Title: The influence of teacher-child interaction on the development of executive functions from toddlerhood to secondary school
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Description of the research idea: Evidence suggests that teacher-child interactions shape the development of executive functions (EFs) in children. Which aspects of teacher-child interactions are relevant, and which aspects of EF are affected most is still unclear. Also, how and for whom these effects are most pronounced needs further elucidation. This project investigates how teacher-child interactions influence children's EF development from toddlerhood to early adolescence, using 1) data from three existing large-scale longitudinal databases: the Pre-COOL, GROW and Europe study databases, and 2) novel microstudies.

Research problem: EFs are tremendously important for children's success in school, social interaction and mental health (Diamond, 2013). EFs are higher-level cognitive processes that exert top-down influence over actions, thoughts and emotions and are involved in goal-directed behaviour (Zelazo & Carlson, 2012). Core aspects of EF are working memory, inhibition and cognitive flexibility (Diamond, 2013). Given the importance of EFs for later developmental outcomes, environmental influences on EF development have gained increasing interest in research and practice (Hughes, 2011). Studies investigating the role of the environment on EF development have focused on the impact of the family context (Hughes, 2011) or on the effectivity of individualized (computer) training (meta analyses: Melby-Lervåg et al., 2016; Sala & Gobet, 2017). However, at the time when children go to school their EFs are still developing (Best & Miller, 2010; Huizinga, Dolan & Van der Molen, 2006), and it largely unknown how such formal and structured learning contexts influence children's EF development; the scarcely available research on this topic focuses nearly exclusively on young children between 2-7 years (Vandenbroucke et al., 2017). To address this knowledge gap, the overarching goal of this project is to investigate the impact of teacher-child interaction on EF development across different ages: from preschool to primary school, and across the transition to secondary school. In this project, we adopt the approach that socially shared attention and stress regulation are candidate mechanisms underlying the link between teacher-child interaction and EF development (Yu & Smith, 2016; Blair, 2017).

Research questions:
1) Which aspects of teacher-child interaction (i.e., emotional support, classroom organization, instructional support) affect EFs?
2) Are different EFs (i.e., working memory, inhibition, cognitive flexibility) differentially influenced by teacher-child interaction, and how?
3) For which children are the effects of teacher-child interaction on EFs most pronounced (e.g., younger vs older, low vs. high socioeconomic status (SES))?
4) Which underlying mechanisms (e.g., attention, stress regulation) explain the relation between teacher-child interaction and EF development?

Methods: The project makes use of a unique combination of existing large-scale longitudinal datasets and novel microstudies:
- Dataset 1, preschool (2-5y): The Pre-COOL study provides 4-wave longitudinal data on observed teacher-child interaction and EFs (N>700), and potential moderators (e.g., SES);

- Dataset 2, primary school (6-12y): The GROW project provides cross-sectional data on observed teacher-child interaction and EFs, and potential moderators (e.g. SES) and mediators in a large sample (N > 5,000 primary school children);
- Dataset 3, transition to secondary school (10-12y): The Europe study provides 3-wave longitudinal data (including the transition to secondary school) on student- and teacher-reported teacher-child interaction and EFs in a German sample (N = 1,500 students), as well as potential moderators (e.g. SES) and mediators;
- Microstudies (new data collection): The process through which teacher-child interaction impacts child EFs in the classroom will be further unraveled through a series of randomized controlled microtrials (Leijten et al., 2015). After assignment to a single short training condition or a control condition, teacher behaviour and behavioural manifestations of child EFs (e.g., focused attention, inhibition) will be observed in the classroom.

Rationale and approach: The longitudinal designs and different age ranges of the three existing datasets allow the identification of sensitive periods for environmental influences on EF development. Multilevel latent growth modelling will be applied to study effects of teacher-child interaction on child EF over time. The mixed-method nature of the data across studies (e.g., observational data, self-rating and student ratings of teacher-child interactions) is a strength of the current approach. The combination with microstudies will allow testing of the direction of effects and will give insight into underlying mechanisms.

Institutional environment: The project will be conducted within the Department of Special Education: Cognitive & Motor Disabilities. Researchers in our department study how pedagogical contexts and facilities can be optimized in order to foster development and learning in a diverse society. The department's research is positioned in the UU research programme Education and Learning and is embedded in several central strategic themes and focus areas of Utrecht University: Dynamics of Youth, Education for Learning Societies, and Institutions for Open Societies.

Relevance: Results of the project will contribute to theory formation about EF development in social contexts and will impact on the design of interventions aimed to promote executive functioning across childhood.

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