with the Bayley-III) and the type of PST, but not preterm birth, parenting stress or family socio-economic status, significantly relate to parents' SCA. Regarding the link from SCA to the problem-solving performance, direct effects are observed from parents' *cognitive* and *metacognitive support*, as well as *transfer of responsibility*. The data also confirm indirect effects from parents' *use of SCA means* to the problem-solving performance, mediated through parents' *cognitive* and *metacognitive support*. Implications for the design of interventions are discussed.

Keywords: *scaffolding, problem-solving, preterm birth, early childhood*

**Zusammenfassung**

Die Studie befasst sich mit Determinanten des elterlichen Scaffolding-Verhaltens (SCA) im Kleinkindalter und damit, wie das SCA die Eltern-Kind-Problemlöseleistung beeinflusst. Die Stichprobe umfasst 133 Eltern mit einem termingeborenen oder frühgeborenen zweijährigen Kleinkind (korrigiertes Alter). Das SCA der Eltern während einer von zwei (zufällig zugewiesenen) Problemlöseaufgaben (PST) wird anhand eines Beobachtungsinstruments auf fünf Skalen bewertet (*Verwendung von SCA-Methoden, kognitive Unterstützung, metakognitive Unterstützung, Transfer oder Verantwortung, Kontingenzmanagement*). Bezüglich der Determinanten von SCA legen die Ergebnisse nahe, dass die kognitive Entwicklung des Kindes (erfasst mit dem Bayley-III) und die Art der PST, nicht aber Frühgeburt, Erziehungsstress oder familiärer sozioökonomischer Status signifikant mit dem SCA der Eltern korrelieren. Die Problemlöseleistung hängt direkt mit der *kognitiven* und *metakognitiven Unterstützung*, sowie der *Verantwortungsübertragung* der Eltern zusammen. Zudem zeigen sich indirekte Effekte von der *Nutzung von SCA-Methoden* auf die Problemlöseleistung, die über die *kognitive* und *metakognitive Unterstützung* mediiert werden. Implikationen für die Gestaltung von Interventionen werden diskutiert.

Keywords: *Scaffolding, Problemlösen, Frühgeburt, frühe Kindheit*

"How do we solve this puzzle?" –
Parental Scaffolding during Problem-Solving in Toddlerhood

Supportive behaviours, in the sense of tutorial interactions of caregivers with the child, represent a crucial aspect of early childhood (Wood, Bruner, & Ross, 1976). From a socio-cultural perspective they are key requirements for successful learning and development (Vygotsky, 1978). Wood and colleagues (1976) introduced the metaphor of *scaffolding* in order to describe parents' instructional interventions during problem-solving with their child. Parental scaffolding includes a set of techniques with which parents "enable the child to solve a problem, carry out a task, or achieve a goal, which would be beyond his unassisted efforts" (Wood et al., 1976, p. 90). Through parents' scaffolding efforts, children thus gradually learn and internalize more developmentally advanced skills and become better able to solve problems independently (Lowe, Erickson, MacLean, Schrader, & Fuller, 2013).

During the last decades, the concept of scaffolding has been applied to diverse contexts in developmental, educational, and cognitive psychology (Granott, 2005; Leith, Yuill, & Pike, 2018; van de Pol, Volman, & Beishuizen, 2010), resulting in a conglomerate of definitions and measures of scaffolding (Mermelshtine, 2017). In an attempt to organize the different approaches, van de Pol et al. (2010) provide an integrative framework. The authors distinguish between scaffolding *intentions* (what is scaffolded) and scaffolding *means* (how is scaffolding taking place). For instance, parents may intend to support their child's metacognitive (i.e. direction maintenance), cognitive (i.e. cognitive structuring, simplification), or affective activities (i.e. recruitment, frustration control) by giving feedback, hints, instructions, or explanations, by asking questions, or demonstrating unique features of the task. The combination of a scaffolding means with a scaffolding intention then construes a scaffolding strategy. However, whether such strategy qualifies as scaffolding depends also on whether it is applied *contingently* and whether it is part of the process of *fading* and *transfer of responsibility* in order to promote the child's learning (Leith et al., 2018; Mermelshtine, 2017; van de Pol et al., 2010).

Parent, child, and contextual characteristics have been identified as major determinants of parenting practices (Belsky, 1984; Bornstein, 2016). With regard to the quality of parental scaffolding, research suggests that low socio-economic status (SES) (Lengua et al., 2014), low maternal education (Carr & Pike, 2012; Neitzel & Stright, 2004), as well as parental mental health problems (Hoffman, Crnic, & Baker, 2006) exert a negative influence. Furthermore, according to Belsky's (1984) model, parenting stress might limit parents' ability to meet their child’s needs, provide the necessary scaffolds, and support their child’s autonomy. Yet the degree to which parenting stress actually affects parental scaffolding in early childhood remains in question. In addition, only recently have researchers started to investigate the effect of child characteristics, such as preterm birth, on parental scaffolding (Erickson et al., 2013; Lowe et al., 2014; Lowe et al., 2013).

Approximately 9% of infants in Germany are born prematurely (before 37 complete weeks of gestation) (IQTIG, 2015). Due to an interplay of various aspects of development, including neural maturation, psycho-social functioning, familiar and cultural environment, these children display an increased risk for adverse long-term neuropsychological impairments (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Montagna & Nosarti, 2016). Preterm birth represents an extremely stressful and disturbing event for parents. Many of them experience increased stress, anxiety and depressive symptoms up to seven years later (Treyvaud, Lee, & Doyle, 2014). It has been shown that these factors may hinder effective scaffolding in parents of full-term born (FT) children (e.g., Hoffman et al., 2006). With regard to the preterm population, to date the evidence is mixed. For instance, mothers of preterm born (PT) toddlers and preschoolers seem to provide significantly less scaffolding, use less complex scaffolding, and show less respect for their child’s autonomy than mothers of FT children (Donahue & Pearl, 1995; Erickson et al., 2013; Lowe et al., 2013; Potharst et al., 2012). Other studies report no differences in parental scaffolding among mothers of FT and PT toddlers and pre-schoolers (Landry, Smith, Swank, & Miller-Loncar, 2000; Lowe et al., 2014). These heterogeneous findings might be due to conceptual as well as methodological issues. As stated before, a major challenge for the study of parental scaffolding has been the paucity of a unified definition and the lack of common measures (Mermelshtine, 2017). For the purpose of the present study, a high-inference rating scheme was developed and applied based on van de Pol and colleagues’ (2010) integrative conceptual framework.

The first aim of this study was to examine the determinants of parental scaffolding. In particular, how parent, child, and contextual characteristics (i.e., preterm birth, child cognitive development, parenting stress, SES, and the type of problem-solving task) contribute to different levels of parental scaffolding. Three levels of scaffolding are distinguished: Level 1: scaffolding means (i.e., parents’ use of questions, hints, instructions, feedback, explanations or transfer), Level 2: scaffolding intentions (i.e., metacognitive, cognitive, or affective support[1]), and Level 3: process variables (i.e., parents' transfer of responsibility and contingency management).

The second aim of the present study was to examine, how the different levels of parental scaffolding relate to parent and child's problem-solving performance. It is assumed that parents' scaffolding intentions (cognitive and metacognitive support), as well as the process variables (parents' contingency management and transfer of responsibility) augment the child's problem-solving performance and enable the child to achieve a goal that he/she would not have reached without assistance (e.g., Conner, Knight, & Cross, 1997; Grolnick, Gurland, DeCourcey, & Jacob, 2002; Neitzel & Stright, 2003). Hence, we expected these aspects to contribute significantly to parent and child's problem-solving success. In addition, van de Pol et al. (2010) explain that scaffolding means always serve a certain function or intention. For instance, by asking questions, giving feedback, hints or instructions, parents structure and simplify the task (cognitive support) and/or support the child's problem-solving process (metacognitive support) and thus enable the child to solve the task successfully. In order to test this link empirically, the third aim of this study was to analyse if the effect from parents' scaffolding means to parent and child's problem-solving success would be (partially) mediated through parents' scaffolding intentions (cognitive and/or metacognitive support).

## Method

### Sample

Of the original 161 parent-child dyads who participated in this study, 91 FT (gestational age, GA ≥ 37 weeks) and 42 PT toddlers (GA < 37 weeks) and their parents were included in the analyses, resulting in a final sample of 133 parent-child dyads[2]. Table 1 presents sample characteristics. Children were between 23 and 35 months of (corrected) age. Only one parent (mostly the primary caregiver) participated in the study[3]. Families' SES was computed based on parents' school education, professional education, recent professional status and family income following the procedure by Winkler and Stolzenberg (2009) and averaging scores for

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[1] In the present study we only refer to parents' metacognitive and cognitive support.

[2] Data of 29 parent-child interactions (18%) was not included because no video was available ($n$ = 8), no valid rating of parents' scaffolding or parent-child task performance could be generated (e.g., because parent-child-dyads spent not enough time on task) ($n$ = 18), or because no valid assessment of child cognitive development could be obtained as children were uncooperative. See Appendix A in the online material for dropout analyses.

[3] Four mothers participated with twins. They completed the assessment sessions and all questionnaires for both children and were thus included in the analyses.

mothers and fathers to create a family-based measure of SES (Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012). With scores of 3 to 8 indicating low, 9 to 14 moderate, and 15 to 21 high SES, participating families were on average from the upper social class ($M$ = 16.23, $SD$ = 3.63).

*[Please insert Table 1 here]*

## Procedure

Data was collected in the southwest of Germany within the scope of a quasi-experimental intervention study (for more details on the intervention see [BLINDED]). The present study refers to data from the pre-test. Based on a multi-method approach, data was obtained on the parent and child level via questionnaires and observational measures. Pre-test assessment of the parent-child interaction took place in a laboratory setting at the university hospital and/or university and lasted approximately one and a half hours. The assessment started with the Cognitive Scale of the Bayley Scales of Infant and Toddler Development, 3rd edition (Reuner & Rosenkranz, 2014), followed by parent-child interactions during free play (5 minutes), two problem-solving situations (10 minutes each)[4], and finally two inhibitory control tasks[5]. While the child participated in the Bayley Scales and the inhibition tasks, the parent filled out questionnaires. The study protocol was approved by the Institutional Review Board of the University Hospital and written informed consent was obtained from all parents.

### Parent-child interaction.

As a consequence of the pre-test – intervention – post-test design, parent-child dyads were randomly given one of two age-appropriate problem-solving tasks at pre-test and correspondingly the other task at post-test. In either task, parents were instructed to support their child to solve the task without doing so themselves. Both tasks required sorting according to two dimensions (colour and size or colour and shape). In the first problem-solving task (PST1), children had to sort 12 blocks according to size and colour (green, blue, and red) into the corresponding holes (see figure 1 in Appendix B in the online supplementary material). In the second problem-solving task (PST2), 20 blocks of five different shapes (e.g., triangle, square, circle) and four different colours (blue, green, yellow, and red) had to be sorted on five poles according to both dimensions (see figure 2 in Appendix B in the online supplementary material). Both tasks were supposed to be comparable in terms of difficulty.

[4] The second problem-solving situation was aimed to be too difficult for the age group and to induce frustration in the parent and the child. Results of this study are based only on the first (challenging but age-appropriate) problem-solving situation.

[5] Data from the inhibitory control tasks is not reported in this study.

## Measures

### Ratings on scaffolding means, intentions, and process variables.

Interactions were analysed with a self-developed high-inference rating scheme reflecting the three levels of parental scaffolding via five scales. Scales were represented by several indicators (except for *contingency management*). These indicators were rated on a 5-point Likert scale (ranging from 0 = *not at all applicable* to 4 = *fully applicable*)[6] and were averaged to build a mean score for each scaffolding dimension. The scales included parents' *use of scaffolding means* (four items, Cronbach's $\alpha$ = .64)[7], *cognitive support* (2 items, *r* = .66) and *metacognitive support* (2 items, *r* = .57), as well as *transfer of responsibility* (6 items, Cronbach's $\alpha$ = .83) and *contingency management* (1 item) (see Appendix C in the online supplementary material for more details). After an extensive training, three independent coders rated the videos. All coders were blind to child birth status and assessment point (pre- or post-test). Interrater-reliability was calculated using *intra-class-correlation coefficients* (*ICC*; mixed methods, absolute agreement) on 24 videos[8]. Interrater-reliability was fair to good (Cicchetti, 1994) for the scales *use of scaffolding means* (*ICC* = .68), *cognitive support* (*ICC* = .50), *metacognitive support* (*ICC* = .62), *transfer of responsibility* (*ICC* = .68), and *contingency management* (*ICC* = .71).

### Problem-solving performance.

Parent-child problem-solving performance was coded as 1 = *successful* if the child (with the parents' assistance) managed to sort all blocks correctly according to size/shape and colour. However, if the child did not accomplish to sort the blocks according to both dimensions or if the parent ended up finishing the task for the child, this was coded as 0 = *unsuccessful*. Although both tasks were aimed to be of comparable difficulty, the proportion of parent-child-dyads who solved the first task (PST1) successfully was significantly higher ($\chi^2$ (1) = 4.15, $p < .05$). The problem-solving task at hand was included as a possible determinant of parental scaffolding in the following analyses. Two coders rated the *parent-*

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[6] Parents' *use of scaffolding means* was rated on a 5-point scale that ranged from *not at all* to *very often*.

[7] Parents' *use of scaffolding means* contained four items that described how often parents provided questions, hints, instructions, and feedback to the child in the problem-solving process. Parents' use of explanations and transfer were rated, too. However, since these means were observed only very occasionally (explanations: *M* = 0.56, *SD* = 0.72; transfer: *M* = 0.23, *SD* = 0.50), they were not included in the final scale.

[8] Twelve videos from pre- and 12 videos from post-test (with an equal distribution of FT and PT children).

*child problem-solving performance*. Interrater-reliability was excellent (*Cohen's* κ = .83; Cicchetti, 1994).

**Cognitive development.**

The Bayley Scales of Infant and Toddler Development, 3rd edition (Reuner & Rosenkranz, 2014) is a widely used standardized observational measure of general cognitive, motor and verbal development of infants and toddlers aged 1 – 42 months. For the purpose of our study, we administered the Cognitive Scale only and used the derived norm-referenced standard scores ($M$ = 100, $SD$ = 15).

**Parenting stress.**

The German version of the Parenting Stress Index (PSI; Tröster, 2011) is a 48-item self-report questionnaire. The parent rates each item on a 5-point scale with 1 = *strongly disagree* and 5 = *strongly agree*. In the present study, we used the PSI-Total Stress score and transformed it into a standard T-score ($M$ = 50, $SD$ = 10) using the normative data. Higher scores indicate more parenting stress.

## Results

### Statistical analyses

All descriptive and preliminary as well as logistic and multiple regression analyses were performed with IBM SPSS 24. Mediation analyses were conducted with Mplus Version 7.31 (Muthén & Muthén, 1998-2012).

Table 2 provides an overview of the descriptive data of the scaffolding variables. Correlations among the study variables are presented in Table 3. The scaffolding variables correlated moderately, with no indication of multicollinearity.

*[Please insert Table 2 and Table 3 here]*

### RQ1: Determinants of parental scaffolding

We performed five separate multiple regression analyses with the variables of parental scaffolding as the dependent variables, and the problem-solving task (PST1/PST2), child birth status (FT/PT), child cognitive development (COG), parenting stress, and family SES as the predictors (see Table 4).

While birth status, parenting stress, and family SES did not contribute significantly when controlling for the remaining variables, the problem-solving task and child COG were the only significant predictors of the parental scaffolding variables. Parents used significantly more scaffolding means and transferred less responsibility to their child in PST2 than parents who worked on PST1 with their child. In addition, the higher child COG, the more parents provided cognitive support, metacognitive support (only marginally significant), and transferred responsibility to the child.

*[Please insert Table 4 here]*

**RQ2: Relation of parental scaffolding and parent-child problem-solving performance**

We performed sequential logistic regression analyses with the parent-child problem-solving performance (0 = *unsuccessful*, 1 = *successful*) as the dependent variable and the problem-solving task (PST1 vs. PST2) and child COG as covariates. No violation of linearity in the logit was observed. As shown in Table 5, a test of Model 1 against a constant only model was only marginally significant ($\chi^2(2) = 4.90$, $p < .10$), indicating that *PST* but not child *COG* significantly related to the parent-child problem-solving success. Including parents' use of *scaffolding means* in the next step (Model 2) improved the model fit significantly ($\chi^2(1) = 6.70$, $p < .05$). When parents' scaffolding intentions (*cognitive* and *metacognitive support*) were added in Model 3, the model fit increased tremendously ($\chi^2(2) = 25.94$, $p < .001$). Parents' scaffolding intentions (*cognitive support* and *metacognitive support*) significantly predicted dyadic task performance, while parents' *use of scaffolding means* was no longer statistically significant. In the last step, the process variables of parental scaffolding (parents' *transfer of responsibility* and *contingency management*) were included and improved the model fit even further ($\chi^2(2) = 11.41$, $p < .01$). Parents' *contingency management* (though only marginally significant) was positively related to successful problem-solving, whereas a significant negative link was observed for parents' *transfer of responsibility*. Parents' scaffolding intentions remained significant positive predictors in this last model.

*[Please insert Table 5 here]*

**RQ3: Mediation analyses**

A multiple mediation model was conducted to analyse the indirect paths from parents' use of scaffolding means to the dyadic task performance via parents' scaffolding intentions (cognitive support and metacognitive support, see figure 1)[9]. For the cognitive support mediation path, there were significant regression weights from parents' use of scaffolding

[9] Since Mplus uses the underlying continuous latent response variable approach for logistic regression analyses (e.g., McKelvey & Zavoina, 1975), the models' direct and indirect effects refer to a latent continuous response variable assumed to underlie the dichotomous indicator of task performance (for details on Mplus mediation analysis with binary outcomes, see Muthén & Muthén, 1998-2012).

means to cognitive support ($\beta = .34$, $p < .001$), and from cognitive support to the dyadic task performance ($\beta = .44$, $p < .001$). For metacognitive support, we found significant regression weights from use of scaffolding means to metacognitive support ($\beta = .39$, $p < .001$) and metacognitive support to task performance ($\beta = .23$, $p < .05$). Adding cognitive support and metacognitive support to the model reduced the predictive power of parents' use of scaffolding means on task performance from $\beta = .20$ ($p < .05$) to $\beta = .02$ ($p = .42$), with significant specific indirect effects resulting for cognitive support ($b = .47$, $p < .01$) as well as metacognitive support ($b = .27$, $p < .05$), thus indicating a full mediation.

*[Please insert figure 1 here]*

## Discussion

With regard to the determinants of parental scaffolding (research question 1), our findings indicate that child's COG and the type of task were significant predictors of parental scaffolding, while birth status, parenting stress, or family SES exerted no independent effects. The higher the child's COG, the more cognitive support parents provided and the more responsibility they transferred to the child. At first this might sound contradictory, since one might have expected more cognitive support for those children with lower COG. However, it rather seems that if children scored lower on COG, parents transferred less responsibility but did not structure or simplify the task appropriately for their child. While this is in accordance with child-driven effects on parents' scaffolding behaviour that have been reported in previous studies (e.g., Eisenberg et al., 2010), we cannot draw any conclusions on the direction of effects since our findings are cross-sectional. Research has shown that parents' scaffolding behaviour in infancy and toddlerhood also predicts better general cognitive abilities and EF in toddlers and preschool children (e.g., Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012; Mermelshtine & Barnes, 2016). Hence, in the present study, parents' earlier scaffolding might as well have affected children's current cognitive abilities.

Parents' scaffolding behaviour also seemed to differ depending on the type of task, with more use of scaffolding means and less transfer of responsibility observed in PST2. PST1 might have been slightly easier due to characteristics of the material that reduced the degrees of freedom and facilitated the sorting according to size. In PST2 there were no task inherent hints on where to place the different shapes, since they would fit on all poles equally well. The findings indicate that parents appropriately adapted their support in face of the more difficult task by using more scaffolding means and transferring less responsibility to the child.

With regard to the effect of preterm birth on parental scaffolding, Lowe et al. (2013) discussed whether their observed differences in parental scaffolding among parents of FT and PT children indicated that mothers of PT children were appropriately 'fine-tuning' their scaffolding behaviour in order to be sensitive to their children's needs (e.g., using simpler strategies as their child faced more developmental problems and difficulties with the task), or whether they might be related to a type of prematurity stereotyping whereby mothers adjusted their input solely based on their child's prematurity. Transferred to the present study, it could be argued that if parents' scaffolding had been the consequence of a 'prematurity stereotype', the effect of preterm birth on parental scaffolding would have remained stable when controlling for child cognitive development, parenting stress and family SES. However, although correlation analyses indicated that parents of PT children transferred less responsibility to their child, preterm birth exerted no longer an effect on any of the scaffolding variables once controlled for the remaining parent, child, and contextual characteristics. It seems like parents' scaffolding behaviour depended stronger on child COG and the task at hand, than birth status, hence speaking against a prematurity stereotype.

Surprisingly and in contrast to previous research on contextual factors (e.g., Lengua et al., 2014), family SES had no effect on parents' scaffolding behaviour. A possible reason might be the rather homogeneous and selective sample as parents were primarily well educated and from high socio-economic background.

Finally, as anticipated by Belsky's (1984) model, we expected parenting stress to exert a negative influence on parents' scaffolding behaviour. Surprisingly, no such effect was observed in the present study. The effect from parenting stress on parental scaffolding might have been stronger if more parents had experienced increased levels of stress. In the present sample parents' level of parenting stress was moderate, and although slightly higher in the preterm sample, the mean was still not counted as "clinically significant".

With regard to the second and third research questions, i.e. the influence of parental scaffolding on parent-child problem-solving success, our findings suggest that parents' scaffolding intentions (cognitive and metacognitive support) were directly related to the parent-child problem-solving success. Parents' use of scaffolding means was indirectly associated with the parent-child problem-solving performance, fully mediated via parents' scaffolding intentions. This reinforces van de Pol and colleagues' (2010) notion that a scaffolding means combined with a scaffolding intention results in a scaffolding strategy that supports the child's problem-solving effort. These findings are also in accordance with previous studies. For instance, Stright, Neitzel, Sears, and Hoke-Sinex (2001) reported that parents' provision of metacognitive information did not effectively predict children's self-regulatory behaviours in school unless parents reduced the cognitive demands of the task for their children by breaking down the task and presenting information in small steps, reviewing the steps, and discussing progress in relation to the overall task goal.

With regard to parents' transfer of responsibility, Grolnick et al. (2002) reported that dyads including more autonomy-supportive mothers performed better on a problem-solving task than dyads with less autonomy-supportive mothers. Research also indicates that the better parents support their child's autonomy, the better executive functions (EF) children develop in preschool age (e.g., Matte-Gagné, Bernier, & Lalonde, 2015), and the more task persistence and behaviour control children show in school (Neitzel & Stright, 2003). In contrast, our findings indicate that the transfer of responsibility was related to unsuccessful problem-solving. Three explanations might account for this effect. First, as van de Pol et al. (2010) argue, the transfer of responsibility should be adapted to the child's level of competence. It might be the case that parents faded out their support too much and possibly overtaxed their child, which eventually resulted in unsuccessful problem-solving. Second, the fact that parents were videotaped while interacting with their child might have put them under pressure and led parents to behave differentially with their child than they would normally do. Third and related to this, the task and how it was presented might have triggered a 'performance goal orientation' instead of a 'learning goal orientation' in parents. Hence, parents might have transferred less responsibility to their child (possibly acting in a more controlling manner) in order to perform well on the task, instead of taking it as a learning opportunity for their child. In a study with school-age children, Grolnick and colleagues (2002) observed that mothers in a high-pressure condition (i.e., emphasizing the child's performance) were rated as more controlling than those in the low-pressure (i.e., emphasizing the child's learning) condition. The orientation under which parents worked with their children thus seemed to affect their interaction styles, despite that the dyads had a history of working together on a task. In addition, when left to complete the tasks alone, children whose mothers had been in the high-pressure condition did not perform as well as children of mothers in the low-pressure condition. As Grolnick and colleagues (2002) conclude, this emphasizes the need to foster an orientation in parents to working with their children that does not focus excessively on evaluation and performance standards, but learning goals instead. Future studies should thus also explore more thoroughly cognitive determinants of parental scaffolding, taking into account, for instance, parents' self-efficacy beliefs, goal orientation or implicit theories of child development.

Finally, we observed only a marginally significant effect of parents’ contingency management on the dyadic task performance. One reason might be that contingency management was highly correlated with parents’ cognitive support ($r$ = .71), thus the additional variance explained by contingency management might have been reduced.

**Limitations and practical implications**

The present study is one of the first to analyse determinants of parental scaffolding in toddlerhood and the effects of different levels of parental scaffolding on the parent-child problem-solving performance. Anyhow, the presented results must be viewed in the light of some limitations. First, the scaffolding variables as well as parent, child, and contextual characteristics were assessed concurrently, thus no inferences on the direction of effects can be drawn. Second, only the dyadic problem-solving performance was assessed. Hence, no conclusion can be made about the child’s initial problem-solving competence, neither about how parents’ scaffolding efforts might have affected child’s subsequent independent problem-solving performance. Although findings suggest that the dyadic parent-child task performance and the child’s success during the parent-child interaction are related to the child’s independent performance in a subsequent task (Conner et al., 1997; Grolnick et al., 2002), future studies should assess child’s problem-solving performance separately. Third, our scaffolding rating was a high-inference rating focusing on the parent and not taking into account the child’s problem-solving actions. Some researchers have argued that the dynamic nature of parental scaffolding, and especially parents’ contingent shifting and adaptation of support, might be better captured with a micro-analytic coding scheme (Carr & Pike, 2012; Pino-Pasternak, Whitebread, & Tolmie, 2010; Pratt, Kerig, Cowan, & Cowan, 1988). Finally, more longitudinal studies addressing how parental scaffolding in early childhood predicts child development of problem-solving and related cognitive skills (e.g. EF) throughout childhood are strongly needed, focusing not only on ‘normally’ developing children (e.g., Hammond et al., 2012; Hughes & Devine, 2017) but also on children who are at risk for adverse developmental outcomes, such as PT children (Aarnoudse-Moens et al., 2009). First findings indicate positive effects from parental scaffolding to PT children’s cognitive skills and emotion regulation (Erickson et al., 2013; Lowe et al., 2013). Training of parental scaffolding [BLINDED] may represent a promising venue to promote positive parenting and establish a developmental environment for the child as optimal as possible.

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Table 1

*Demographic and neonatal characteristics for the total (N = 133) and separately for the full-term vs. preterm sample*

| | *N* | Total | *n* | Preterm | *n* | Full-term | $\chi^2/t$ | *p* |
|---|---|---|---|---|---|---|---|---|
| Child’s (corrected) age [months] *M (SD)* | 133 | 27.18 (3.28) | 42 | 27.82 (3.84) | 91 | 26.88 (3.00) | 1.40 | .166 |
| Child’s sex [female] % | 133 | 45.9 | 42 | 50.0 | 91 | 44.0 | 0.42 | .516 |
| Gestational age [weeks] *M (SD)* | 133 | 36.38 (4.96) | 42 | 29.90 (3.57) | 91 | 39.36 (1.31) | 16.64 | <.001 |
| Child’s cognitive development *M (SD)* | 133 | 98.61 (15.21) | 42 | 93.93 (16.73) | 91 | 100.77 (14.02) | 2.46 | .015 |
| Parent’s age [years] *M (SD)* | 128 | 35.77 (5.00) | 39 | 36.97 (6.06) | 89 | 35.24 (4.39) | 1.62 | .112 |
| Parent’s sex [female] % | 129 | 86.0 | 39 | 79.5 | 90 | 88.9 | 2.00 | .157 |
| Parents with twins % | 129 | 10.1 | 39 | 30.8 | 90 | 1.1 | | <.001[1] |
| Parenting stress *M (SD)* | 125 | 58.18 | 39 | 60.80 (8.01) | 86 | 56.99 (8.01) | 2.46 | .015 |
| Family SES [range: 3 – 21] *M (SD)* | 133 | 16.23 (3.63) | 42 | 15.61 (4.01) | 91 | 16.52 (3.43) | 1.35 | .178 |
| Problem-solving task [PST1] % | 133 | 52.6 | 42 | 40.5 | 91 | 58.2 | 3.64 | .056 |
| Problem-solving performance [successful] % | 133 | 37.6 | 42 | 33.3 | 91 | 39.6 | 0.48 | .491 |

*Note.* [1] Fisher’s exact test.

Table 2

*Descriptive data of the scaffolding variables*

| | M | (SD) | Min | Max | Skew | (SE Skew) | z |
|---|---|---|---|---|---|---|---|
| *SCA* | 2.46 | (0.69) | 0.75 | 3.75 | -0.22 | (0.21) | 1.05 |
| *COG SUPPORT* | 3.06 | (0.89) | 0.50 | 4.00 | -0.82 | (0.21) | 3.90*** |
| *META* | 2.41 | (1.13) | 0.00 | 4.00 | -0.28 | (0.21) | 1.33 |
| *TRANSFER* | 2.80 | (0.80) | 0.50 | 4.00 | -0.58 | (0.21) | 2.76** |
| *CONTINGENCY* | 2.62 | (1.00) | 0.00 | 4.00 | -0.28 | (0.21) | 1.33 |

*Note.* ***p* < .01 ****p* < .001; SCA = scaffolding means; COG SUPPORT = cognitive support; META = metacognitive support; TRANSFER = transfer of responsibility; CONTINGENCY = contingency management.

Table 3

*Bivariate correlation coefficients for socio-demographic and scaffolding variables.*

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. PST | 1 | | | | | | | | | | |
| 2. BIRTH | .17 | 1 | | | | | | | | | |
| 3. COG | .12 | -.21* | 1 | | | | | | | | |
| 4. PSI | -.05 | .22* | -.04 | 1 | | | | | | | |
| 5. SES | .04 | -.12 | .27** | -.02 | 1 | | | | | | |
| 6. PS PERFORM | -.18* | -.06 | .05 | -.03 | .04 | 1 | | | | | |
| 7. SCA | .26** | .08 | .12 | .00 | .00 | .17* | 1 | | | | |
| 8. COG SUPPORT | -.03 | -.01 | .20* | .00 | .02 | .41*** | .34*** | 1 | | | |
| 9. META | .13 | -.10 | .24** | .03 | .20* | .36*** | .39*** | .52*** | 1 | | |
| 10. TRANSFER | -.22*** | -.18* | .20* | .04 | .18* | .02 | -.08 | .29*** | .33*** | 1 | |
| 11. CONTINGENCY | -.09 | -.13 | .15 | .07 | .09 | .41*** | .25** | .71*** | .54*** | .39*** | 1 |

*Note*. ***$p < .001$; **$p < .01$, *$p < .05$ (two-tailed tests); PST = problem-solving task, BIRTH = full-term vs. preterm; COG = child cognitive development; PSI = parental stress; SES = family socio-economic status; PS PERFORM = problem-solving performance; SCA = scaffolding means; COG SUPPORT = cognitive support; META = metacognitive support; TRANSFER = transfer of responsibility; CONTINGENCY = contingency management.

Table 4

*Multiple regression analyses with the scaffolding variables as the dependent variables, and problem-solving task, birth status, cognitive development, and parental stress as predictors.*

| *Scaffolding means* | | | | | |
|---|---|---|---|---|---|
| | *b* | (*SE*) | β | *t* | $R^2$ |
| Constant | 1.89 | (0.61) | | 3.08 | .09* |
| PST | 0.35 | (0.12) | 0.25 | 2.84** | |
| BIRTH | 0.06 | (0.14) | 0.04 | 0.45 | |
| COG | 0.01 | (0.00) | 0.11 | 1.20 | |
| PSI | 0.00 | (0.01) | 0.01 | 0.13 | |
| SES | -0.01 | (0.02) | -0.05 | -0.56 | |
| *Cognitive Support* | | | | | |
| | *b* | (*SE*) | β | *t* | $R^2$ |
| Constant | 1.97 | (0.81) | | 2.43 | .04 |
| PST | -0.10 | (0.16) | -0.06 | -0.61 | |
| BIRTH | 0.04 | (0.18) | 0.02 | 0.23 | |
| COG | 0.01 | (0.01) | 0.21 | 2.20* | |
| PSI | 0.00 | (0.01) | 0.00 | 0.02 | |
| SES | 0.00 | (0.02) | -0.01 | -0.15 | |
| *Metacognitive Support* | | | | | |
| | *b* | (*SE*) | β | *t* | $R^2$ |
| Constant | -0.08 | (0.99) | | -0.08 | .10* |
| PST | 0.31 | (0.20) | 0.14 | 1.54 | |
| BIRTH | -0.25 | (0.22) | -0.10 | -1.12 | |
| COG | 0.01 | (0.01) | 0.17 | 1.80$^+$ | |
| PSI | 0.01 | (0.01) | 0.07 | 0.81 | |
| SES | 0.04 | (0.03) | 0.13 | 1.48 | |
| *Transfer of responsibility* | | | | | |
| | *b* | (*SE*) | β | *t* | $R^2$ |
| Constant | 1.29 | (0.70) | | 1.84 | .14** |
| PST | -0.40 | (0.14) | -0.25 | -2.82** | |
| BIRTH | -0.16 | (0.16) | -0.09 | -1.03 | |
| COG | 0.01 | (0.00) | 0.18 | 2.05* | |
| PSI | 0.01 | (0.01) | 0.06 | 0.65 | |
| SES | 0.03 | (0.02) | 0.13 | 1.45 | |
| *Contingency* | | | | | |
| | *b* | (*SE*) | β | *t* | $R^2$ |
| Constant | 1.12 | (0.90) | | 1.25 | .05 |
| PST | -0.15 | (0.18) | -0.08 | -0.83 | |
| BIRTH | -0.27 | (0.20) | -0.13 | -1.34 | |
| COG | 0.01 | (0.01) | 0.12 | 1.26 | |
| PSI | 0.01 | (0.01) | 0.10 | 1.07 | |
| SES | 0.01 | (0.03) | 0.05 | 0.57 | |

*Note*. $**p < .01$, $*p < .05$, $^+p < .10$; (two-tailed tests). $n = 129$
PST = Problem-solving task; BIRTH = full-term (0) vs. preterm (1); COG = child cognitive development; PSI = Parental Stress Index (German Version).

Table 5

*Logistic regression analysis of parent-child problem-solving performance (unsuccessful vs. successful) as a function of parents' scaffolding behaviour, controlling for the problem-solving task and child's cognitive development.*

| | | *b* | (*SE*) | *Wald* $\chi^2$*-test* | *OR* | *95% Confidence Interval for OR* lower | upper |
|---|---|---|---|---|---|---|---|
| Model 0 | (Constant) | -0.51 | (0.18) | 8.01 | 0.60 | | |
| Model 1 | *PST* | -0.78 | (0.37) | 4.43* | 0.46 | 0.22 | 0.95 |
| | *COG* | 0.01 | (0.01) | 0.70 | 1.01 | 0.99 | 1.03 |
| | (Constant) | -1.16 | (1.21) | 0.92 | 0.31 | | |
| | *Nagelkerke's* $R^2$ = .05 | | | | | | |
| Model 2 | *PST* | -1.07 | (0.40) | 7.09** | 0.34 | 0.16 | 0.75 |
| | *COG* | 0.01 | (0.01) | 0.37 | 1.01 | 0.98 | 1.03 |
| | *SCA* | 0.74 | (0.30) | 6.25* | 2.09 | 1.17 | 3.73 |
| | (Constant) | -2.63 | (1.40) | 3.54 | 0.07 | | |
| | *Nagelkerke's* $R^2$ = .11 | | | | | | |
| Model 3 | *PST* | -1.12 | (0.46) | 5.93* | 0.33 | 0.13 | 0.80 |
| | *COG* | -0.01 | (0.01) | 0.16 | 0.99 | 0.97 | 1.02 |
| | *SCA* | 0.31 | (0.35) | 0.80 | 1.37 | 0.69 | 2.73 |
| | *COG SUPPORT* | 0.98 | (0.33) | 8.88** | 2.65 | 1.40 | 5.04 |
| | *META* | 0.53 | (0.22) | 5.62* | 1.70 | 1.10 | 2.65 |
| | (Constant) | -4.71 | (1.76) | 7.18 | 0.01 | | |
| | *Nagelkerke's* $R^2$ = .34 | | | | | | |
| Model 4 | *PST* | -1.51 | (0.52) | 8.43** | 0.22 | 0.08 | 0.61 |
| | *COG* | 0.00 | (0.02) | 0.02 | 1.00 | 0.97 | 1.03 |
| | *SCA* | 0.06 | (0.39) | 0.02 | 1.06 | 0.49 | 2.27 |
| | *COG SUPPORT* | 0.79 | (0.40) | 3.87* | 2.21 | 1.00 | 4.87 |
| | *META* | 0.69 | (0.27) | 6.50* | 1.99 | 1.17 | 3.39 |
| | *TRANSFER* | -1.08 | (0.37) | 8.45** | 0.34 | 0.16 | 0.70 |
| | *CONTINGENCY* | 0.67 | (0.34) | $3.80^{+}$ | 1.95 | 1.00 | 3.82 |
| | (Constant) | -3.25 | (1.91) | 2.90 | 0.04 | | |
| | *Nagelkerke's* $R^2$ = .42 | | | | | | |

*Note.* $^{+}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $n = 133$; OR = Odds Ratio; PST = problem-solving task; COG = child cognitive development; SCA = use of scaffolding means; COG SUPPORT = cognitive support; META = metacognitive support; TRANSFER = transfer of responsibility; CONTINGENCY = contingency management.

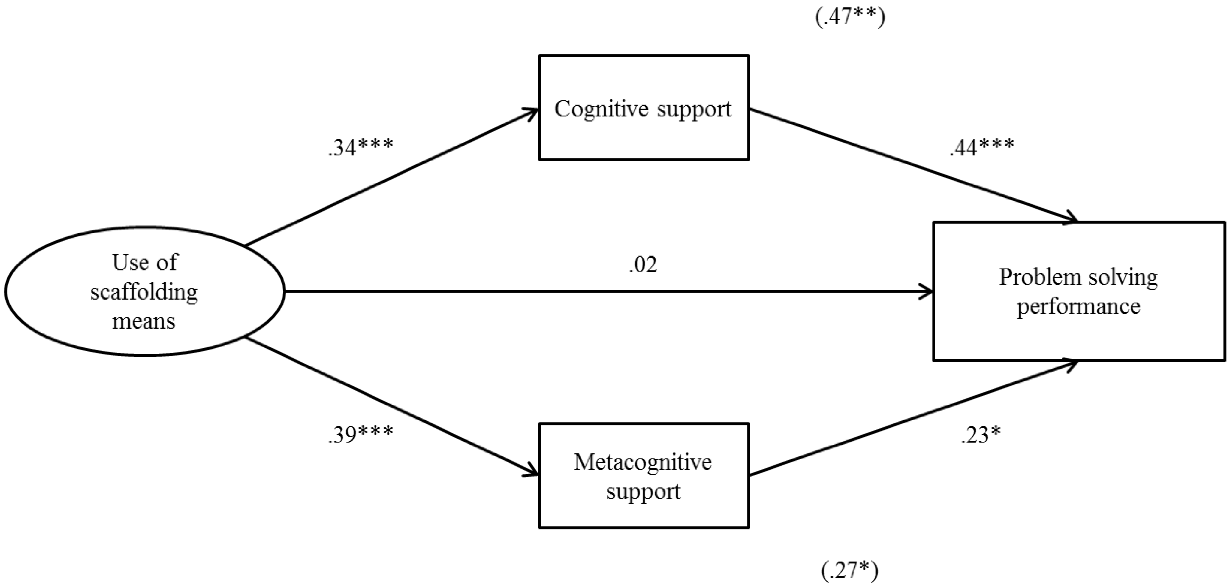


*Figure 1.* Mediation model for parents' scaffolding intentions (cognitive support and metacognitive support) with standardized path coefficients. Unstandardized specific indirect effects are presented in parentheses. *$p$ < .05, **$p$ < .01, ***$p$ < .001 (one-tailed).

**Online Supplementary Material**

Appendix A

*Demographic and neonatal characteristics of participants who were excluded and included in the final sample.*

| | *n* | Excluded | *n* | Included | $\chi^2/t$ | *p* |
|---|---|---|---|---|---|---|
| Child birth status [preterm] % | 28 | 42.9 | 133 | 31.6 | 1.32 | .251 |
| Child's (corrected) age [months] *M (SD)* | 28 | 28.54 (3.17) | 133 | 27.18 (3.28) | 2.01 | .046 |
| Child's sex [female] % | 28 | 28.6 | 133 | 45.9 | 2.83 | .093 |
| Child's gestational age [weeks] *M (SD)* | 27 | 35.41 (6.07) | 133 | 36.38 (4.96) | 0.89 | .375 |
| Child's cognitive development *M (SD)* | 25 | 89.60 (15.54) | 133 | 98.61 (15.21) | 2.71 | .008 |
| Parent's age [years] *M (SD)* | 28 | 35.79 (4.93) | 132 | 35.85 (5.04) | 0.06 | .952 |
| Parent's sex [female] % | 28 | 82.1 | 133 | 86.5 | 0.35 | .552 |
| Parents with twins % | 28 | 21.4 | 133 | 12.8 | 1.41 | .235 |
| Parenting stress *M (SD)* | 28 | 61.46 (8.94) | 129 | 58.37 (8.20) | 1.78 | .077 |
| Family SES [range: 3 – 21] *M (SD)* | 28 | 15.91 (3.49) | 133 | 16.23 (3.63) | 0.43 | .668 |
| Problem solving task [PST1] % | 28 | 53.6 | 133 | 52.6 | 0.01 | .928 |

Appendix B

*Figure 1*. Problem solving task 1 (PST1)

*Figure 2*. Problem solving task 2 (PST2)

Appendix C

*Rating scheme of parental scaffolding*

| ***Level 1: Scaffolding Means*** | | | | | | |
|---|---|---|---|---|---|---|
| The parent uses the following **scaffolding means** to support the child's problem-solving efforts: | not at all | very seldom | some-times | often | very ofte n | n.c. |
| a) Questions | **0** | **1** | **2** | **3** | **4** | **77** |

*Questions are used to structure the task and problem-solving process, as well as to cognitively prompt and to actively engage the child. Rhetorical questions are not being included. Questions may refer to:*

- *the aim of the task*
- *colours/shapes*
- *solution options*
- *course of action*

<u>*Examples*</u>

- *Is there an empty hole?*
- *What colour is this?*
- *Which one next?*

| | | | | | | |
|---|---|---|---|---|---|---|
| b) Hints/cues | **0** | **1** | **2** | **3** | **4** | **77** |

*Providing hints and suggestions that might advance the problem-solving process. Through cues, the child receives task relevant information that is useful for aim achievement, but the solution is not given away. Hints and cues can be verbal and/or nonverbal. Hints/cues may help:*

- *perceive important aspects of the task*
- *understand the task*
- *identify and understand the aim of the task as well as possible approaches*
- *direct the child's problem-solving behaviour*

<u>*Examples*</u>

- *There is one missing.*
- *Here are some blue ones.*
- *Look, all red ones are in this row, all blue ones in this one, and all green ones here in this one. The green ones go together.*

Appendix C (continued)

| c) Instructions | 0 | 1 | 2 | 3 | 4 | 77 |
|---|---|---|---|---|---|---|

*Instructions may help the child reach the aim of the task, and focus is on problem-solving* <u>*actions*</u>*, meaning the parent describes or demonstrates possible further steps (this specifically does not include actions that solve the task for the child). Instructions on how to play the game are also included in this category (i.e., the parent explains the task and its aim or refers back to them). Instructions help the child:*

- *find an approach*
- *test different approaches*
- *observe the execution of a certain approach find a solution/solve a task*

<u>*Examples*</u>

- *Now, we need to roll the dice again.*
- *Let’s sort the blocks by size.*
- *You can look for a blue block.*

| d) Feedback | 0 | 1 | 2 | 3 | 4 | 77 |
|---|---|---|---|---|---|---|

*Feedback is appreciative and constructive. It may refer to mistakes, but in a constructive way. Feedback may be given on:*

- *approaches*
- *progress*
- *motivation*
- *results and result status*

*Feedback may help the child:*

- *recognize what he or she is doing.*
- *adapt and adjust the approach.*
- *perceive his or her improvement and success.*
- *stay motivated and interested in the task.*

<u>*Examples*</u>

- *Very good, now the first row is done.*
- *Uhm, does that fit in there? It looks too small…*
- *Look, all the other ones are green, but this is red. That’s wrong.*

Appendix C (continued)

| ***Level 2: Scaffolding Intentions*** | | | | | | |
|---|---|---|---|---|---|---|
| **Metacognitive support**<br>The parent… | not at all applicable | mainly not applicable | partly applicable | mainly applicable | fully applicable | n.c. |
| a) *Strategy use and planning*:<br>… makes suggestions on how to work on the task (i.e., demonstrates or suggests problem-solving strategies and techniques) | **0** | **1** | **2** | **3** | **4** | **77** |
| b) *Monitoring and evaluation*: Formulates interim results and discusses the task progression. | **0** | **1** | **2** | **3** | **4** | **77** |
| **Cognitive support**<br>The parent… | not at all applicable | mainly not applicable | partly applicable | mainly applicable | fully applicable | n.c. |
| a) … structures the situation (i.e., verbalizes how to proceed, lays out the material, etc.). | **0** | **1** | **2** | **3** | **4** | **77** |
| b) … simplifies the task for the child according to the *zone of proximal development* (e.g., by subdividing the task into smaller steps, or if necessary by demonstrating possible actions). | **0** | **1** | **2** | **3** | **4** | **77** |

Appendix C (continued)

| ***Level 3: Process Level*** | | | | | | |
|---|---|---|---|---|---|---|
| **Transfer of responsibility**<br>The parent… | not at all applicable | mainly not applicable | partly applicable | mainly applicable | fully applicable | n.c. |
| a) … lets the child decide how to work on the task. | **0** | **1** | **2** | **3** | **4** | **77** |
| b) … picks up on the child’s ideas and actions. | **0** | **1** | **2** | **3** | **4** | **77** |
| c) … actively engages the child in the problem solving task (cognitive engagement). | **0** | **1** | **2** | **3** | **4** | **77** |
| d) … encourages the child to independently work on the task. | **0** | **1** | **2** | **3** | **4** | **77** |
| e) … gives the child opportunities to independently identify errors . | **0** | **1** | **2** | **3** | **4** | **77** |
| f) … gives the child opportunities to independently correct errors. | **0** | **1** | **2** | **3** | **4** | **77** |
| **Contingency Management**<br>The parent… | not at all applicable | mainly not applicable | partly applicable | mainly applicable | fully applicable | n.c. |
| … appropriately adapts his or her support to the child’s reactions and behaviour.<br>*If the child accepts the support and successfully implements it, the level of support is reduced (i.e., hints and instructions become more general), whereas it is increased, if the child fails to implement the parent’s support (i.e., more distinct hints are given or more specific questions are asked).* | **0** | **1** | **2** | **3** | **4** | **77** |

*Note.* n.c = not codable

# Appendix C – Publication 3

This is the accepted version of the following article published in *British Journal of Educational Psychology*:

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Running head: TRAINING OF PARENTAL SCAFFOLDING

# Training of Parental Scaffolding in High-SES Families: How Do Parents of Full- and Preterm-Born Toddlers Benefit?

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## Abstract

**Background:** Preterm children have an increased risk regarding self-regulation development. Given the strong link between parenting behaviour (i.e., scaffolding and sensitivity) and children's self-regulation, parental training presents a promising way to counteract the negative consequences of preterm birth.

**Aims:** We explored the effectiveness of parental training by comparing a basic scaffolding training and a combined scaffolding/sensitivity training to an active treatment control group (stress management). Basic and combined treatments should increase parents' domain-specific self-efficacy (DSSE) and beliefs on parental co-regulation and the promotion of learning (BCL) more than the control treatment should. No such differences were expected for parents' domain-general self-efficacy (DGSE). We examined whether parents of preterm and full-term children benefitted equally from training conditions.

**Sample(s):** A total of 87 parents of full-term and 35 parents of preterm toddlers (24-36 months of age, corrected for prematurity) participated.

**Methods:** Based on a quasi-experimental pre-test–post-test follow-up design, parents were randomly assigned to treatments. A multi-method approach was applied, including self-report, parent-child interactions and standardized behavioural tasks. The presented study is limited to questionnaire data on parents' DGSE, DSSE and BCL.

**Results:** An overall increase resulted from pre- to post-test and/or follow-up. Parents' BCL changed significantly stronger in the combined training than in the control group. Parents of preterm and full-term children benefitted equally from basic and combined training.

**Conclusions:** The combined training enhanced BCL among parents of full-term and preterm children the most. If such training also yields improvement on the behavioural level, this finding will advance preterm aftercare.

# Training of Parental Scaffolding in High-SES Families: How Do Parents of Full- and Preterm-Born Toddlers Benefit?

Preterm children have an increased risk of adverse development regarding self-regulation and executive functions (EF) (Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Baron, Kerns, Müller, Ahronovich, & Litman, 2012; Mulder, Pitchford, Hagger, & Marlow, 2009), which are important prerequisites for learning and academic achievement (McClelland & Cameron, 2012; Zelazo & Müller, 2007). Parental scaffolding and sensitivity are consistently associated with individual differences in children's EF (Bernier, Carlson, & Whipple, 2010; Carlson, 2003; Fay-Stammbach, Hawes, & Meredith, 2014; Hughes & Ensor, 2009). Thus, parent training might be helpful in supporting these skills and counteracting the negative consequences of preterm birth.

The effectiveness of parental training to promote scaffolding strategies has been reported in a former study with a non-clinical sample (Gärtner, Pauen, & Hertel, 2017; Gärtner, Vetter, Reuner, & Hertel, 2016). In the present study, these training programmes were adapted to the needs of parents of preterm toddlers aged two to three years.

**Preterm birth**

Approximately 9% of infants are born premature, with less than 37 weeks of gestational age (Beck et al., 2010; Goldenberg, Culhane, Iams, & Romero, 2008) and with comparable rates reported in Germany (IQTIG, 2016; Pöschl, 2017). Preterm birth is a major determinant of neonatal mortality and morbidity (Beck et al., 2010). Remarkably, due to advances in neonatal intensive medicine and care, the survival rates of infants born very preterm (≤ 33 weeks gestation) and/or with very low birth weight (≤ 1500 g) (VPT) have increased over the last decade (Aarnoudse-Moens et al., 2009; Arpi & Ferrari, 2013), but the prevalence of severe impairments, such as cerebral palsy, has stayed constant in recent years (Oskoui, Coutinho, Dykeman, Jetté, & Pringsheim, 2013; Stavsky et al., 2017).

Apart from severe disabilities, children born extremely (EPT) or very premature have a higher risk for adverse long-term neuropsychological impairments, including in cognition, attention, and self-regulation (Aarnoudse-Moens et al., 2009; Anderson et al., 2011; Arpi & Ferrari, 2013; Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Mulder et al., 2009; Reuner, Weinschenk, Pauen, & Pietz, 2014; van de Weijer-Bergsma, Wijnroks, & Jongmans, 2008).

Developmental trajectories after preterm birth are very heterogeneous (Yaari et al., 2017). Although strong everyday functioning is reported even among VPT preschoolers (Andersson, Martin, Strand Brodd, & Almqvist, 2017), detrimental long-term sequelae following extremely or very preterm birth are well documented and evidenced by a substantially heightened prevalence of attention deficit disorders, learning difficulties, behavioural and socio-emotional problems (Aarnoudse-Moens et al., 2009; Arpi & Ferrari, 2013; Eryigit-Madzwamuse, Baumann, Jaekel, Bartmann, & Wolke, 2015; Johnson et al., 2016; Johnson & Marlow, 2016; Lemola, 2015; Montagna & Nosarti, 2016). Even among MLPT children, evidence for disadvantageous long-term consequences expands: a prolonged school career due to late school enrolment and class repetition and demand for therapeutic interventions in low-risk preterm children (Reuner, Hassenpflug, Pietz, & Philippi, 2009), and less advanced cognitive functioning, more school and behaviour problems, and higher prevalence of psychiatric disorders for MLPT children and adults compared with full-term peers (de Jong, Verhoeven, & van Baar, 2012; Quigley et al., 2012; Vohr, 2013).

**Parenting influences on developmental outcomes**

Given the enormous health-related costs of preterm birth (Beck et al., 2010; Blencowe et al., 2012), the need for preventive strategies in preterm aftercare to counteract this adverse development is high. Thus, research in the last decade has focused on factors associated with developmental outcomes in the preterm population. Among others, the immaturity of the brain, neonatal distress, and parental variables, such as parental distress, have been identified as major risk factors (Grunau et al., 2009; Ortinau & Neil, 2015; Treyvaud et al., 2009; Tu et al., 2007; Voigt et al., 2013).

Sensitive parenting, including the warm acceptance of the child's needs and interests, as well as prompt and contingent responses to child signals (Landry, Smith, & Swank, 2006), is discussed as a protective factor for preterm children's development (Jaekel, Pluess, Belsky, & Wolke, 2015; Ravn et al., 2011; Treyvaud et al., 2009; Wolke, Jaekel, Hall, & Baumann, 2013). This parenting feature is assumed to promote children's emotion and stress regulation by providing them with experiences of successfully impacting the social environment, thus enhancing their confidence in their evolving self-regulatory abilities (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; Merz et al., 2016).

In accordance with Differential Susceptibility Theory (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007; Belsky & Pluess, 2009; Poehlmann et al., 2011), VPT children in particular display a disproportional vulnerability to the adverse effects of insensitive parenting (Jaekel et al., 2015; Wolke et al., 2013), while they also adapt better and seem to benefit more from more optimal and sensitive parenting (Jaekel, Wolke, & Chernova, 2012; Landry, Smith, Miller-Loncar, & Swank, 1997; Shah, Robbins, Coelho, & Poehlmann, 2013; Wolke et al., 2013).

Although there is wide acceptance that parental sensitivity is a key predictor of developmental outcomes, parental scaffolding (Wood, Bruner, & Ross, 1976), a behaviour that might buffer developmental problems, has gained attention only recently. Parental scaffolding refers to parents' verbal or physical actions that help children engage with a challenging activity. In line with the socio-cultural theory of development (Vygotsky, 1978), this behaviour is assumed to enable children to internalize skills and strategies and be able to "solve a problem, carry out a task or achieve a goal which would be beyond [their] unassisted efforts" (Wood et al., 1976, p. 90). Despite different approaches to the study of scaffolding and the lack of a unified definition, it is commonly characterized by parents' age-appropriate contingent response, the fading of support and the transfer of responsibility in order to promote their child's learning (Mermelshtine, 2017; Pino-Pasternak & Whitebread, 2010; van de Pol, Volman, & Beishuizen, 2010).

Broad evidence suggests that parental scaffolding predicts better EF in typically developing children from toddlerhood to school age (Bernier et al., 2010; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012; Hughes & Ensor, 2009; Lowe et al., 2014), with a notably strong relation during the early years (Valcan, Davis, & Pino-Pasternak, 2017).

Although still relatively scarce in preterm research, including predominantly VPT children, current findings imply positive associations between parental scaffolding and a range of developmental outcomes. These outcomes include verbal working memory (Dilworth-Bart, Poehlmann, Hilgendorf, Miller, & Lambert, 2010), cognitive skills (Lowe, Erickson, MacLean, Schrader, & Fuller, 2013; Murray & Hornbaker, 1997) and emotion regulation (Erickson et al., 2013) in toddlerhood, verbal and nonverbal cognitive skills (Lowe et al., 2014; Smith, Landry, & Swank, 2000) among preschoolers, and decoding and reading comprehension skills at school age (mediated through children's language abilities at three and four years of age) (Dieterich, Assel, Swank, Smith, & Landry, 2006). Further results indicate an indirect path from maternal scaffolding at three years to children's EF at six years of age, mediated through children's language and nonverbal problem-solving at four years (Landry, Miller-Loncar, Smith, & Swank, 2002), although Lowe et al. (2014) report no relation between maternal scaffolding and preschoolers' EF. Additional research, including more longitudinal studies and greater variance among preterm children (including MLPT), is needed to strengthen these findings.

When examining the quality and use of scaffolding among parents of term and preterm children, differences emerge. Lowe and colleagues (2013) find that mothers of VPT toddlers aged 18 to 22 months use less complex scaffolding than the full-term group. Similarly, they provide significantly less scaffolding than mothers of term-born children aged three to four years (Donahue & Pearl, 1995; Erickson et al., 2013). Investigating the long-term effects of prematurity on mother-child interaction in preschool, Potharst and colleagues (2012) report that mothers of preterm children at the age of five show less respect for their child's autonomy than mothers of term-born children, although no differences are observed for mothers' supportive presence.

**Parenting interventions and evaluation**

Taking into account these differences in parental scaffolding and sensitive parenting and the potentially differential susceptibility of preterm infants to parenting influences, there is a strong need for preventive programmes to promote parental scaffolding and sensitivity in preterm children. While ample evidence indicates that training may facilitate sensitive parenting (Bakermans-Kranenburg, van Ijzendoorn, & Juffer, 2003; Landry, Smith, Swank, & Guttentag, 2008; Milgrom et al., 2010; van den Boom, 1997), research evaluating parental scaffolding interventions is rare. In a recent study (Gärtner et al., 2016, 2017), the authors report significant treatment effects on parents' procedural knowledge and beliefs about scaffolding, with parents in the treatment groups (sensitivity and/or scaffolding training) outperforming parents in a wait-list control group. Training further enhanced parents' use of scaffolding strategies during a problem-solving task with their 18- to 36-month-old children. No differences resulted in parents' perceived self-efficacy at post-test.

There is a consensus that interventions should not only be evaluated based on overt behavioural change but also take into consideration associated attitudes and perceived behavioural control, i.e., self-efficacy (e.g. Coleman & Karraker, 1998; Wittkowski, Dowling, & Smith, 2016). Extensive research has identified parental self-efficacy beliefs, i.e., parents' perceived ability to positively influence their child's behaviour and development, as key correlates of parenting practices (Coleman & Karraker, 2003; Jones & Prinz, 2005; Roskam &

Meunier, 2012; Sanders & Woolley, 2005). By comparing measures of domain-general self-efficacy, i.e., global competence expectations that are linked to the parenting role in general, to domain-specific self-efficacy, i.e., focused on one parenting domain, such as the promotion of learning, Coleman and Karraker (2003) found that the latter were especially related to toddler's cognitive development and parents' interactive behaviour. This finding is in accordance with Bandura (1989), who postulated that measures of domain-specific self-efficacy were more precise predictors of actual behaviour than rather global beliefs.

With regard to parents' psychological functioning and adjustment, vast amounts of evidence point towards a reliable relation with parental self-efficacy (see Jones & Prinz, 2005 for a review). As elevated parenting stress (Gray, Edwards, O'Callaghan, Cuskelly, & Gibbons, 2013; Schappin, Wijnroks, Uniken Venema, & Jongmans, 2013) and higher levels of mental health problems are documented in parents of VPT children up to seven years after birth (Treyvaud, Lee, & Doyle, 2014), this finding might also have an impact on parents' self-efficacy. Indeed, Pennell, Whittingham, Boyd, Sanders, and Colditz (2012) show that psychological symptoms explain a significant proportion of the variance in VPT and MLPT parents' domain-specific self-efficacy. Various studies have further reported reduced feelings of parental self-efficacy among mothers of preterm infants (Gross & Rocissano, 1988; McGrath, Boukydis, & Lester, 1993), although Pennell et al. (2012) do not confirm these findings.

In addition to parental self-efficacy, parents' behavioural beliefs, i.e., beliefs about a behaviour's likely consequences, are assumed to act as important predictors of behaviour by producing a positive or negative overall attitude towards it (Ajzen, 2011). This phenomenon, together with a person's perceived behavioural control and subjective norm, may form the intention to perform certain behaviours and account for a large proportion of behavioural variance (Ajzen, 2011; Bandura, 1982, 1998; Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016; Webb & Sheeran, 2006). Transferred to the parenting domain, in order to display effective scaffolding, a parent would need a positive belief towards the behaviour's likely consequences (e.g., scaffolding may promote my child's development) and feel confident that he/she has the requisite skills to perform the behaviour.

Taken together, there is a high need for preventive programmes in preterm aftercare. To date, interventions targeting parenting behaviours have predominantly focused on sensitive parenting, leaving aside parental scaffolding. Group-based interventions may represent an effective way to not only enhance the quality of scaffolding and sensitivity but to also target parental self-efficacy in parents of term and preterm children (see Benzies, Magill-Evans, Hayden, & Ballantyne, 2013; Wittkowski et al., 2016 for a review), as well as parents' beliefs about the importance of parental scaffolding for children's learning (Gärtner et al., 2016, 2017). Regarding the appropriate timing of interventions, evidence suggests that the toddler age is a sensitive period, during which the training of parental scaffolding may yield the strongest effects (Landry et al., 2008).

**Aims**

The aim of the present study was to adapt and evaluate training programmes to enhance parental scaffolding as well as related attitudes and self-efficacy beliefs. Parents of term- and preterm-born children who participated in a basic scaffolding or combined scaffolding/sensitivity training were compared to parents in an active treatment-control group who received stress-management training.

We expected 1) that domain-specific self-efficacy (DSSE) regarding scaffolding and beliefs on parental co-regulation and the promotion of learning (BCL) would increase more in parents of full- and preterm children who participated in either a basic scaffolding or combined scaffolding/sensitivity training, than in parents in a stress-management control treatment. As parents' strengths and resources within the parenting-domain were covered in all treatment groups, we assumed 2) that parents' domain-general self-efficacy (DGSE) would be affected by all treatments equally. Thus, we hypothesized an overall increase in parents' DGSE from pre- to post-test/follow-up, independent of treatment condition. Finally, we 3) explored differential treatment effects for parents of term and preterm children when testing for differences in the benefit of parents of term and preterm toddlers from basic and combined training after controlling for potential covariates. As prior research on parental beliefs and self-efficacy among parents of preterm and full-term children has resulted in heterogeneous findings (Gross & Rocissano, 1988; McGrath et al., 1993; Pennell et al., 2012), the last research question was exploratory in nature. Furthermore, no prior expectations were formulated concerning differential treatment effects between basic and combined training, due to the lack of intervention studies addressing parental scaffolding.

## Methods

### Sample

The original sample consisted of 134 parents with a two-year old toddler who were recruited in urban areas in the southwest of Germany via local newspaper, day care centres, information letters, paediatricians, hospitals, and parents' associations. Of the original sample, 11 parents with a term-born and one parent with a preterm child dropped out before or during the intervention phase. The attrition rate was random across treatment conditions (Fisher's exact test = 2.05, $p$ = .33)[1], but not group belonging (preterm/full-term) (Fisher's exact test, $p$ = .18). Participants who terminated earlier were comparable to the final sample regarding school education (Fisher's exact test, $p$ = .26) and prior knowledge about supportive learning environments (i.e., from books about learning environments) (Fisher's exact test, $p$ = .58). However, they were fairly younger ($t$(131) = -1.72, $p$ = .09) and reported slightly lower socio-economic status (SES) ($t$(132) = -1.54, $p$ = .13).

The final sample comprised 87 parents of full-term (gestational age, GA ≥ 37 weeks) and 35 parents of preterm toddlers (GA < 37 weeks). Table 1 presents demographic and neonatal characteristics of the sample. Overall, fourteen parents had twins and participated with either one or both children[2], resulting in a total sample of 129 children between 24 and 36 months (age corrected for prematurity). Any children with congenital anomalies, major sensory impairment, severe brain injury or neurological complications and parents who did not speak German were excluded. One caregiver of each family took part in the study (parents decided who participated). Families' SES was computed following the procedure by Winkler and Stolzenberg (2009) and averaging scores for mothers and fathers to create a family-based measure of SES (ranging between 3 and 21) (Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012). As shown in Table 1, parents of preterm and full-term children were comparable regarding the proportion of gender and families' SES. Differences were observed regarding parents' age, the percentage of parents having twins, being multilingual, having a university-entrance diploma, and prior knowledge about supportive learning environments. While children's age (corrected for prematurity) was comparable among groups, preterm children had significantly lower GA, birth weight and a longer hospital stay than term-born children. Additionally, they scored significantly lower on the

[1] Significance level was adjusted to $\alpha = .20$ for comparisons among background characteristics to enhance power and reduce type II error (Bortz, 1999, p. 121; Schäfer, 2016).

[2] Five parents with twins decided to participate with only one child in the study, mainly due to time expenses.

cognitive scale of the Bayley Scales of Infant and Toddler Development-III (Reuner & Rosenkranz, 2014).

No differences were observed among treatment groups on demographic and background characteristics, except for parents' age and attended treatment sessions (see Table 2). These differences appeared marginal, considering the rather conservative significance level of $\alpha = .20$.

**Procedure**

Data collection for this study was carried out from October 2015 until February 2017. The Institutional Review Board of the University Hospital approved the study protocol, and written informed consent was obtained from all parents.

Based on a quasi-experimental 2 x 3 pre-/post-test design with a three-month follow-up interval, parents of term- and preterm-born children were randomly assigned to treatment conditions: 1) basic training scaffolding, 2) combined training scaffolding/sensitivity, and 3) treatment-control group stress management. Training groups were mixed regarding parents of term and preterm children, with a maximum of 12 parents per group. Each training consisted of four sessions with a duration of 180 minutes on a weekly basis, administered by two experienced trainers. Training contents varied according to treatment condition (see Table 3). During training, parents were encouraged to actively participate and share their experiences. Video examples, reflection tasks, group discussions, role-play, and brief revisions at the beginning and homework at the end of each session helped to consolidate the training contents. Statistics were performed with IBM SPSS Statistics (IBM Corp., Version 24, Armonk, NY, USA).

**Instruments**

Based on a multi-method approach, data on the parent- and child-level were assessed via questionnaires, standardized developmental tests, and videotaped parent-child interactions (semi-standardized) one to two weeks before and after training (see Table 4). Diagnostic sessions at pre- and post-test with parent and child occurred in a laboratory setting at the university hospital and/or university. Follow-up questionnaires were administered to parents 12 weeks after the final training session in an online format.

The focus of this study lies in parents' self-reported DGSE and DSSE, as well as their BCL. Items for all scales were rated on a six-point Likert scale, ranging from "strongly disagree" to "strongly agree", and scores were averaged for each scale to build a mean score (see supplementary material for all items)[3].

Parents' DGSE was assessed with three items (e.g., "I am able to find a solution for any problem with my child") from the Parenting Self-Efficacy Questionnaire (Kliem, Kessemeier, Heinrichs, Döpfner, & Hahlweg, 2014). Cronbach's alpha coefficients for pre-test, post-test and follow-up were .67/.83/.81, respectively.

To collect information on parents' DSSE regarding scaffolding, four items (e.g., "I am able to explain things to my child, so he/she is able to understand") were developed from the literature (Coleman & Karraker, 2003; Pino-Pasternak & Whitebread, 2010; van de Pol et al., 2010). Cronbach's alpha coefficients for pre-test, post-test, and follow-up were .69/.62/.76, respectively.

Parents answered nine items regarding their BCL, which were developed from the literature (Pino-Pasternak & Whitebread, 2010; van de Pol et al., 2010), e.g., "Children learn most effectively, when parents adapt their support contingently". Cronbach's alpha coefficients for pre-test, post-test, and follow-up were .79/.78/.76.

## Results

### Treatment effects

To answer the first two research questions, a doubly multivariate analysis of variance (MANOVA) (Tabachnick & Fidell, 2014), with treatment condition as a between-subject factor and time (pre- and post-test) as a within-subject factor, was conducted[4]. Parents' DGSE, DSSE, and BCL assessed before and after training served as dependent variables. The assumption of homogeneity of variance-covariance matrices was met, and there were no univariate (critical

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[3] Results of confirmatory factor analyses confirmed the different dimensions of parenting beliefs addressed in this study, with a three factor model (CFI = .93, SRMR = .07, RMSEA = .05, 90% CI [.03, .08]) providing an acceptable to good (Weston & Gore, 2006), and considerably better, model fit than a one factor model (CFI = .75, SRMR = .09, RMSEA = .08, 90% CI [.07, .10]).

[4] Treatment groups differed regarding parents' age and treatment sessions attended ($p < .20$), although these differences appeared rather marginal, considering the conservative significance level of $\alpha = .20$. However, to rule out potential effects of these variables on parents' ratings at posttest, MANCOVAs were conducted, controlling for pretest values and parents' age and treatment sessions attended. Since there was no significant effect of the covariates (age, treatment sessions) and treatment effects remained, it was decided to exclude them from the reported analyses.

value $z = |3.3|$, $\alpha = .001$) or multivariate outliers, $\chi^2(6) = 22.458$, $\alpha = .001$. Cell means and standard deviations for the four dependent variables over all combinations of treatment conditions and measurement points (pre- and post-test) are depicted in Table 5. Six cases were excluded from the analysis due to missing values in one or more of the dependent variables.

Results revealed a large statistically significant multivariate effect for time, Wilk's $\lambda = .70$, $F(3,111) = 16.08$, $p < .001$, partial $\eta^2 = .30$, suggesting an overall increase in dependent variables from pre- to post-test. No main effect for treatment condition was observed, but results displayed a statistically significant multivariate treatment by time interaction, Wilk's $\lambda = .89$, $F(6,222) = 2.21$, $p < .05$, partial $\eta^2 = .06$, suggesting that the change in the dependent variables from pre- to post-test was moderated by treatment condition.

On a univariate level (see Table 6), a significant main effect of time on all dependent variables but DGSE was found, with planned contrasts pointing towards a significant increase from pre- to post-test independent of treatment condition (DSSE: $t = -2.72$, $p < .01$; BCL: $t = -6.89$, $p < .001$).

However, differential treatment effects resulted for parents' BCL, as evidenced by the significant treatment by time interaction. Planned contrasts revealed that participants of the combined training showed significantly stronger increases than parents of the stress-management control group ($t = -2.94$, $p < .01$), while parents in the basic training did not differ from neither the control ($t = -1.07$, $p > .05$) nor the combined treatment groups ($t = -1.79$, $p > .05$).

**Stability of treatment effects**

Follow-up analyses should account for the stability and long-term effects of treatment on parents' self-efficacy and beliefs. Not all parents completed follow-up questionnaires, resulting in reduced sample sizes, with most dropouts in the control group (see Table 2)[5]. Parents who were lost to follow-up did not differ from those remaining regarding child's birth status (preterm vs. full-term), sex, age, and education ($p > .20$). However, differences appeared concerning parents' SES, $F(1,120) = 2.67$, $p = .11$, and attended treatment sessions. Parents who completed follow-up assessment had attended, on average, more training sessions, $F(1,120) = 6.54$, $p = .01$).

At follow-up assessment, no differences in parents' background characteristics were observed among treatment groups ($p > .20$) (see Table 7).

[5] The authors refrained from imputing missing data, as this approach is discussed controversially with small sample sizes and high attrition rates (McNeish, 2017; Sterne et al., 2009).

A doubly MANOVA with treatment condition as a between-subject factor and time (pre-test, post-test and follow-up) as a within-subject factor was conducted[6]. Parents' DGSE, DSSE, and BCL, assessed at pre-test, post-test, and follow-up, served as dependent variables. Table 8 presents cell means and standard deviations for the dependent variables over all treatment conditions and measurement points. The assumptions of homogeneity of variance-covariance matrices and sphericity were met. There were no univariate (critical value $z = |3.3|$, $\alpha = .001$) or multivariate outliers, $\chi^2(9) = 27.88$, $\alpha = .001$. Eight cases were excluded from the analysis due to missing values in one or more of the dependent variables.

Again, data revealed a large statistically significant multivariate effect for time, Wilk's $\lambda = .52$, $F(6,56) = 8.72$, $p < .001$, partial $\eta^2 = .48$, which was present on a univariate level for all dependent variables (see Table 9). Planned contrasts revealed that parents' ratings at 12-week follow-up were significantly higher compared to at pre-test but also for post-test data. Only parents' BCL did not change significantly from post-test to follow-up.

No significant multivariate main effect of treatment, nor an interaction of treatment by time, was observed.

**Differential treatment benefit**

To analyse if parents of term and preterm children benefitted equally from basic and combined treatments after accounting for potential covariates (e.g., SES, prior knowledge), we conducted a multiple hierarchical regression analysis (see Table 10). Apart from a significant treatment effect, neither group nor the interaction of group by treatment predicted parents' BCL at post-test, suggesting that parents of term and preterm children benefitted equally from training.

## Discussion

The present study addressed three major questions regarding the promotion of scaffolding in parents of term and preterm toddlers with the aid of a parent training.

With respect to the first research question, there is a consensus that interventions should not only be evaluated based on overt behavioural change but also take into consideration associated attitudes and self-efficacy beliefs (e.g. Ajzen, 2011; Steinmetz et al., 2016; Wittkowski et al., 2016). In accordance with this assumption, parents of the combined training group showed

[6] As treatment groups at follow-up did not differ among background characteristics (see Table 7), no covariates were included in the model.

the strongest increase in their BCL from pre- to post-test. During the first session, all treatments addressed the role of parental co-regulation for the development of self-regulation in early childhood to a similar extent. In the following sessions, the basic training focused on the rather cognitive or "cool" part of co- and self-regulation, while the combined training further included facets of emotion regulation, or the "hot" aspects of co- and self-regulation (Metcalfe & Mischel, 1999). Learning more about these processes in the combined training might have changed parents' BCL stronger than did the basic and control training.

However, at that point it remains open whether this change in beliefs is accompanied by a change in parental scaffolding behaviour and child behaviour as well (Webb & Sheeran, 2006). Future analyses, including data of videotaped parent-child-interactions, will address this issue.

However, concerning parents' DSSE, participants in the current study reported higher scores at post-test and follow-up than at pre-test, independent of the treatment condition. This finding is unexpected in the sense that we assumed that we would find a stronger increase in parents of the basic or combined training compared to the control treatment group.

In a recent review, Wittkowski et al. (2016) examined the impact of group-based interventions on parental self-efficacy in parents of preschool children. Overall, the majority of the studies included in the review found a significant positive effect, regardless of whether a task-specific or domain-general measure of parental self-efficacy was employed. However, differences resulted regarding the effect sizes for the interventions: while the majority of studies that applied task- or domain-specific measures reported medium to large post-intervention effect sizes (0.42-1.25), small to medium effect sizes (0.26-0.74) appeared in studies using domain-general measures of parental self-efficacy.

This finding relates to our second research question, namely, the effect of our treatment conditions on parents' DGSE. As expected, an increase in parents' DGSE was observed from pre- and post-test to follow-up, with no significant differences among treatment conditions. Surprisingly, however, no differential effects for the experimental and control treatment groups were found regarding parents' DSSE. As parents' DGSE and DSSE were moderately correlated at pre-test, post-test, and follow-up ($r_{T1} = .51$, $p < .001$, $r_{T2} = .62$, $p < .001$, $r_{T3} = .68$, $p < .001$), it is conceivable that parents' confidence in their general parenting skills exerted an influence on their perception of DSSE and attenuated differential effects for experimental and control treatment groups.

The third main research question explored whether parents of term and preterm children would benefit equally from basic and combined training. Neither group-belonging (preterm/full-term) nor the interaction of group by treatment significantly predicted parents' BCL post-intervention after controlling for pre-test values and potential covariates. Thus, parents of preterm- and term-born children were comparable with regard to their BCL post-treatment, indicating that they benefitted equally from both treatments.

**Limitations**

The results of this study must be viewed in the light of some limitations. Generalization is restrained for several reasons. First, the recruitment of parents with preterm children resulted in a small sample of 35 parent-child dyads, including EPT, VPT and MLPT infants, a high number of whom were twins. Although results indicated that, on average, parents of the preterm and full-term group benefitted equally from the intervention, future studies should explore whether treatment effects might be different in parents of EPT and VPT children. As studies have shown, developmental risks are more frequent in this group, especially with regard to self-regulation (e.g. Anderson et al., 2011; Baron et al., 2012; Mulder et al., 2009). Additionally, there is evidence that parents of preterm twins face higher levels of stress and display lower interaction quality (Beer et al., 2013). Their possibly higher need for support might explain the large portion of parents of preterm twins in our study and should be addressed by future research.

Second, both groups (preterm/full-term) consisted of parents with primarily moderate to high SES, while differences appeared regarding parents' education. There is evidence that the quality of parenting, and more precisely, scaffolding behaviour, is positively related to maternal education and SES (Carr & Pike, 2012; Mermelshtine & Barnes, 2016; Neitzel & Stright, 2004). Living in low-income and low-education families may thus create a dual risk for children born preterm, significantly increasing the likelihood of negative developmental outcomes (Eryigit-Madzwamuse et al., 2015; Liaw & Brooks-Gunn, 1994). Preventive programmes targeting these parenting skills might thus be especially beneficial and relevant for socially and economically disadvantaged families (but see Lundahl, Risser, & Lovejoy, 2006). Further research, including more parents with low SES and educational background, is needed to address this issue.

Third, to evaluate treatment effects, intervention studies should include variables on the parent- and child-level, as well as multiple measures (Benzies et al., 2013). Results of the presented study have been based on parental self-report only. Although research suggests that changing beliefs and attitudes is an important step towards changing behaviour (Ajzen, 2011; Webb & Sheeran, 2006), our findings should be complemented by further analyses using observational methods to account for the possible limitations of self-reports, e.g., social desirability. Data of videotaped parent-child interactions during problem-solving are available for the present sample and are currently being analysed. The next steps are to incorporate ratings of parental scaffolding behaviour during these interactions to strengthen the current findings, look for potential differences in parents' scaffolding behaviour between parents of term and preterm children, and explore if basic and combined training served to improve parental scaffolding behaviour in these groups. Furthermore, current analyses are restricted to the parental level only. It is of major interest if training exerts an impact on children's development of self-regulation in the long term.

The last limitation concerns the high attrition rate at follow-up. A plausible reason may be the fact that follow-up questionnaires were very time consuming and administered to the participants in an online format at home. Further analyses, including parents' subjective training evaluations and motivation to apply and transfer the learned strategies, might give more insight into why a substantial number of parents (especially from the control treatment) dropped out at the final assessment.

**Conclusion**

The need for preventive programmes in preterm aftercare is highly emphasized. The presented intervention study evaluated training programmes with a focus on parental scaffolding behaviour that might reduce the risk of an adverse development of self-regulation. The results indicated that the training of parental scaffolding could enhance BCL in parents of both term- and preterm-born children. This finding represents an important step and a prerequisite to motivating parents to use the learned strategies. Assuming that this training is able to yield improvements on behavioural level as well, this strategy will be an important venue for preterm aftercare.

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Table 1

*Demographic and neonatal characteristics for the full-term vs. preterm sample*

| | *n* | Preterm | *n* | Full-term | $\chi^2/t$ | *p* |
|---|---|---|---|---|---|---|
| Parent’s age [years] *M (SD)* | 35 | 37.77 (5.39) | 87 | 35.25 (4.38) | 2.68 | .008 |
| Parent’s sex [female] % | 35 | 82.9 | 87 | 85.1 | .09 | .786 |
| Parents with twins % | 35 | 37.1 | 87 | 1.1 | 31.83 | <.001 |
| Socio-economic status *M (SD)* | 35 | 15.9 (3.22) | 87 | 16.43 (3.44) | 0.77 | .438 |
| University-entrance diploma % | 35 | 57.1 | 86 | 90.7 | 18.19 | <.001 |
| Prior knowledge % | 35 | 2.9 | 83 | 28.9 | 10.01 | .002 |
| Child’s (corrected) age [months] *M (SD)* | 41 | 27.96 (3.69) | 88 | 27.24 (2.96) | 1.10 | .277 |
| Child’s sex [female] % | 41 | 46.3 | 88 | 42.0 | 0.21 | .705 |
| Gestational age [weeks] *M (SD)* | 41 | 30.37 (3.80) | 87 | 39.44 (1.27) | 14.90 | <.001 |
| Birth weight [g] *M (SD)* | 41 | 1472.68 (678.50) | 88 | 3369.65 (458.65) | 16.26 | <.001 |
| Child’s cognitive development *M* (SD) | 41 | 93.66 (16.99) | 88 | 99.72 (13.46) | 2.01 | .049 |
| Length of hospital stay [d] *M (SD)* | 40 | 56.78 (46.64) | 84 | 4.00 (2.36) | 7.15 | <.001 |
| Multilingual [child] % | 39 | 10.3 | 86 | 22.1 | 2.50 | .139 |

Table 2

*Parents' demographic and background characteristics within the three treatment conditions*

| | *n* | Basic | *n* | Combined | *n* | Stress (CG) | $\chi^2/F$ | *p* |
|---|---|---|---|---|---|---|---|---|
| Attended treatment sessions *M (SD)* | 39 | 3.36 (0.84) | 43 | 3.60 (0.54) | 40 | 3.33 (0.73) | 2.43[1] | .095 |
| Parent's age [years] *M (SD)* | 39 | 34.90 (4.67) | 43 | 36.91 (4.88) | 40 | 36.03 (4.76) | 1.82 | .167 |
| Parent's sex [female] % | 39 | 84.6 | 43 | 83.7 | 40 | 85.0 | 0.03 | .986 |
| Parents with twins % | 39 | 12.8 | 43 | 9.3 | 40 | 12.5 | 0.40[2] | .880 |
| Socio-economic status *M (SD)* | 39 | 15.95 (3.23) | 43 | 16.79 (3.50) | 40 | 16.04 (3.38) | 0.78 | .459 |
| University-entrance diploma % | 38 | 84.2 | 43 | 79.1 | 40 | 80.0 | 0.38 | .825 |
| Parents with prior experience % | 37 | 27.0 | 42 | 16.7 | 39 | 20.5 | 1.28 | .527 |
| Parent of preterm child % | 39 | 23.1 | 43 | 32.6 | 40 | 30.1 | 0.95 | .622 |
| Parents lost to follow-up [dropout T3] % | 39 | 43.6 | 43 | 30.2 | 40 | 50.0 | 3.51 | .173 |

*Note*. CG = Control group; [1] Welch-Test *F*, [2] *Fisher's exact test*

Table 3

*Contents of the basic, combined and control training*

| Sessions (180 min.) | Basic training: *Scaffolding* | Combined training: *Scaffolding and parental sensitivity* | Control training: *Stress management* |
|---|---|---|---|
| Session 1 | • Development of self-regulation<br>• Co-and self-regulation: the role of parental scaffolding<br>• Zone of proximal development (Vygotsky)<br>• Child competence and development | • Development of self-regulation<br>• Co-and self-regulation: the role of parental scaffolding and sensitive parenting<br>• Zone of proximal development (Vygotsky)<br>• Child competence and development | • Development of self-regulation<br>• Co-and self-regulation: the impact of parental stress<br>• Relaxation methods |
| Session 2 | • Play and self-regulation<br>• Scaffolding means: questions & hints | • Play and self-regulation<br>• Scaffolding means: questions & hints<br>• Reading the child’s signals | • Stress: a vicious circle<br>• Bio-psycho-social consequences of stress<br>• Stressors in everyday life and in interactions with the child |

Table 3 (continued)

*Contents of the basic, combined and control training*

| Sessions (180 min.) | Basic training: *Scaffolding* | Combined training: *Scaffolding and parental sensitivity* | Control training: *Stress management* |
|---|---|---|---|
| Session 3 | • Scaffolding means: instructions and feedback<br>• Contingency management<br>• Transfer of responsibility and fading of support<br>• Explanations and transfer | • Emotions and emotion regulation in early childhood<br>• Mirroring and labelling emotions<br>• Scaffolding means: Instructions, feedback, explanations and transfer | • The influence of thoughts on our perception of (stressful) events—reframing negative thoughts<br>• Social support<br>• Time management<br>• Habits as a way to counteract stress |
| Session 4 | • Scaffolding means: Explanations & transfer<br>• Summary and reflection on the learned strategies | • Setting boundaries sensitively vs. transferring responsibility<br>• Handling anxiety<br>• Summary and reflection on the learned strategies | • “Quality time” and relaxation with the child<br>• Strategies to address acute stress<br>• Summary and reflection on the learned strategies |

Table 4

*Assessment points and applied measures*

| | Pre-test | Intervention | | | Post-test | Follow-Up |
|---|---|---|---|---|---|---|
| | | Session 1 | Session 2-3 | Session 4 | | |
| Anamnesis + SES | X | | | | | |
| Self-efficacy, beliefs (self-report) | | X | | X | | X |
| IMMA 1-6[ab] | X | | | | X | X |
| CBCL 1.5 – 5[ac] | X | | | | X | X |
| BRIEF-P[ad] | X | | | | X | X |
| ECBQ[ae] | X | | | | X | X |
| SBE-2-KT[af] | X | | | | | |
| PSI[ag] | X | | | | | |
| Training evaluation[a] | | | | X | | |
| Cognitive development (child)[h] | X | | | | | |
| Self-regulation (child)[ai] | X | | | | X | |
| Parent-child-interaction[a] | X | | | | X | |

*Note.* [a]Not reported in this study; [b]IMpuls-MAnagement in Toddlers and Preschoolers (Pauen, Hochmuth, Schulz, & Bechtel, 2014); [c]Child Behavior Checklist 1.5-5 (Achenbach & Rescorla, 2000); [d]Behavior Rating Inventory of Executive Function – Preschool Version (Daseking & Petermann, 2013); [e]Early Childhood Behavior Questionnaire (Putnam, Gartstein, & Rothbart, 2006); [f] Parental language assessment (Suchodoletz & Sachse, 2011); [g]Parenting Stress Index (Tröster, 2011); [h] Bayley Scales of Infant and Toddler Development III (Reuner & Rosenkranz, 2014); [i]Snack Delay/Sun-Moon (Voigt et al., 2012).

Table 5

*Means and standard deviations of parents' self-efficacy and beliefs at pre- and post-test for the three treatment groups*

| | | Basic training | | | Combined training | | | Control training | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *valid n* | *M* | (*SD*) | *valid n* | *M* | (*SD*) | *valid n* | *M* | (*SD*) |
| Domain-general SE | Pre-test | 39 | 4.09 | (0.70) | 43 | 4.02 | (0.93) | 40 | 3.96 | (0.79) |
| | Post-test | 37 | 4.02 | (0.99) | 42 | 4.12 | (0.93) | 39 | 4.26 | (0.94) |
| Domain-specific SE (scaffolding) | Pre-test | 39 | 4.35 | (0.63) | 43 | 4.21 | (0.74) | 40 | 4.29 | (0.69) |
| | Post-test | 37 | 4.39 | (0.65) | 42 | 4.43 | (0.56) | 39 | 4.48 | (0.53) |
| Beliefs about co-regulation and learning | Pre-test | 39 | 5.06 | (0.53) | 43 | 5.06 | (0.57) | 40 | 5.18 | (0.52) |
| | Post-test | 36 | 5.34 | (0.45) | 41 | 5.54 | (0.39) | 39 | 5.35 | (0.46) |

*Note.* SE = self-efficacy

Table 6

*Univariate results of doubly MANOVA with main effects for treatment and time (pre- and post-test), and the interaction (n = 116)*

| | | *F* | *df* | *p* | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Treatment | Domain-general self-efficacy | 0.18 | 2/113 | .836 | 0.00 |
| | Domain-specific self-efficacy (scaffolding) | 0.089 | 2/113 | .915 | 0.00 |
| | Beliefs about co-regulation and learning | 0.46 | 2/113 | .566 | 0.01 |
| Time | Domain-general self-efficacy | 2.94 | 1/113 | .089 | 0.02 |
| | Domain-specific self-efficacy (scaffolding) | 7.37 | 1/113 | .008 | 0.06 |
| | Beliefs about co-regulation and learning | 47.42 | 1/113 | < .001 | 0.30 |
| Time*treatment | Domain-general self-efficacy | 2.12 | 2/113 | .125 | 0.04 |
| | Domain-specific self-efficacy (scaffolding) | 0.68 | 2/113 | .508 | 0.01 |
| | Beliefs about co-regulation and learning | 4.42 | 2/113 | .014 | 0.07 |

Table 7

*Parents' demographic and background characteristics within the three treatment conditions (only parents who completed follow-up assessment)*

| | *n* | Basic | *n* | Combined | *n* | Stress (CG) | $\chi^2/F$ | *p* |
|---|---|---|---|---|---|---|---|---|
| Attended treatment sessions *M (SD)* | 22 | 3.55 (0.74) | 30 | 3.67 (0.55) | 20 | 3.45 (0.69) | 0.690 | .505 |
| Parent's age [years] *M (SD)* | 22 | 35.46 (5.12) | 30 | 37.13 (4.93) | 20 | 36.45 (3.85) | 0.804 | .452 |
| Parent's sex [female] % | 22 | 81.8 | 30 | 90.0 | 20 | 85.0 | 0.885[1] | .691 |
| Parents with twins % | 22 | 13.6 | 30 | 6.7 | 20 | 0.0 | 2.670[1] | .263 |
| Socioeconomic status *M (SD)* | 22 | 15.80 (3.29) | 30 | 17.32 (3.56) | 20 | 16.73 (2.92) | 1.341 | .268 |
| University-entrance diploma % | 22 | 77.3 | 30 | 80.0 | 20 | 85.0 | 0.459[1] | .869 |
| Parents with prior experience % | 22 | 27.3 | 30 | 13.3 | 19 | 21.1 | 1.664[1] | .450 |
| Parent of preterm child % | 22 | 27.3 | 30 | 30.0 | 20 | 30.0 | 0.055 | .973 |

*Note*. CG = Control group; [1] *Fisher's exact test*

Table 8

*Means and standard deviations of parents' self-efficacy and beliefs at pre-test, post-test and follow-up for the three treatment groups (including only parents who completed follow-up assessment)*

| | | Basic training | | | Combined training | | | Control training | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *valid n* | *M* | (*SD*) | *valid n* | *M* | (*SD*) | *valid n* | *M* | (*SD*) |
| Domain-general SE | *Pre-test* | 22 | 4.05 | 0.74 | 30 | 3.92 | 0.96 | 20 | 4.00 | 0.84 |
| | *Post-test* | 22 | 3.82 | 1.02 | 29 | 4.14 | 1.00 | 20 | 4.37 | 1.07 |
| | *Follow-up* | 22 | 4.53 | 0.65 | 30 | 4.37 | 0.82 | 20 | 4.50 | 0.65 |
| Domain-specific SE (scaffolding) | *Pre-test* | 22 | 4.35 | 0.63 | 30 | 4.19 | 0.70 | 20 | 4.39 | 0.79 |
| | *Post-test* | 22 | 4.36 | 0.70 | 29 | 4.47 | 0.60 | 20 | 4.49 | 0.56 |
| | *Follow-up* | 20 | 4.65 | 0.52 | 30 | 4.58 | 0.71 | 18 | 4.60 | 0.68 |
| Beliefs about co-regulation and learning | *Pre-test* | 22 | 5.06 | 0.53 | 30 | 5.17 | 0.48 | 20 | 5.20 | 0.61 |
| | *Post-test* | 21 | 5.37 | 0.39 | 28 | 5.56 | 0.38 | 20 | 5.38 | 0.48 |
| | *Follow-up* | 20 | 5.40 | 0.46 | 30 | 5.67 | 0.32 | 17 | 5.38 | 0.47 |

*Note.* SE = self-efficacy

Table 9

*Univariate results of doubly MANOVA with main effects for treatment and time (pre-, post-test, follow-up), and the interaction (n=64)*

| | | Univariate analyses | | | | Contrasts (time) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | T1 vs. T3 | | | T2 vs. T3 | | |
| | | *F* | *df* | *p* | Partial $\eta^2$ | *F* | *df* | *p* | *F* | *df* | *p* |
| Treatment | Domain-general self-efficacy | 0.05 | 2/61 | .947 | 0.00 | | | | | | |
| | Domain-specific self-efficacy (scaffolding) | 0.04 | 2/61 | .965 | 0.00 | | | | | | |
| | Beliefs about co-regulation and learning | 2.50 | 2/61 | .090 | 0.08 | | | | | | |
| Time | Domain-general self-efficacy | 12.76 | 2/122 | < .001 | 0.17 | 31.09 | 1/61 | < .001 | 9.72 | 1/61 | .003 |
| | Domain-specific self-efficacy (scaffolding) | 8.46 | 2/122 | < .001 | 0.12 | 14.22 | 1/61 | < .001 | 5.62 | 1/61 | .021 |
| | Beliefs about co-regulation and learning | 20.10 | 2/122 | < .001 | 0.25 | 27.90 | 1/61 | < .001 | 2.15 | 1/61 | .148 |
| Time*treatment | Domain-general self-efficacy | 2.31 | 4/122 | .062 | 0.07 | | | | | | |
| | Domain-specific self-efficacy (scaffolding) | 0.65 | 4/122 | .628 | 0.02 | | | | | | |
| | Beliefs about co-regulation and learning | 0.70 | 4/122 | .594 | 0.02 | | | | | | |

*Note.* T1 = pre-test, T2 = post-test, T3 = follow-up

Table 10

*Multiple regression analysis with parents' beliefs about co-regulation and learning (BCL) at post-test as dependent variable* ($n$ = 73)

| | | *b* | (*SE*) | β | *t* | *p* |
|---|---|---|---|---|---|---|
| Modell 1 | Constant | 3.41 | (0.37) | | 9.19 | < .001 |
| | BCL (T1) | 0.41 | (0.07) | .55 | 5.59 | < .001 |
| Modell 2 | Constant | 3.37 | (0.39) | | 8.60 | < .001 |
| | BCL (T1) | 0.39 | (0.07) | .54 | 5.28 | < .001 |
| | Group (full-term vs. preterm) | 0.01 | (0.12) | .01 | 0.09 | .926 |
| | Treatment (basic vs. combined) | 0.20 | (0.09) | .26 | 2.25 | .028 |
| | Interaction group by treatment | -0.06 | (0.16) | -.06 | -0.36 | .716 |
| Modell 3 | Constant | 3.53 | (0.43) | | 8.14 | < .001 |
| | BCL (T1) | 0.43 | (0.08) | .59 | 5.18 | < .001 |
| | Group (full-term vs. preterm) | 0.02 | (0.13) | .02 | 0.14 | .889 |
| | Treatment (basic vs. combined) | 0.21 | (0.09) | .27 | 2.31 | .024 |
| | Interaction group by treatment | -0.08 | (0.17) | -.08 | -0.45 | .651 |
| | SES | -0.12 | (0.11) | -.12 | -1.10 | .274 |
| | Parents‘ sex (male vs. female) | -0.01 | (0.01) | -.07 | -0.65 | .516 |
| | Prior knowledge | 0.00 | (0.10) | .00 | -0.01 | .991 |

$R^2$ = .31*** step 1, $\Delta R^2$ = .06 step 2, $\Delta R^2$ = .02 step 3

*Note.* T1 = pre-test; ***$p$ < .001

**Supplementary Online Material**

Table 11

*Item overview for the scales: domain-general self-efficacy (DGSE), domain-specific self-efficacy (DSSE), and beliefs on parental co-regulation and the promotion of learning (BCL)*

| | Cronbach's α coefficient | | |
|---|---|---|---|
| | Pretest | Posttest | Follow-up |
| *Domain-general self-efficacy* | (n = 122) | (n = 118) | (n = 72) |
| I am able to find a solution for any problem with my child. | .67 | .83 | .81 |
| I don't have any difficulties reaching my goals concerning parenting. | | | |
| I think I have all the competence a good parent needs to have. | | | |
| *Domain-specific self-efficacy (scaffolding)* | (n = 122) | (n = 118) | (n = 68) |
| I am able to… | .69 | .62 | .76 |
| …explain things to my child, so he/she can understand. | | | |
| …challenge my child in play and learning situations without pushing him/her too hard. | | | |
| …judge correctly how much support my child needs. | | | |
| …keep my child's attention on one thing at a time. | | | |

Table 11 (continued)

*Item overview for the scales: domain-general self-efficacy (DGSE), domain-specific self-efficacy (DSSE), and beliefs on parental co-regulation and the promotion of learning (BCL)*

| | Cronbach's α coefficient | | |
|---|---|---|---|
| | Pretest | Posttest | Follow-up |
| *Beliefs on parental co-regulation and the promotion of learning* | (n = 120) | (n = 115) | (n = 66) |
| Parents may actively support their child's development of self-regulation. | .79 | .78 | .76 |
| Self-regulation may be promoted during play. | | | |
| Child self-regulation develops in interplay with the parents. | | | |
| Self-regulation develops when children are given the opportunity to regulate themselves. | | | |
| Parents may stimulate their child's learning in every play situation. | | | |
| Parents play an important role in children's learning. | | | |
| Children learn most effectively when parents adapt their support contingently. | | | |
| To support learning may imply withholding/stop helping. | | | |
| Parents may actively shape their child's learning process. | | | |

# Appendix D – Erklärung gemäß § 8 (1) c) und d) der Promotionsordnung

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**FAKULTÄT FÜR VERHALTENS-
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**Promotionsausschuss der Fakultät für Verhaltens- und Empirische Kulturwissenschaften
der Ruprecht-Karls-Universität Heidelberg**
**Doctoral Committee of the Faculty of Behavioural and Cultural Studies of Heidelberg University**

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