# Concerted Cultivation in Early Childhood and Social Inequalities in Cognitive Skills: Evidence from a German Panel Study

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**Abstract**

According to Lareau's (2003) concept of concerted cultivation, upper and middle-class parents aim more systematically to promote their children's skills in various ways in comparison with lower class parents. These differences in parenting, are assumed to affect children's skill development. Whereas Lareau developed her concept for families with elementary school children, and much of the subsequent literature has focused on this age group or older, we argue that concerted cultivation is likely to be visible already during early childhood. Therefore, we investigated if participation in organized leisure activities and parents' promotion of cognitive stimulation during early childhood—as two indicators of concerted cultivation—explain later differences in cognitive skills. We furthermore examined if concerted cultivation mediates the association between social background and cognitive skills of children. We drew on longitudinal data from 1,632 children in the Starting Cohort 2 of the German National Educational Panel Study (NEPS). We show that parents with high socio-economic status are more likely to enroll their 5-year-old children in organized leisure activities and to read to them daily. Results from lagged dependent variable regressions indicate that only enrollment in music mediates the relationship between parental socio-economic status and children's skill development in math and reasoning. Our study highlights the prevalence of concerted cultivation as a parenting style of the German middle-class already during early childhood. Nevertheless, it only moderately contributes to children's cognitive skill development. Our mediation analysis showed that only music participation explained a modest portion of the background-specific differences in math and reasoning skills.

*Keywords:* concerted cultivation; cognitive skills; early childhood; parental cognitive stimulation; social inequality; organized leisure activities

# 1 Introduction

Cognitive skills are an important predictor not only of educational attainment (Bernal & Keane, 2011; Bourne, Bukodi, Betthäuser, & Goldthorpe, 2018) but also of longer term outcomes such as earnings (Murnane, Willett, Duhaldeborde, & Tyler, 2000) and health (Bijwaard, van Kippersluis, & Veenman, 2015). Therefore, cognitive skills represent a central resource that may support success in various life domains. Research has shown that even before starting school, children from families with higher socio-economic status have, on average, an advantage in cognitive skills over their peers from lower socio-economic statuses (Bradley & Corwyn, 2002; Duncan & Magnuson, 2012; Feinstein, 2003). Yet, how do these differences in cognitive skills develop at an early age?

Previous research has suggested that parenting behaviors are key contributors to differences in children's skills (Anders et al., 2012; Niklas & Schneider, 2017; Sylva et al., 2013; Authors, 2020). In this paper, we therefore studied the role of parenting behaviors during preschool years in creating cognitive skill differences between children from different socio-economic backgrounds. We focus on the non-monetary dimension of social background. We base our study on Lareau's (2003) argument that middle- and working-class parents differ in their parenting strategies: Whereas middle-class families try to actively foster the talents and skills of their children (*concerted cultivation*), working-class parents focus on fulfilling their children's basic needs and allow them to grow more freely (*accomplishment of natural growth*).

While several researchers have tested Lareau's theoretical ideas in quantitative and qualitative studies (Bodovski & Farkas, 2008; Cheadle & Amato, 2011; Chin & Phillips, 2004; Covay & Carbonaro, 2010), some questions remain unanswered. Previous research has rarely questioned if the core dimensions of parenting strategies described by Lareau are indeed

the most salient parenting dimensions that differ between social classes and lead in turn to differences in children's development. To our knowledge, most previous research has either examined concerted cultivation with a combined measure of all three or four dimensions (Bodovski & Farkas, 2008; Cheadle, 2009; Cheadle & Amato, 2011; Redford, Johnson, & Honnold, 2009), or has focused on single dimensions of concerted cultivation such as children's enrollment in organized leisure (Coulangeon, 2018; Dumais, 2006). Moreover, few researchers have explored to what extent Lareau's theoretical concepts can be applied to the context of early childhood. The salient parenting dimensions in which parent's different approaches of childrearing are reflected, may vary to some extent between early and late childhood. Research has shown that parents adjust their parenting behaviors according to their child's age (Kalil, Ryan, & Corey, 2012). For instance, preschoolers' leisure time is more tightly controlled by parents and more likely to involve direct interaction between children and parents, compared to older children (Hofferth, 2008; Kalil et al., 2012). Thus, we argue that concerted cultivation of preschoolers may take a different form than concerted cultivation of school children and is, to a certain extent, expressed in the degree of parental cognitive stimulation at home. To test this argument, we used German panel data and investigated the following research question: Does concerted cultivation at the age of five, measured as being enrolled in organized leisure activities and being offered cognitive stimulation from parents, explain cognitive skill gaps between first graders from different socio-economic backgrounds at the age of seven?

Answering this question allows us to test our proposed theoretical extension and adds to previous research in three more regards. First, we examine the relative explanatory power of these two forms of parental investment in order to shed some light on the question under which conditions cultural activities contribute more to the child's development. It might be relevant if children learn informally from their parents or in more non-formal and structured

contexts, such as music and sports lessons. However, previous research has rarely explored these two processes in combination. Second, little is known about the extent to which Lareau's research findings from the U.S. context transfer to other cultural contexts, such as Germany, where organized leisure activities are subsidized by the government. Most previous research on concerted cultivation has been based on data from the U.S. or other Anglo-Saxon countries (Bodovski & Farkas, 2008; Cheadle, 2008; Covay & Carbonaro, 2010; Dumais, 2006). Third, we use three different measures of children's cognitive skills (math test scores, reasoning skills and the ability to concentrate on a task). Previous research has mainly relied on academic test scores or basic cognitive ability tests to measure the relationship between concerted cultivation and cognitive skills, whereas reasoning skills and concentration are considered an important foundation for academic success.

## 2 Educational Reproduction by Means of Parenting

### 2.1 Concerted Cultivation and Accomplishment of Natural Growth

According to Lareau's considerations, cultural differences in parenting strategies on the basis of social class may explain children's distinct developmental paths (Lareau, 2002, 2003). Her ethnographic research on families in the US has suggested that parents' perceptions of what children need for successful development are stratified by social class. She has identified two distinct parenting strategies, termed *concerted cultivation* and *accomplishment of natural growth*. A parenting strategy is understood as an umbrella concept for a set of parenting behaviors and investments that follow an overall aim. Middle-class parents tend to engage in parenting behaviors such as enrolling their children in adult-orchestrated organized activities and reasoning, negotiating, and intervening in school on a child's behalf. By contrast, working-class parents tend to allow their children a great deal of free play, use many directives in conversations with their children, and rarely interact with the school (Lareau, 2002). According to Lareau, these differences in parenting represent a key

mechanism through which higher status parents transmit their advantages to their children by increasing their children's school success. Being raised under concerted cultivation teaches children cognitive and noncognitive skills, which are beneficial in school, for instance, in interactions with teachers (Calarco, 2014; Lareau, 2002).

Quantitative studies have tried to map the concept of concerted cultivation with survey data (Cheadle & Amato, 2011). Indeed, these studies have shown that concerted cultivation mediates parts of the relationship between parents' socio-economic status and children's academic skills (Bodovski & Farkas, 2008; Cheadle, 2008; Covay & Carbonaro, 2010; Dumais, 2006). However, little research has examined Lareau's concepts about parenting strategies outside Anglo-Saxon countries (e.g., France: Coulangeon, 2018; Japan: Matsuoka, Nakamuro, & Inui, 2015; Sweden: Sjödin & Roman, 2018). Hence, the extent to which her theoretical considerations apply to other cultural contexts, such as Germany, remain largely unknown. Furthermore, most studies have focused on the parenting of school children (Bodovski & Farkas, 2008; Covay & Carbonaro, 2010; Dumais, 2006) or have used samples of children of a larger age range (Cano, Perales, & Baxter, 2019; Hsin & Felfe, 2014) so that we know little about concerted cultivation specifically during preschool age.

## 2.2 Concerted Cultivation in the Form of Enrollment in Organized Leisure Activities

According to Lareau, one of the most salient differences between "concerted cultivation" and "accomplishment of natural growth" is the organization of children's daily lives. Middle-class parents tend to enroll their children in several adult-orchestrated organized leisure activities and thereby establish very structured daily routines. Structured organized leisure activities resemble classroom settings in several ways (e.g., regularity, clear rules, adult guidance) so that enrollment in organized leisure prepares children for learning in class. Hence, by participating in organized leisure activities, children do not only develop their cognitive skills through stimulation, but they also learn how to follow rules, perform in front

of an audience, or interact with authorities (Lareau, 2003). Furthermore, persistence and a strong work ethic are the kinds of skills that are trained in organized leisure settings. Such skills provide benefits for children in the classroom setting (Covay & Carbonaro, 2010). Whereas the accomplishment of natural growth, in the form of unstructured free play, also allows children to develop skills such as creativity and peer conflict resolution, these skills do not result in the same benefits in school (Lareau, 2003). Hence, whereas both parenting strategies lead to children's skill development, the middle-class parenting strategy is more effective in teaching children the skills with the largest pay-off in the school setting.

In line with Lareau's theory, there is compelling evidence that school children's enrollment in organized leisure activities is related to parents' socio-economic status (Bodovski & Farkas, 2008; Carolan, 2016, 2018; Cheadle & Amato, 2011; Coulangeon, 2018; Dumais, 2006). Furthermore, studies have shown that school children's enrollment in organized leisure activities is related to higher school outcomes (Eccles, Barber, Stone, & Hunt, 2003; Mahoney, Cairns, & Farmer, 2003) such as test scores (Dumais, 2006), teacher ratings (Dumais, 2006), and school grades (Coulangeon, 2018; Redford, Johnson, & Honnold, 2009). Whereas Lareau based her argument on the number of organized leisure activities, some studies on concerted cultivation have analyzed distinct organized leisure activities rather than a mere sum score (Coulangeon, 2018; Dumais, 2006). This research suggests that not all organized leisure activities contribute to children's skill growth to the same extent. For instance, Coulangeon (2018), using a sample of 6$^{th}$ graders in France, showed with a fixed-effects regression that only three (public library membership, enrolling in a music academy or school of music, and participating in an activity club at school) out of eight organized leisure activities under scrutiny were related to higher grades in math and French.

The most commonly studied organized activities are sports and music participation. For both types of organized leisure activities, there is evidence that they support school success

(Cabane, Hille, & Lechner, 2016; Felfe, Lechner, & Steinmayr, 2016; Pfeifer & Cornelißen, 2010; Southgate & Roscigno, 2009). However, these two types of activities differ in several respects and may therefore support school success via distinct channels (e.g., development of cognitive vs. noncognitive skills). It is a common argument of researchers who focus on the benefits of organized sports participation that sports influences educational outcomes indirectly through a multitude of channels ranging from health, to soft skills (e.g., teamwork, dealing with criticism and competition, following rules and instructions), to behavioral habits (e.g., motivation, discipline, perseverance; Felfe et al., 2016; Pfeifer & Cornelißen, 2010). Studies focusing on music, by contrast, have usually argued more in terms of the development of cognitive skills: Music training stimulates cognitive abilities such as intelligence (Schellenberg, 2004), auditory discrimination abilities (Forgeard, Winner, Norton, & Schlaug, 2008), verbal memory (Ho, Cheung, & Chan, 2003), and executive functioning (Moreno et al., 2011). Nevertheless, being musically active may also be related to noncognitive skills such as openness to experience (Cabane et al., 2016). Cabane et al. (2016) examined with a propensity score matching analysis whether music and sports contribute to school success via the same mechanisms and concluded that regarding basic cognitive skills in particular, adolescents' music activities seem to have a higher payoff than participating in sports. The positive association between music activities and cognitive skills has also been found using an experimental design (Kaviani, Mirbaha, Pournaseh, & Sagan, 2014; Rauscher et al., 2016; Schellenberg, 2004). Yet, a meta-analysis of experimental studies concludes that impact of music training on children's and young adolescents' cognitive and academic skills is rather small and is moderated by study quality (Cohen's d= 0.16; Sala & Gobet, 2017). However, these researchers also report that the effect of music training varies by outcome measure. For intelligence, for instance, they found an effect size of Cohen's d= 0.35.

While there is compelling evidence that school children's enrollment in organized leisure activities contributes to their skill development, less research has focused on organized leisure enrollment during preschool years. Yet, it seems plausible that the child-rearing strategies described by Lareau also shape the leisure time experiences of preschool children. A 5-year-old's leisure time is likely to be much more influenced by his or her parents' wishes compared to school children, who are experiencing the growing influence of their peers (Hofferth, 2008). Moreover, participating in organized leisure activities during early ages may be particularly beneficial for cognitive skill development. Research has suggested that brain sensitivity to the development of several cognitive skills is largest at a young age (National Scientific Council on the Developing Child, 2007). In the age of intensive parenting (Hays, 1996; Schaub, 2010), there seems to be an upward trend of already enrolling children in organized leisure activities at a young age (Lareau, 2008, 2011; Schmidt, Henn, Albrecht, & Woll, 2017).

Several studies suggest that concerted cultivation as a parenting strategy of the higher social classes is already visible during early childhood. These studies found that parents' socio-economic status is related to young children's enrollment in organized leisure activities (Carolan, 2018; Gülzau, 2018; Moll & Betz, 2014; Schmiade & Spieß, 2010; Schober & Spieß, 2013; Sjödin & Roman, 2018). Yet, few studies have examined the extent to which children's enrollment in organized leisure activities at a young age contributes to greater growth in their cognitive skills. For instance, Carolan's (2018) analysis of U.S. preschoolers showed that the number of organized leisure activities of children during the year prior to first grade was related to their first grade math and reading scores. In contrast, Hsin and Felfe (2014) who analyzed a sample of U.S. children between 0-12 years using a fixed-effects estimation, found no significant relationship between time spent in organized activities and cognitive skill measures. Yet, they found a positive relationship between time spent in organized leisure activities and behavioral outcomes for children older than six years.

Similarly, Cano et al. (2019) did not report any significant relationship between time spent in structured activities and vocabulary test scores using value-added models using time diaries of Australian children (4-8 years old). However, these studies used a sum score of all organized leisure activities or time spent in all organized activities, which can hide the potential differential effects of single organized leisure activities, as reported by studies on school children. Hence, the extent to which the specific organized leisure activities during early childhood contribute to skill differences and thereby transmit social class advantages remains unclear.

### 2.3 Concerted Cultivation in the Form of Cognitive Stimulation at Home

Besides Lareau's observation of the high degree of enrollment in organized leisure activities in middle-class families, she also observed that middle-class parents, in contrast to working class parents, were more likely to provide cognitive stimulation at home. This is because these parents perceive an obligation to actively develop their child's skills (Lareau, 2011, pp. 82–83). In particular, when applying the concept of concerted cultivation to the context of early childhood, this dimension of concerted cultvation may be one of the most salient dimensions on which parents of distinct socio-economic backgrounds differ. In line with this, the family investment model suggests that a key channel through which parents transmit their social class status is parental cognitive stimulation at home (Becker & Biedinger, 2016; Becker & Tomes, 1986; Bradley & Corwyn, 2002; Conger & Donnellan, 2007; Feinstein, Duckworth, & Sabates, 2008; Guo & Harris, 2000). Hence, we argue that in early childhood, the parenting strategy of concerted cultivation (i.e., parents' urge to develop children's talents and improve children's skills at every occasion) may not only be visible in the core dimensions mentioned by Lareau but also in the extent to which parents stimulate their children on a cognitive level at home (Bodovski, 2010; Kaiser & Diewald, 2014; Pensiero, 2011).

Indeed, there is a long-standing tradition in early childhood research examining to which extent the home learning environment explains skills differences in children by parental socio-economic status. This research shows that parents with higher socio-economic status provide their young children with a more cognitively stimulating home environment (e.g., reading to the child, helping the child learn colors, engaging in frequent conversations with the child) and thereby secure them a head-start at school (Anders et al., 2012; Duncan, Brooks-Gunn, & Klebanov, 1994; Guo & Harris, 2000; Kluczniok & Mudiappa, 2018; Melhuish et al., 2008; Niklas & Schneider, 2017). Whereas older studies focused on the role of the home environment as a set of diverse activities (Duncan et al., 1994; Melhuish et al., 2008) or as time spent with parents (Milkie, Nomaguchi, & Denny, 2015), more recent studies have emphasized that only certain activities in the home environment (e.g., educational parent-child activities) contribute to skill development (Cano et al., 2019; Fiorini & Keane, 2014; Hsin & Felfe, 2014). For instance, Hsin and Felfe (2014) used a fixed-effects approach and found that parent-child time in educational activities was significantly related to children's cognitive abilities, whereas parent-child time spent on unstructured activities was not. The underlying assumption of this literature is similar to Lareau's argument about organized leisure activities: structured activities along with adult-guidance may generate larger benefits for school-relevant outcomes than unstructured activities (Hsin & Felfe, 2014).

### 2.4 Enrollment in Organized Leisure Activities versus Cognitive Stimulation at Home

Whereas studies have examined the benefits of organized leisure activity enrollment and parental cognitive stimulation at home, few studies have shed light on their relative importance regarding the development of early-age skill differences by parental socio-economic background. These studies show that it is rather the engagement in cognitively stimulating activities (e.g., reading to the child) that generates beneficial outcomes for children and not the sum of organized leisure activities (Cano et al., 2019; Fiorini & Keane,

2014; Hsin & Felfe, 2014; Pensiero, 2011). However, Funk and Kemper's (2016) study, which examined single organized leisure activities instead of a sum score, found that enrolling in music lessons and not the factor score of home learning environment was the best predictor of math scores. A potential explanation for these contradicting results might be that not all forms of organized leisure activities or parental cognitive stimulation contribute to cognitive skill development. Therefore, it is necessary to distinguish specific activities for both forms of parental investment when studying their relative importance for children's skill development.

## 3 Concerted Cultivation in the Context of Germany

Most of the research on concerted cultivation has been conducted in the US (Bodovski & Farkas, 2008; Cheadle, 2008; Covay & Carbonaro, 2010; Dumais, 2006) or other Anglo-Saxon countries (Fiorini & Keane, 2014; Lee et al., 2019). However, the resources that are needed by and available to parents to follow a parenting style of concerted cultivation may vary by country. For instance, concerning parents' time constraints, it is important to note that most of the main caregivers in Germany are mothers who are homemakers or work part time. This usually leaves enough time for stimulating activities at home and taking children to leisure activities outside the home (German Federal Ministry for Family Affairs, Senior Citizens, Women, 2012).

In particular, concerted cultivation in the form of organized leisure activity enrollment may be influenced by country-specific conditions such as costs and opportunity structures of organized leisure activities. Organized leisure activities have a long tradition in Germany and are primarily organized in institutions (e.g., music schools, sports clubs) separate from early childhood education and care institutions (ECEC). Hence, all day-care facilities exert very limited control over organized leisure activities, leaving the choice about enrolling children

in organized leisure activities to the parents. In Germany, 95,6 % of children between the ages of 4 and 5 attend day-care facilities before transitioning to elementary school at the age of 6 (Strunz, 2011). Yet, more than half of the children in Germany in 2011 attended them for a maximum of seven hours a day, leaving enough time for many children to also enroll in various leisure activities (Strunz, 2011). In contrast to other countries, financial constraints for enrolling in organized leisure activities are less pronounced in Germany. For instance, organized leisure activities are strongly subsidized so that the participation fees are rather low (Breuer & Feiler, 2015; VDM). In addition, in 2011, the German government passed a law ("*Bildungs- und Teilhabepaket*") to increase educational support to low-income households by covering membership fees or equipment costs (up to 10 Euro per month) for activities such as music or sports. At the same time, the distribution of household income in Germany is less unequal than, for instance, in the U.S. context. Therefore, in particular, in the German context, cultural orientations (i.e., parents' education) rather than financial or time constraints are likely to influence parents' child-rearing behavior (Cabane et al., 2016).

## 4 The Present Study

In our study, we applied Lareau's concept of concerted cultivation to preschoolers who transition to elementary school. We bridge the two theoretical approaches of concerted cultivation and parental investment by extending the concept of concerted cultivation to the dimension of parental cognitive stimulation at home. Specifically, we aimed to test the following hypotheses:

***Hypothesis 1a:*** *Parents' socio-economic background will be positively associated with enrolling preschool children in organized leisure activities.*

***Hypothesis 1b (mediation):*** *Enrolling preschool children in different types of organized leisure activities will mediate the effect of parents' socio-economic background on later differences in cognitive skills.*

***Hypothesis 2a:*** *Parents' socio-economic background will be positively associated with parental cognitive stimulation at home for preschoolers.*

***Hypothesis 2b (mediation):*** *Parental cognitive stimulation will mediate the effect of parents' socio-economic background on later differences in cognitive skills.*

Testing these hypotheses advances previous research in several aspects. First, we tested the extent to which Lareau's theory can be generalized to other cultural contexts and age groups using data on preschool children enrolled in German early education institutions. Second, we tested whether concerted cultivation as a parenting strategy of higher educated parents during the preschool phase would be reflected by an additional dimension, i.e., parental cognitive stimulation at home. Third, we differentiated between specific activities because critics of Lareau's work have argued that specific parenting behaviors rather than the complete set of behaviors may drive the skill gap between children from different family backgrounds (Pensiero, 2011). Thereby, we contribute to the knowledge about the relative importance of learning in two different contexts (at home with parents and in organized leisure activities). Finally, we measured cognitive skills not only with academic test scores but also with measures of reasoning and concentration abilities.

# 5 Data and Methods

## 5.1 Data

The following analyses were based on data from the German National Educational Panel Study (NEPS, doi:10.5157/NEPS:SC2: 6.0.1; Blossfeld, Roßbach, & Maurice, 2011), which applies a multicohort sequence design in order to shed light on lifelong educational processes

(Blossfeld et al., 2011). For the current study, we focused on the Starting Cohort 2 "Kindergarten" (preschool care), which includes rich data from a sample of children in day-care facilities (Kindergartens) in Germany. The sample was drawn using an indirect sampling strategy because there is no central register of German day-care facilities from which a random sample of enrolled children could be drawn. First, elementary schools were sampled on a nationwide and representative basis. These schools provided a list of day-care facilities from which children could transfer to these particular elementary schools. Second, a set of day-care facilities was randomly drawn from this list for each school in proportion to the school size. 33% of the contacted day-care facilities participated in the study. All 4-year-old children and their parents from the participating day-care facilities were invited to participate (Skopek, Pink, & Bela, 2012). The data contains information from a standardized test of children's cognitive skills, from a parent questionnaire and from a questionnaire administered to the day-care teachers. The baseline sample can be regarded as roughly representative of German children at the age of 4 to 5 years because over 95,6% of the children in this age group attended day-care facilities in 2011 (Strunz, 2011).

Data collection started in 2011 when the children were about 4 years old. The data set provides comprehensive information about the children's learning environments at home and in the day-care facilities as well as their competence development, which rendered the data set well suited for testing our hypotheses. We used general information about the household structure and family resources, child's sex, age and health condition from the parent questionnaire of Wave 1 (at age 4). The information about children's leisure activities and children's cognitive outcomes was included in the data collection of Wave 2 (at age 5) and Wave 4 (at age 7). Most of the items we used for our study were included in the questionnaire every other wave, so that Wave 3 does not contain all measures of interest. We therefore used a data structure that resembles a two-wave panel although we use three waves of the data (a

detailed description of all variables follows below). In Wave 1, 2996 children were interviewed, which corresponds to a response rate of 56.2% (Skopek et al., 2012). We restricted our analytic sample to children without a diagnosed disability (N= 30) who attended regular day-care facilities. For our analyses, we used only cases that include a completed parent questionnaire in Wave 1 and Wave 2 (N=1,632). Between Waves 2 and 3, the children changed from institutional early childhood care to elementary school. Due to the study design, only children in previously selected elementary schools were followed in Wave 3. This led to a reduction in the sample size from 1,632 (Wave 2) to 393 (Wave 3) children. Due to further non-response, in Wave 4, a total of 343 children were left in the sample that builds the sample for our mediation analysis which relies on panel data. Due to the large reduction in the sample size between Wave 2 and 4, the sample for the analysis of children's cognitive skills may no longer be representative of the German population of children enrolled in all day-care facilities. A comparison of the descriptives (see Appendix Table A1, A2) and an analysis of the attrition showed that the the respondents who remain in the sample are more privileged (see Appendix Table A5). The children in the sample of the mediation analysis were less often from a single parent family and engaged less frequently in educational activities at preschool. Also these children were less likely to have a migration background but were more likely to be enrolled in sports and had higher math scores. This limitation should be kept in mind when drawing conclusions from the results because it may have downward biased the coefficients of our concerted cultivation indicators. Our final sample of parents and children consisted of $N$ = 1,632 (Waves 1 and 2) and $N$ = 343 (Waves 1, 2, and 4). We imputed item-missing data using chained equations (20 imputations, STATA 14, command: mi impute chained.). The largest amount of missing data occurred for the household income item (13.8%). For further information on the missing data, see Table A1 in the Appendix.

## 5.2 Variables

Descriptive statistics of all variables can be found in the Appendix (Tables A1 and A2).

### 5.2.1 Core variables

We used three dependent variables to measure children's cognitive skills: children's math skills, concentration skills, and basic reasoning skills. All skill measures were standardized and measured in Waves 2 and 4.

Math skills were measured with a weighted maximum likelihood estimator (WLE; Warm, 1989) from a standardized math competence test developed for preschool children by NEPS. This test was developed to capture the ability to apply mathematics in realistic situations. The test consisted of 26 items covering four content areas (quantities, change and relationships, shape and spaces, data and chance) and six competence areas (arguing, communicating, modelling, problem solving, representing, applying technical skills; (for details see Neumann et al., 2013; Schnittjer & Duchardt, 2015). The children were tested in one-on-one situations where the interviewer reads the items to the child and sometimes illustrates the task using illustrative materials (e.g., stones to count).

Reasoning skills were measured as part of children's basic (nonverbal) cognitive abilities. The standardized test (NEPS-MAT) consisted of two sets each with six items (for details see Haberkorn & Pohl, 2013). Each item consisted of a matrix of geometrical elements with only one field remaining empty. The child has to deduce the logical rule on which the pattern of the geometrical elements is based in order to select the right complement for the empty field from the offered solutions. The child had three minutes to solve each set.

Concentration skills were measured with the day-care teacher's response to the question "Compare <target child's name> with other children of the same age: Is <target child's name's> stamina and ability to concentrate (e.g., ability to do something for long periods of

time) much worse, slightly worse, the same as, slightly better, or much better than other children of his/her age?" The response categories ranged from 1 (*much worse*) to 5 (*much better*).

We measured concerted cultivation with two forms of parental investments, each measured with a set of several items: enrolling children in organized leisure activities (4 items) and parental cognitive stimulation at home (6 items). Organized leisure activities were measured in Wave 2 (at the age of five) by asking parents whether their child was currently taking part in regular activities outside preschool. The regular leisure activities items in the questionnaire were sporting activities (e.g., gymnastics, swimming, sports clubs, riding lessons), musical activities (e.g., music lessons, music clubs, music school), language courses to learn a foreign language, and other activities (e.g., painting, ballet). Overall, sport was the most popular activities for the 5-year-olds, followed by music, other activities, and foreign language courses. We collapsed language courses with the "other" category because language course participation was very rare. For the analyses we hence use the three activities sport, music and 'other activities'.

Parental cognitive stimulation at home was measured with parents' self-reports of how often they engaged in learning activities with their children at home. We used data from Wave 2, containing information on the following six activities: reading to the child, painting/crafts/drawing, activities with letters, activities with numbers, teaching poems/rhymes/songs, and visiting the library. Due to skewed distributions, we collapsed the eight response categories into two (daily and less than daily). Overall, parent-child reading was the most popular activity with 73% of parents reading to their children on a daily basis. We decided to exclude the library item because it was a very rare activity at this age and therefore not well suited for measuring parental cognitive stimulation in young children (Aminipour, Asgari, Hejazi, & Roßbach, 2018).

### 5.2.2 Independent variables

We measured family socio-economic status with a dummy variable that indicated whether at least one of the parents had a tertiary education degree (Wave 1). We used a single indicator of socio-economic background rather than a composite score because results tend to differ depending on the indicator used (Duncan & Magnuson, 2003; Linberg & Wenz, 2017). We focused on parental education for theoretical and empirical reasons. In accordance with Weininger, Lareau, and Conley (2015), parental education best captures different cultural orientations rather than mere objective resources or constraints. Parental education is a very good marker for parents' values and beliefs from which their parenting strategies derive (Bradbury, Corak, Waldfogel, & Washbrook, 2015). Furthermore, previous research has often shown that parental education is one of the most reliable predictors of differences in parenting (Duncan & Magnuson, 2003; Hoff, Lausen, & Tardig, 2002). In addition, parental education is very stable during individual life courses, compared to income or occupation, which may fluctuate across time, especially in a family with young children. We constructed the dummy on the basis of the CASMIN classification, which is an established measure for capturing school and vocational qualifications (König, Lüttinger, & Müller, 1988). A more fine-grained differentiation that also included a middle-level education category was not possible due to the small number of observations in the category of low-level education.

### 5.2.3 Controls

In order to reduce bias from omitted variables, we considered several child-level controls, mostly measured in Wave 1: a subjective measure of children's overall health (parent report), children's educational activities at the day-care facilities (caregiver report, sum score of five items: looking at picture books, comparing and sorting, construction games, puzzles, number games), child's age (in months), and child's gender (1 = female).

We also included the following family-level controls: equivalized household income (OECD modified scale, logarithm, in steps of 1,000 Euros), the migration background of the responding parent (= 1 if the parent or one of the grandparents was born outside Germany), number of siblings in the household (Wave 2), resident in West Germany, single parent (= 1 if a parent lived alone in a household, Wave 2), and mothers' weekly working hours (Wave 2).

### 5.3 Analytic approach

Our first step was a general descriptive overview of bivariate associations (group comparisons using percentage point differences and mean comparisons) between the core variables. In a second step, we applied multivariate regression models that allow us to control for potential endogeneity bias. In the first part of our multivariate regressions we examined the relationships between parents' socio-economic status, organized leisure activities, and parental cognitive stimulation. To this end, we used data from Waves 1 and 2. The analytic sample included 1,632 children enrolled in German day-care facilities. To test Hypotheses 1a and 2a, we applied logistic regressions to predict children's probabilities of being enrolled in organized leisure activities and of receiving daily cognitive stimulation from parental background factors. To reduce any confounding bias, we included parental migration background, household income, mothers' working hours, number of siblings in the household, and children's health in the models because they were likely to be correlated with parents' education and our dependent variables. We also controlled for children's age and gender in the models. The logistic regression to test Hypotheses 1a and 2a takes the following form:

$$Logit(ConCul_t) = \beta_0 + SES_{(t-1)} + \beta_1 X_{(t-1)} + e_t \qquad (1)$$

where subscript t refers to the time period; $ConCul_t^*$ represents the probability to carry out the examined parental concerted cultivation activity; $\beta_0$ refers to the model intercept;

$SES_{(t-1)}$denotes parental socio-economic status; $X_{(t-1)}$is a vector of control variables; and e is the random error term.

In the second part of our multivariate analysis, we examined the extent to which enrolling in organized leisure activities and parental cognitive stimulation mediates the effect of parents' education on children's cognitive skill differences. Therefore, we used measures of the dependent variables from Wave 4, but due to the panel attrition, our analyses were based on a smaller sample of 343 children. In order to test our mediation hypotheses 1b and 2b, we estimated separate linear regressions for each of the three outcomes. We included the Wave 2-measure of all dependent variables (lagged dependent variable (LDV) approach, also known as value-added approach). By doing so, we model the association between the independent variables and the growth of individual skills between Wave 2 and Wave 4. The LDV approach has the advantage that it reduces unobserved baseline differences between the children in our sample. This allows us to approximate the association of concerted cultivation with cognitive skills, net of individual advantages that were present already before age 5. The model for each cognitive skill outcome was built in three steps. First, we estimated the relationship between parental education and cognitive skills ($CogSkill_t$ ) controlling for a lag of the dependent variable ($CogSkill_{(t-2)}$), parental migration background, living in West Germany, child gender and age $X_{(t-3)}$):

$$CogSkill_t = \beta_0 + SES_{(t-3)} + \beta_1 X_{(t-3)} + \beta_2 CogSkill_{(t-2)} + e_t (2)$$

In a second step, we added more control variables, which may function as a mediator of the relationship between parental educatioan and cognitive skills but at the same time represent potential confounders for the relationship between organized leisure activities and cognitive skills. This additonal vector of control variables ($Z_{(t-3)}$) consisted of the following variables: household income, single parenthood, mothers' working hours, siblings in the household,

children's educational activities at the day-care center, child health. The second step of the step-wise regression takes the following form:

$$CogSkill_t = \beta_0 + SES_{(t-3)} + \beta_1 X_{(t-3)} + \beta_2 Z_{(t-3)} + \beta_3 CogSkill_{(t-2)} + e_t \quad (3)$$

In a third step, we included a vector of our mediator variables ($ConCul_{(t-2)}$) into the model:

$$CogSkill_t = \beta_0 + SES_{(t-3)} + \beta_1 X_{(t-3)} + \beta_2 Z_{(t-3)} + \beta_3 CogSkill_{(t-2)} + ConCul_{(t-2)} + e_t \quad (4)$$

To test the indirect effect of parents' socio-economic status on children's cognitive skills via concerted cultivation, we used the STATA command khb (Kohler & Karlson, 2011), as it facilitates calculating the size and statistical significance of the mediation effect.

For all our models, we used clustered standard errors to account for the fact that the children were nested in day-care facilities. For all analyses that were based on Waves 1 and 2, we applied a survey weight provided by NEPS (longitudinal weight for the joint participation of parents and children: w_tp12). Given the large attrition rate at the transition to primary school, which is responsible for the sample reduction between Wave 2 and 4, the NEPS team pointed out in personal communication that the survey weights are unlikely to fully compensate for the selectivity in the remaining sample. We therefore decided against applying survey weights for the analyses based on the smaller sample. Instead, we examined the predictors of this attrition at Wave 3 and included variables that were related to sample dropout (e.g., single parenthood, parents' migration background) in the model to reduce bias. Furthermore, we reflected on the implications of the selective attrition for the generalizability of our results in the discussion section.

# 6 Results

## 6.1 Bivariate Results

To provide the first insights into our data, we show the percentages of children enrolled in three organized leisure activities by parents' education using the observed data (Figure 1). Across all activities, children from higher educated families had significantly higher enrollment rates. The largest difference occurred for enrollment in music activities: 52% of children from higher educated families were enrolled in organized music activities, compared to 26% of children from families with lower education. In contrast to our expectations, we did not observe that children from higher educated families were engaged in cognitively stimulating activities significantly more often, except for daily reading to the child (Figure 2). We observed that 84% of the higher educated families reported daily reading, compared to 67% of the families with lower education. However, we found that families with lower education significantly more often reported that they practiced singing or painting with their children daily, compared to families with higher education.

[Figure 1]

[Figure 2]

In a second step, we examined the mean differences in cognitive skills by parental education, children's enrollment in organized leisure activities, and daily parental cognitive stimulation (Table A3). We used the cognitive skill scores from Wave 4 (N=343). As expected, parental education was significantly and positively related to all three cognitive skill measures. Furthermore, our results showed that, on average, children who were enrolled in organized music activities had significantly higher values on all cognitive skill measures compared to children who were not enrolled. The largest mean difference existed in math

scores (.522 SDs), closely followed by differences in reasoning (.460 SDs), and concentration (.413 SDs). Similarly, children who were enrolled in organized sporting activities had higher means on all cognitive skill measures compared to children who were not enrolled. Yet, only the mean differences in math and concentration skills were statistically significant (.533 and .252 SDs, respectively). Being enrolled in any other activity was only significantly related to higher concentration abilities (.220 SDs). Regarding parents' promotion of cognitively stimulating activities, we found that only daily parent-child reading was significantly related to higher means in math, reasoning, and concentration skills (.401, .341, .311 SDs, respectively).

# 7 Multiple Regression Analyses

## 7.1 Enrollment in Organized Leisure Activities and Parents' Promotion of Cognitive Stimulation by Parents' Socio-Economic Status

In the first part of the multiple regression analyses, we estimated a logistic regression for each concerted cultivation indicator to test Hypotheses 1a and 2a. Table 1 presents the average marginal effects of parental background characteristics on enrollment in organized sports, music, or any other activity at the age of five. In line with Hypothesis 1a, the results showed that, on average, children from higher educated families were around 9 percentage points more likely to be enrolled in organized sporting activities and around 19 percentage points more likely to be enrolled in organized music activities than children of lower educated parents. Regarding children's enrollment in any other organized leisure activity, we did not find significant differences between children from families with higher and lower levels of education.

[Table 1]

Table 2 shows the average marginal effects of parental background characteristics on five distinct parent-guided cognitively stimulating activities, which represented our second measure of concerted cultivation. As stated in Hypothesis 2a, we expected that higher educated parents were more likely to frequently offer their children cognitively stimulating activities at home. On average, 5-year-olds from higher educated families were around 12 percentage points more likely to be read to daily. This was in line with our expectations. Yet, these families were significantly less likely to teach their children songs or to play number games with their children on a daily basis. Unexpectedly, we did not find significant differences in cognitively stimulating activities with letters by parents' education.

[Table 2]

### 7.2 Enrollment in Organized Leisure Activities and Parental Cognitive Stimulation as Mediators

In the second part of our analysis, we tested our mediation Hypotheses 1b and 2b by estimating lagged dependent variable (LDV) regressions for each of our three cognitive skill measures (Table 3). As we showed in the first part of the analysis, parents' education was positively related only to enrolling children in sports, enrolling children in music, and daily reading to the child. Hence, only these three forms of parental investment were potential mediators that might explain skill differences in children from families with varying educational degrees. Therefore, the following analyses focused only on these three potential mediators.

We tested the proposed mediation with stepwise regressions. First, we estimated the relationship between parental education and cognitive skills while controlling for the baseline heterogeneity (skill measure from Wave 2), migration background, living in West Germany, gender and age of child (Models 1, 4, and 5). Children of higher educated parents showed a

stronger growth in math and reasoning skills between Wave 2 and Wave 4. For instance, the background-specific difference in growth of children's math skills was .389 standard deviations (SDs). By contrast, parents' education did not predict growth in concentration skills. Second, we included additional covariates that may represent potential common causes of our mediator and dependent variables into the models (Models 2, 5, and 8). Some of these covariates represent also potential mediators of the relationship between parental education and children's cognitive skills which is reflected in the reduction of the coefficient of parental education. Regarding other parental background factors, we observed a positive relationship between household income and children's reasoning and concentration skills. Parents' migration background was not significantly related to any growth in cognitive skills.

In a third step, we included our hypothesized mediators (i.e., organized sporting activities, organized music activities, and daily reading to the child) in the regression models (Models 3, 6, and 9). On average, enrolling in organized music activities was related to a .260 SD increase in mathematic skill-growth. Similarly, enrolling in music activities was positively related to growth in reasoning (.299 SD) and concentration skills (.224 SD). Neither enrollment in organized sports nor daily reading to the child was significantly associated with growth in any cognitive skill. In the models predicting growth in math and reasoning skills, we observed that the coefficient for parents' education level was reduced once the mediators were introduced (Models 3 and 6). However, neither enrollment in organized sports nor daily reading to the child was significantly associated with growth in any cognitive skill. This indicates that these activities are unlikely to act as mediator between parental background and cognitive skills. The only activity that renders significant effects on all three outcomes is music enrollment. This may indicate that music enrollment is a mediator of the association between parental background and math as well as reasoning. As there is no significant association between parental background and concentration which could be mediated, the

question of mediation is obsolete. We nevertheless also observed a drop of the association between parental background and concentration once the mediators were introduced. In the full model predicting reasoning skills (Model 6), the coefficient for parents' education was even rendered non-significant. This lends some support to Hypothesis 1b for music on math and reasoning, but not for concentration. Hypothesis 2b was not supported by the data as we do not observe an association between parent-child reading and cognitive skill growth.

As a final step, we computed the indirect effects to examine the magnitude and significance of the mediation through participation in organized music activities at the age of five (see Appendix, Table A4). Standard errors of the indirect effects were obtained using the delta method (Sobel, 1982) which is implemented using the using the KHB method (STATA command khb; Kohler & Karlson, 2011). The indirect effect from parents' education to math skills via children's enrollment in music activities was significant at the 10% level. The same applied to the indirect effect from parents' education to basic reasoning skills via children's enrollment in music activities. Enrollment in organized music activities explained around 12% (i.e., indirect effect/total effect) of the relationship between parents' education and children's math skills and around 17% of the relationship between parents' education and children's reasoning skills. These results confirm our above support for Hypothesis 1b.

[Table 3]

## 8 Sensitivity Analyses

We ran additional analyses to demonstrate to which extent our results are sensitive to model specifications. In order to address concerns that the binary coding (daily vs. less than daily) of parental cognitive stimulation at home influenced our conclusions about the relationship between parents' socio-economic status and indicators of parental cognitive stimulation, we ran the logit models using an alternative coding (Table A6). We collapsed the

response categories into two categories, distinguishing between parents who reported engaging in an activity with their child at least weekly or less than weekly. In line with the main models above, the results from these models suggested that parents' education was significantly positively related only to reading activities.

Next, we addressed concerns that the relationship between children's music activities and their math skills is driven by the common cause of parents' cultural capital. We ran the model including parents' cultural capital measured as number of books at home and parental cultural activity in order to test whether parents' cultural capital was indeed a common cause that was confounding the mediator-outcome relationship. However, parents' cultural capital was not significantly associated with children's math scores (Table A7). In addition, an analysis using the KHB method (Kohler & Karlson, 2011) showed that parental cultural capital was not a significant confounder of the relationship between music participation and math. Including cultural capital in our mediation models may introduce bias through an overcontrol of the relationship between parents' education and concerted cultivation. Therefore, we decided to report the main models without parental cultural capital as a covariate.

We conducted an additional analysis to address concerns that the non-significant relationship between indicators of parental cognitive stimulation and children's cognitive skills were related to the choice of dependent variables. We ran the models using children's vocabulary skills as the dependent variable (Table A8). The results showed that parents' education was not related to children's growth in German vocabulary between Wave 1 and Wave 3. Yet, we found a significant positive relationship between parent-child reading and children's vocabulary test scores. Hence, reading seems to be a parenting behavior that can increase children's vocabulary. However, the vocabulary skills were measured in Waves 1 and 3, which differed from the time points for the other dependent variables (Waves 2 and 4)

used in the main analysis. We did not include these results in order to maintain comparability of the variables in the models.

Furthermore, we ran the mediation analyses with different model specifications: (1) full sample with outcome measured in Wave 2; (2) small sample (using only respondents who participated in Wave 4) with outcome measured in Wave 2; (3) small sample with outcome measured in Wave 4, without the lagged dependent variable; (4) small sample with outcome measured in Wave 4, with the lagged dependent variable (Figure A1). A comparison of the coefficients between the two models with outcomes measured in Wave 2 (black and grey markers), shows the extent to which panel attrition may have influenced the results. A comparison of the confidence intervals (large versus small sample Wave 2) indicates to what extent our results may be biased through a lack of power in the reduced sample. Some of the associations would be significant with a larger sample (sports with math, reading with math, and reading with concentration). However, we do not know if this would still be true if a lagged dependent variable were included. Reducing the baseline heterogeneity may also lead to non-significant effects, even in a larger sample.

A comparison of the effect magnitude in the large sample compared to the small sample with outcomes measured in Wave 2 may indicate how sensitive a specific association is to selective sample attrition. It is striking that primarily the associations involving reasoning and reading are sensitive to the selective attrition, which may be driven by the reduced share of children with migration background in the small sample, as these indicators involve language capacities to some extent. The associations of music enrollment with any of the outcomes are not sensitive to selective attrition. It is, however, noteworthy that the effect magnitude jumps up in the Wave 4-models. As an explanation, we may speculate that music training shows its full benefits for children's skill development only after a certain exposure and duration of practice. To conclude, the reduction in the sample size may have led to an underestimation of

the effects of our mediators, in particular for parental reading. The reported findings in the main analysis about the association between music and cognitive skills, however, are supported by our sensitivity analysis.

In addition, we estimated all mediation models using an indicator of the total hours spent engaged in organized leisure activities (Table A9). The latter did not predict growth in any of the cognitive skill measures. We checked for multicollinearity of the variables in the final models. The variance inflation factors (VIF, calculated with mivif) were all around 1, which indicates that the analysis does not suffer from multicollinearity problems (Table A10).

## 9 Discussion

This paper contributes to our understanding of how educational inequalities widen across the transition from preschool to elementary school and how disadvantages are transmitted from parents to children in the context of the German society. In order to explain this phenomenon, we referred to Lareau's theoretical concept of concerted cultivation—a parenting strategy that focuses on the continuous fostering of children's skills through various parenting behaviors—which is prominent in families of higher social classes. For this study, we applied Lareau's concept of concerted cultivation, which arose from observations of families with school children to the context of preschool children. We proposed a theoretical extension of her concepts to suit the preschool context. We argued that concerted cultivation is likely to be visible already during early childhood and that it is likely to be reflected not just in enrollment in organized leisure activities but also in the degree of parental cognitive stimulation.

To test our hypotheses, we analyzed German panel data from children in day-care. In the first part of our analysis, we found that socio-economic status, measured as parents' education, was positively related to distinct indicators of concerted cultivation. Children from

families with higher socio-economic status were more likely to be enrolled in music and sports, a finding that is in line with previous research (Carolan, 2018; Carolan & Wasserman, 2015; Coulangeon, 2018; Dumais, 2006; Moll & Betz, 2014). We found that only reading was significantly positively related to parents' socio-economic status, but not other forms of parental cognitive stimulation. This finding is surprising given previous research that shows a positive relationship between parental socio-economic status and home learning environment (Guo & Harris, 2000; Kluczniok & Mudiappa, 2018; Niklas & Schneider, 2017). These studies, however, used sum scores rather than single items, which may disguise that only few types of parental activities drive the observed association. Another explanation for our findings may be that - at this early age - parents with a higher socio-economic status focus on other stimulation activities that are perceived as more appropriate for this age group. In the case of Germany, where preschool is not part of the formal educational system like in the U.S., the idea of teaching children academic content already before they enter school is comparatively new (Knauf, 2019). From a theoretical perspective, our results may explain why Lareau did not report rich parental cognitive stimulation at home as a core dimension of parenting of the middle-class. Also, the finding is in line with Schaub's (2010) argument that parental cognitive stimulation may have become a normative behavior at the end of the 20$^{th}$ century and therefore may be independent of parents' socio-economic status (see also research by Cano et al., 2019; Craig, Powell, & Smyth, 2014).

In the second part of our analysis, we focused on the relationship between concerted cultivation and children's cognitive skills. The results showed that only participation in music activities at the age of five, but not sports, was significantly positively related to children's cognitive skills at the age of seven. This finding is in line with research by Cabane et al. (2016), who used German data and explicitly focused on comparing the benefits of sports and music activities. Yet, our finding is in contrast with studies that found a positive relationship

between dance or athletic activities and children's math or reading skills (Covay & Carbonaro, 2010; Dumais 2006). Our rather broad measurement of organized sports activities may have hidden some of the positive associations between cognitive stimulation and children's cognitive skill gain. Specific sports activities may indeed contribute to cognitive skills gains. Furthermore, the children in our sample were very young, so that we believe their sports activities are more likely to trigger motoric skills rather than cognitive skills compared to sports training at later ages. Since the samples, cultural contexts, and operationalizations vary between our study and previous research, some of these differences may explain the varying results. Further research is needed on the specific mechanisms through which different activities contribute to cognitive skill gains.

Our mediation analysis showed that music participation explained a modest portion of the differences in math and reasoning skills that existed between children from different socio-economic backgrounds. Yet, the strength of the association of music participation with math skills is somewhat larger than the association reported in the meta-analysis (Cohen's d=0.17) by Sala and Gobet (2017). Our sensitivity analyses showed that our sample does suffer from selective attrition, but that – unlike the other two predictors – especially music and its association with cognitive outcomes seems to be only marginally affected by this attrition. Although we suggest a cautious interpretation of the results, we have reason to be confident that our analyses for music are reasonably robust. We, therefore, suggest the following explanations for the deviating results. First, experimental studies (Kaviani, Mirbaha, Pournaseh, & Sagan, 2014; Rauscher et al., 1997; Schellenberg, 2004) also report non-negligible effects of music training on cognitive outcomes. The experimental design of these studies neutralizes the influence of unobserved confounders, which lends certain credibility to our results. We controlled for a rich set of covariates but we cannot entirely rule out that part of the association between music and cognitive skills is driven by unobserved

confounders, which may increase the magnitude of the relationship. Moreover, our study assumes exposure to music training over an extended period, whereas the typical experimental study takes place within a limited time frame. If we assume that music training does not take effect immediately, but rather after a longer period of enduring training, the effect in our analyses may not materialize before age seven. Given that our observation period is longer than in the typical experimental setting, it also may be plausible that our effects render somewhat larger than in previous research. This, however, certainly is an aspect of concerted cultivation that deserves further scrutiny and validation in the future. Parent-child reading at the age of five was not related to growth in the three sets of cognitive skills we focused on but was related to vocabulary development, as shown in the sensitivity analyses (Table A8). Overall, our findings suggest that only a small set of parenting behaviors of higher educated parents is related to actual cognitive skill gains. Yet, in particular, those activities with the clearest association with parental education were those that turned out to predict children's cognitive skill development. This shows that highly educated parents, consciously or unconsciously, apply the parenting behaviors with the highest pay-off.

Yet, the results of this study should be interpreted with some limitations in mind. First, as with all studies based on observational data, we cannot rule out that our results are biased by unobserved heterogeneity, even though we controlled for a large set of covariates, including pretest scores on our cognitive skill measures. Second, due to the small sample sizes on which the second part of our analysis was based, our findings cannot be generalized to the German population. The analysis of attrition suggested that the sample of the mediation analysis was more privileged (fewer single-parent households and parents with migration background), which may have biased the benefits of concerted cultivation downwards. We suggest that this attrition may primarily affect outcomes and activities that involve language skills (reasoning and reading), because of the higher share of native Germans in the reduced sample. Moreover,

our sensitivity analyses showed that some of the associations between our independent and dependent variables might have become significant using a larger sample. This concerns in particular the relationships of sports enrollment with math skills, of reading with math skills, and of reading with concertation skills). Yet, we cannot apply a LDV approach to the Wave 2-only-analyses and therefore it is not possible to establish whether non-significant results are driven by power issues or by baseline heterogeneities. Another limitation is that our study was restricted to observations of children enrolled in day-care facilities. However, only 4% of the 5-year-olds in Germany are not enrolled in a day-care facility, and this group consists of children from various social backgrounds. Hence, a day-care sample should be largely representative (Schmitz & Spieß, 2018; Schober & Spieß, 2013). Fourth, we focused on only three types of cognitive skills. Therefore the data did not allow us to study the role of non-cognitive skills. For instance, organized sports participation may contribute to children's skills such as team spirit, leadership skills, adherence to rules, perseverance and frustration tolerance, which we could not assess in this study. Therefore, it is important that future studies examine a diverse set of outcome measures including cognitive and noncognitive skills. Furthermore, it may be valuable to use two types of academic outcome measures: standardized test scores and more subjective skills ratings by teachers (e.g., Coulangeon, 2018). Using merely standardized scores does not allow to capture “symbolic benefits” of concerted cultivation on academic outcomes (Authors, 2020). Finally, our concerted cultivation measures were based on parents’ self-reports so that we cannot rule out the possibility that the responses were influenced by social desirability or other sources of measurement error. Also, organized leisure activities were measured only with a dummy variable indicating enrollment. Unfortunately, the data neither allowed us to examine the role of the time spent in each activity nor the quality of these activities. This also applies to our measures of parental cognitive stimulation. Interestingly, however, our sensitivity analyses showed that the overall amount

of time spent in organized leisure activities did not significantly explain the social gradient in growth in cognitive skills. Another limitation of the data was that we were not able to differentiate between maternal and paternal involvement. Yet, research has shown that the children's gains of the stimulation may differ between mothers and fathers (Cano et al., 2019; Hsin & Felfe, 2014). Future data collections should, therefore, collect precise information on the involvement of each parent.

Despite these limitations, our study provides valuable insights into socio-economic background differences in parenting strategies in Germany and hence fills a gap in existing research. Our analyses showed that concerted cultivation is a phenomenon that is already visible during preschool age and also exists in the context of Germany. Growing up in a family in which at least one parent has a tertiary degree provides children with a somewhat higher level of stimulating activities inside and outside the home. Concerted cultivation was most strongly reflected in the dimension of enrollment in non-formal music activities. Although organized leisure activities are strongly subsidized in Germany, children from lower income families still tend to be enrolled in these activities less often. Hence, reducing financial barriers might not be sufficient for achieving equal levels of enrollment in organized leisure activities across social classes. On the whole, however, concerted cultivation appears to play a minor role for the intergenerational reproduction of social inequalities in the three cognitive skills domains included in our study. Our results suggest that besides organized music activities at a young age, none of the observed differences explain the skill gap in cognitive skills. Hence, it remains a puzzle how cognitive skill differences evolve and how current parenting strategies are shaping these.

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## Tables

Table 1

*Average marginal effects of family background predicting enrollment in organized leisure activities (logistic regression).*

| | Sports | Music | Other |
|---|---|---|---|
| Tertiary education degree | 0.092** | 0.190*** | 0.032 |
| (family, yes = 1) | (0.034) | (0.034) | (0.037) |
| *Control variables (family):* | | | |
| HH income | 0.192*** | 0.122** | 0.098* |
| (log, in 1,000) | (0.036) | (0.040) | (0.044) |
| Migration background (yes = 1) | -0.091* | -0.061 | 0.031 |
| | (0.038) | (0.042) | (0.039) |
| West Germany (yes = 1) | 0.203*** | -0.007 | -0.062 |
| | (0.035) | (0.047) | (0.042) |
| Mothers' working hours | -0.001 | -0.000 | -0.000 |
| (hr/week) | (0.001) | (0.001) | (0.001) |
| No. siblings in hh | -0.045** | 0.013 | -0.055** |
| | (0.014) | (0.015) | (0.018) |
| Single parent hh (yes = 1) | 0.082* | 0.081 | 0.000 |
| | (0.038) | (0.054) | (0.047) |
| *Control variables (child):* | | | |
| Girl (yes = 1) | 0.021 | 0.142*** | 0.246*** |
| | (0.030) | (0.033) | (0.028) |
| Child's age (months) | -0.006 | 0.004 | -0.002 |
| | (0.003) | (0.004) | (0.004) |
| Child's health | -0.027 | -0.025 | 0.051* |
| | (0.023) | (0.023) | (0.026) |
| N | 1,632 | 1,632 | 1,632 |

*Note*. Based on imputed and weighted data. Standard errors in parentheses (clustered: day-care facility); hh=household. Source: NEPS SC2 v6-0-1.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

*Average marginal effects of family background predicting stimulating activities at home (logistic regression).*

| | Reading | Number activ. | Letter activ. | Teaching songs | Painting |
|---|---|---|---|---|---|
| Tertiary educ. degree | 0.122** | -0.107** | -0.060 | -0.057* | -0.034 |
| (family, yes = 1) | (0.037) | (0.040) | (0.037) | (0.028) | (0.039) |
| *Control variables (family):* | | | | | |
| HH income | 0.103** | 0.105* | 0.045 | 0.044 | -0.063 |
| (log, in 1,000) | (0.039) | (0.043) | (0.044) | (0.029) | (0.048) |
| Migration background (yes = 1) | -0.072 | -0.014 | -0.002 | 0.088*** | 0.078* |
| | (0.039) | (0.035) | (0.035) | (0.024) | (0.033) |
| West Germany (yes = 1) | 0.073* | -0.004 | 0.021 | 0.031 | 0.074 |
| | (0.030) | (0.047) | (0.044) | (0.033) | (0.043) |
| Mothers' working hours | -0.001 | -0.000 | 0.003* | -0.000 | 0.001 |
| (hr/week) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| No. siblings in hh | -0.024 | 0.006 | -0.012 | 0.027* | -0.003 |
| | (0.014) | (0.016) | (0.017) | (0.012) | (0.017) |
| Single parent hh (yes = 1) | -0.070 | 0.002 | -0.002 | 0.005 | 0.017 |
| | (0.047) | (0.058) | (0.058) | (0.041) | (0.058) |
| *Control variables (child):* | | | | | |
| Girl (yes = 1) | 0.036 | 0.034 | 0.079* | 0.049* | 0.070* |
| | (0.030) | (0.034) | (0.031) | (0.023) | (0.032) |
| Child's age (months) | -0.000 | -0.012** | -0.002 | -0.002 | -0.008* |
| | (0.003) | (0.004) | (0.004) | (0.003) | (0.003) |
| Child's health | 0.001 | -0.005 | -0.044 | 0.016 | -0.003 |
| | (0.025) | (0.023) | (0.026) | (0.021) | (0.024) |
| N | 1,632 | 1,632 | 1,632 | 1,632 | 1,632 |

*Note*. Based on imputed and weighted data. Standard errors in parentheses (clustered: day-care facility); hh=household. Source: NEPS SC2 v6-0-1.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table3

*LDV regression of children's cognitive skills (w4, std) on organized leisure (OA) and parent-child reading*

| | Math (m1) | Math (m2) | Math (m3) | Reasoning (m4) | Reasoning (m5) | Reasoning (m6) | Concentr. (m7) | Concentr. (m8) | Concentr. (m9) |
|---|---|---|---|---|---|---|---|---|---|
| Tertiary educ. degree (family, yes=1) | 0.389*** | 0.352*** | 0.282** | 0.307** | 0.268* | 0.220 | 0.140 | 0.023 | -0.048 |
| | (0.081) | (0.098) | (0.101) | (0.097) | (0.107) | (0.111) | (0.109) | (0.117) | (0.122) |
| *Mediators:* | | | | | | | | | |
| Sports (w2) | | | 0.103 | | | -0.111 | | | 0.053 |
| | | | (0.115) | | | (0.139) | | | (0.172) |
| Music (w2) | | | 0.260** | | | 0.299* | | | 0.224* |
| | | | (0.097) | | | (0.120) | | | (0.107) |
| Reading to child (w2) | | | 0.071 | | | 0.054 | | | 0.131 |
| | | | (0.104) | | | (0.155) | | | (0.132) |
| *Control variables (family):* | | | | | | | | | |
| HH income (log, in 1000) | | 0.242* | 0.206 | | 0.291 | 0.268 | | 0.404** | 0.368* |
| | | (0.118) | (0.119) | | (0.166) | (0.168) | | (0.146) | (0.145) |
| Migration background | 0.110 | 0.145 | 0.167 | -0.009 | 0.061 | 0.084 | -0.143 | -0.105 | -0.079 |
| | (0.118) | (0.111) | (0.110) | (0.168) | (0.168) | (0.169) | (0.156) | (0.156) | (0.155) |
| West-Germany (yes=1) | 0.137 | 0.096 | 0.056 | 0.324* | 0.226 | 0.229 | 0.073 | 0.052 | 0.014 |
| | (0.120) | (0.128) | (0.134) | (0.151) | (0.163) | (0.154) | (0.113) | (0.120) | (0.122) |
| Mothers' working hours (h/week) | | -0.004 | -0.003 | | -0.007 | -0.006 | | -0.002 | -0.001 |
| | | (0.003) | (0.003) | | (0.004) | (0.004) | | (0.004) | (0.004) |
| No. siblings in hh | | -0.070 | -0.072 | | -0.078 | -0.092 | | -0.027 | -0.024 |
| | | (0.053) | (0.051) | | (0.061) | (0.059) | | (0.058) | (0.058) |
| Single parent hh (yes=1) | | 0.017 | 0.009 | | 0.200 | 0.182 | | -0.105 | -0.103 |
| | | (0.163) | (0.172) | | (0.279) | (0.279) | | (0.265) | (0.269) |
| *Control variables (child):* | | | | | | | | | |
| Girl | -0.020 | -0.033 | -0.080 | -0.041 | -0.036 | -0.065 | 0.413*** | 0.393*** | 0.361*** |
| | (0.085) | (0.085) | (0.088) | (0.103) | (0.100) | (0.104) | (0.093) | (0.094) | (0.102) |
| Child's age (month) | -0.016 | -0.017 | -0.018 | -0.008 | -0.012 | -0.013 | 0.003 | -0.000 | -0.001 |
| | (0.011) | (0.011) | (0.011) | (0.012) | (0.012) | (0.012) | (0.014) | (0.014) | (0.014) |
| Educ activities (sum, preschool) | | 0.014 | 0.013 | | 0.021 | 0.018 | | 0.026** | 0.024* |
| | | (0.010) | (0.010) | | (0.012) | (0.012) | | (0.010) | (0.010) |
| Child's health | | -0.018 | -0.001 | | -0.091 | -0.075 | | 0.108 | 0.119 |
| | | (0.079) | (0.080) | | (0.098) | (0.099) | | (0.085) | (0.086) |
| *Lagged dependent variable:* | | | | | | | | | |
| Math (w2, std, WLE) | 0.559*** | 0.525*** | 0.506*** | | | | | | |
| | (0.050) | (0.049) | (0.050) | | | | | | |
| Cognitive abilities (w2, std) | | | | 0.254*** | 0.239*** | 0.226*** | | | |
| | | | | (0.045) | (0.045) | (0.044) | | | |
| Concentration (w2, std) | | | | | | | 0.287*** | 0.257*** | 0.253*** |
| | | | | | | | (0.058) | (0.058) | (0.056) |
| N | 343 | 343 | 343 | 343 | 343 | 343 | 343 | 343 | 343 |

*Note*. Based on imputed sample. Standard errors in parentheses (clustered: day-care facility); hh=household. Source: NEPS SC2 v6-0-1.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

## Figures

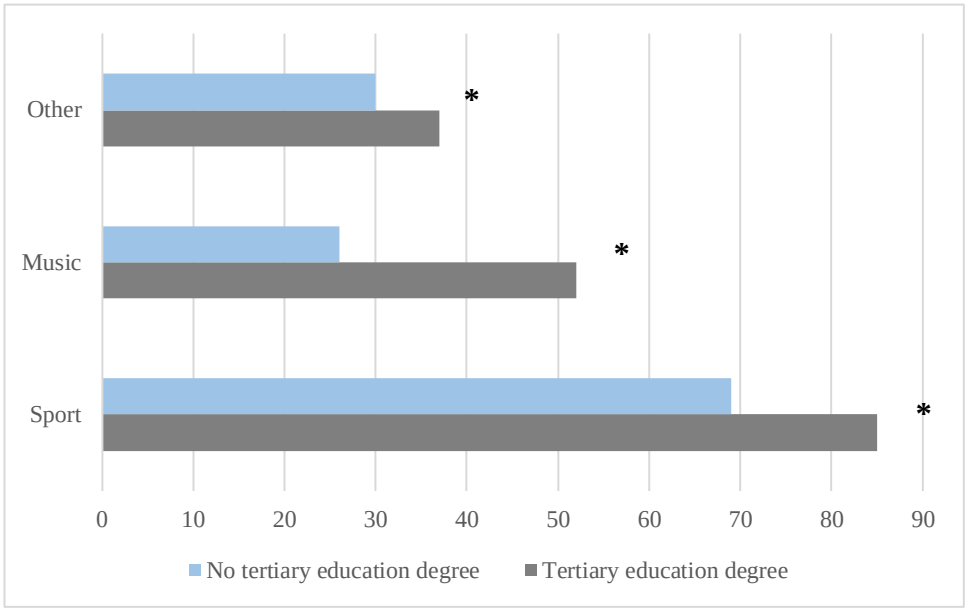


*Figure 1.* Percentages of children enrolled in organized leisure activities (Wave 2) by parental education. Based on weighted observed data. $N_{Sports}$ = 1,625 $N_{Music}$ = 1,624 $N_{Other}$ = 1,624. *Indicates significant differences between groups at $p < .05$. Significance tests were based on an F-statistic equivalent to Pearson chi-squared statistic corrected for survey weights (Rao & Scott, 1984).

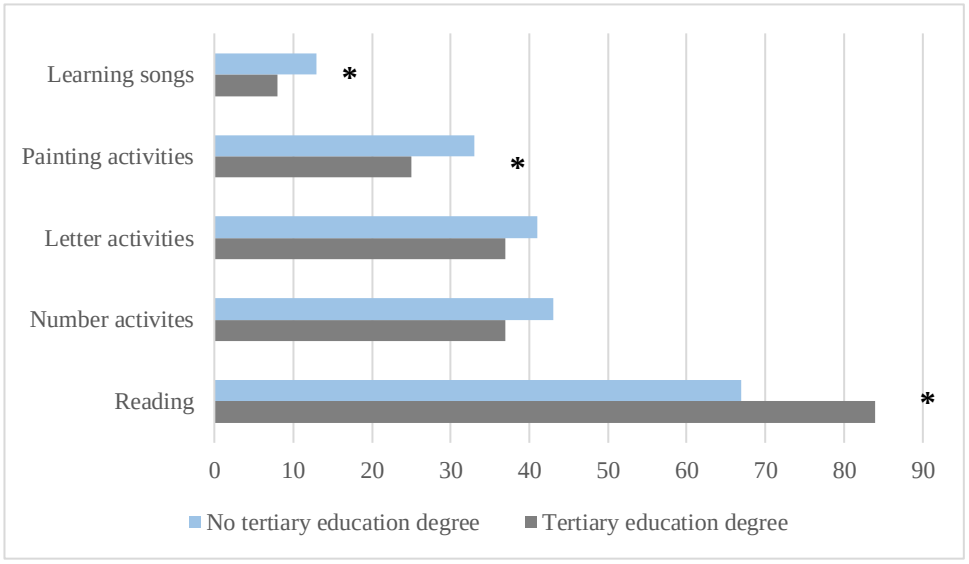


*Figure 2.* Percentages of children who were given daily cognitively stimulating activities (Wave 2) by parental education. Based on weighted observed data. $N_{Reading}$ = 1,632 $N_{Number}$ = 1,628 $N_{Letter}$ = 1,629 $N_{Paint}$ = 1,632 $N_{Songs}$ = 1,630. *Indicates significant differences between groups at p < .05. Significance tests were based on an F-statistic equivalent to Pearson chi-squared statistic corrected for survey weights (Rao & Scott, 1984).

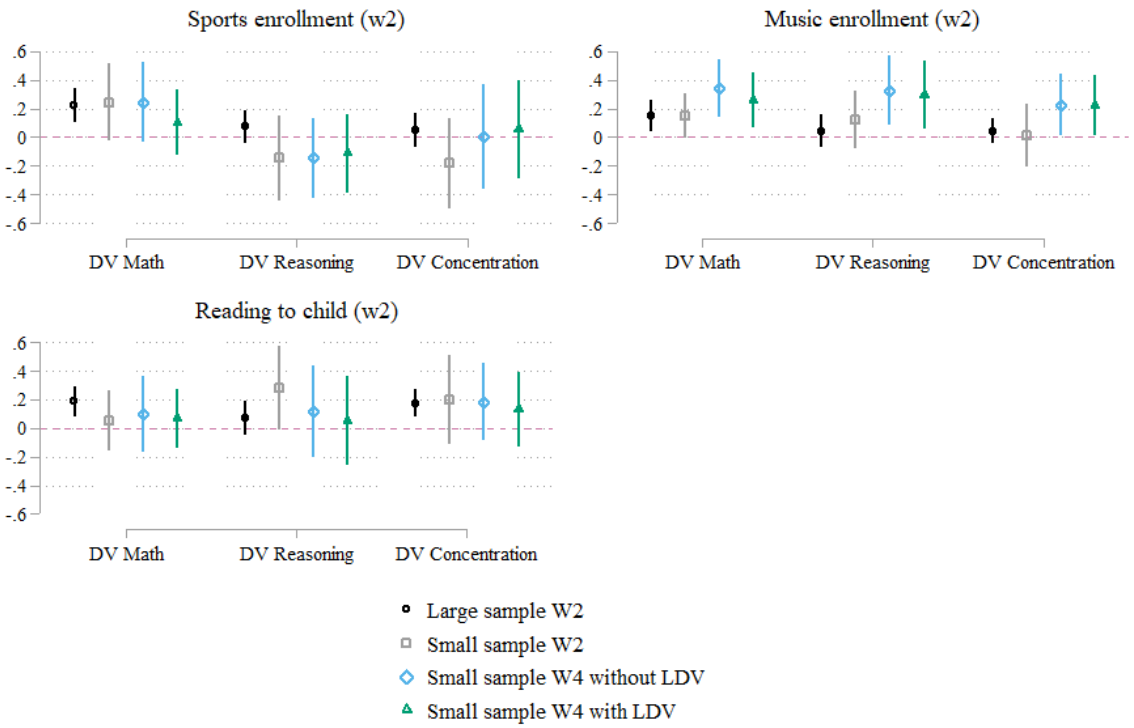


*Figure A1*. Regression coefficient plot of full models including all three mediators (with 95% confidence interval). Each subgraph shows how the coefficients of the mediators for each dependent variable differ by choice of the analysis sample or the inclusion of a lagged dependent variable (LDV).

# Tables for Appendix

Table A1

*Descriptive statistics of variables (Sample of Wave 1 and 2).*

| | Mean/% | SD | Min. | Max | N | No. missing | % missing |
|---|---|---|---|---|---|---|---|
| **Organized leisure activities** | | | | | | | |
| Sports | 74 | 0.60 | 0.00 | 1.00 | 1625 | 7 | 0.40 |
| Music | 35 | 0.63 | 0.00 | 1.00 | 1624 | 8 | 0.50 |
| Other | 32 | 0.61 | 0.00 | 1.00 | 1624 | 8 | 0.50 |
| **Cognitive stimulation at home** | | | | | | | |
| Reading to child (daily) | 73 | 0.59 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| Number activities (daily) | 41 | 0.66 | 0.00 | 1.00 | 1628 | 4 | 0.20 |
| Letter activities (daily) | 40 | 0.65 | 0.00 | 1.00 | 1629 | 3 | 0.20 |
| Teaching songs (daily) | 11 | 0.47 | 0.00 | 1.00 | 1630 | 2 | 0.10 |
| Painting (daily) | 30 | 0.63 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| **Socio-demographic variables** | | | | | | | |
| Tertiary educ. degree (family) | 34 | 0.63 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| HH equiv. income (log, in 1,000) | 0.34 | 0.63 | -2.10 | 2.15 | 1407 | 225 | 13.80 |
| Migration background | 26 | 0.61 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| West Germany (yes = 1) | 83 | 0.47 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| Mother's working hours | 19.51 | 22.01 | 0.00 | 80.00 | 1615 | 17 | 1.00 |
| No. siblings in hh | 1.10 | 1.21 | 0.00 | 8.00 | 1632 | 0 | 0.00 |
| Single parent hh (yes = 1) | 10 | 0.40 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| Girl (yes = 1) | 50 | 0.67 | 0.00 | 1.00 | 1632 | 0 | 0.00 |
| Child's age (months) | 62.43 | 5.83 | 50.00 | 77.00 | 1632 | 0 | 0.00 |
| Child's health | 4.60 | 0.81 | 1.00 | 5.00 | 1632 | 0 | 0.00 |

*Note.* Estimates based on weighted observed data. hh=household; SD=standard deviation. Source: NEPS SC2 v6-0-1.

Table A2

*Descriptive statistics of variables (Sample of Wave 1, 2, and 4).*

| | Mean/% | SD | Min. | Max | N | No. missing | % missing |
|---|---|---|---|---|---|---|---|
| **Dependent variables** | | | | | | | |
| Math skills (w2) | 0.47 | 0.97 | -2.60 | 4.72 | 343 | 0 | 0.00 |
| Reasoning skills (w2) | 5.79 | 2.22 | 3.00 | 10.00 | 342 | 1 | 0.30 |
| Concentration skills (w2) | 3.37 | 0.93 | 1.00 | 5.00 | 342 | 1 | 0.30 |
| Math skills (w4) | 2.52 | 1.17 | -0.40 | 6.57 | 334 | 9 | 2.60 |
| Reasoning skills (w4) | 7.00 | 2.04 | 3.00 | 10.00 | 329 | 14 | 4.10 |
| Concentration skills (w4) | 3.38 | 1.20 | 1.00 | 5.00 | 341 | 2 | 0.60 |
| **Organized leisure activities** | | | | | | | |
| Sports | 83 | 0.38 | 0.00 | 1.00 | 341 | 2 | 0.60 |
| Music | 37 | 0.48 | 0.00 | 1.00 | 341 | 2 | 0.60 |
| Other | 33 | 0.47 | 0.00 | 1.00 | 341 | 2 | 0.60 |
| **Cognitive stimulation at home** | | | | | | | |
| Reading to child (daily) | 78 | 0.42 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| Number activities (daily) | 43 | 0.50 | 0.00 | 1.00 | 342 | 1 | 0.30 |
| Letter activities (daily) | 41 | 0.49 | 0.00 | 1.00 | 342 | 1 | 0.30 |
| Teaching songs (daily) | 8 | 0.27 | 0.00 | 1.00 | 343 | 1 | 0.30 |
| Painting (daily) | 27 | 0.44 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| **Socio-demographic variables** | | | | | | | |
| Tertiary educ. degree (family) | 39 | 0.49 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| HH equiv. income (log, in 1,000) | 0.41 | 0.40 | -0.87 | 1.73 | 300 | 43 | 12.50 |
| Migration background | 13 | 0.33 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| West Germany (yes = 1) | 81 | 0.39 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| Mother's working hours | 19.43 | 14.74 | 0.00 | 65.00 | 340 | 3 | 0.90 |
| No. siblings in hh | 1.00 | 0.89 | 0.00 | 7.00 | 343 | 0 | 0.00 |
| Single parent hh (yes = 1) | 5 | 0.22 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| Girl (yes=1) | 48 | 0.50 | 0.00 | 1.00 | 343 | 0 | 0.00 |
| Child's age (months) | 62.63 | 4.09 | 53.00 | 77.00 | 343 | 0 | 0.00 |
| Educational activities (preschool) | 29.85 | 5.23 | 12.00 | 40.00 | 325 | 18 | 5.20 |
| Child's health | 4.63 | 0.56 | 2.00 | 5.00 | 343 | 0 | 0.00 |

*Note.* Estimates based on observed data. hh=household; SD=Standard deviation. Source: NEPS SC2 v6-0-1.

Table A3

*Means of cognitive skill measures (Wave 4) by parental education, organized leisure activity enrollment and daily cognitive stimulating activities.*

| | Math | | | Reasoning | | | Concentration | | |
|---|---|---|---|---|---|---|---|---|---|
| | yes | no | mean difference | yes | no | mean difference | yes | no | mean difference |
| Tertiary education (family) | 0.381 | -0.246 | 0.627*** | 0.237 | -0.147 | 0.384*** | 0.164 | -0.105 | 0.269** |
| *Organized leisure activities* | | | | | | | | | |
| Music | 0.336 | -0.186 | 0.522*** | 0.297 | -0.163 | 0.460*** | 0.268 | -0.146 | 0.414*** |
| Sports | 0.096 | -0.437 | 0.533*** | 0.027 | -0.120 | 0.147 | 0.050 | -0.202 | 0.252* |
| Other | 0.110 | -0.048 | 0.158 | 0.009 | -0.002 | 0.011 | 0.155 | -0.065 | 0.220* |
| *Cognitive stimulation at home* | | | | | | | | | |
| Reading | 0.090 | -0.311 | 0.401*** | 0.077 | -0.264 | 0.341** | 0.070 | -0.241 | 0.311** |
| Number act. | -0.018 | 0.016 | -0.034 | 0.000 | 0.010 | -0.010 | -0.042 | 0.037 | -0.079 |
| Letter act. | -0.034 | 0.027 | -0.061 | -0.051 | 0.030 | -0.081 | -0.082 | 0.066 | -0.148 |
| Teaching songs | -0.221 | 0.023 | -0.244 | -0.137 | 0.011 | -0.148 | 0.083 | -0.009 | 0.092 |
| Painting | -0.227 | 0.082 | -0.309 | -0.045 | 0.016 | -0.061 | -0.045 | 0.016 | -0.061 |

*Note*. Significance based on t-test. Estimates based on observed data. Source: NEPS SC2 v6-0-1.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table A4
*Effect decomposition of parental education on cognitive skill measures (using Stata command khb).*

| | Effect decomposition (parental SES -> math score) | | % of total effect (indirect effect/total effect*100) | Effect decomposition (parental SES -> reasoning score) | | % of total effect (indirect effect/total effect*100) |
|---|---|---|---|---|---|---|
| Model without music (total effect) | .319 | ** | | .264 | * | |
| Model with music | .282 | ** | | .220 | * | |
| Indirect effect via music | .037 | † | 11.6 | .044 | † | 16.6 |

*Note.* Based on imputed data. N= 343. Source: NEPS SC2 v6-0-1.
$^{\dagger}p < .1$. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Table A5

*Logit coefficients of logistic regression predicting response in Wave 3.*

| | Response (w3) | SE |
|---|---|---|
| *Cognitive skill measures:* | | |
| Math (w2, std, WLE) | 0.200* | (0.082) |
| Cognitive abilities (w2, std) | 0.043 | (0.071) |
| Concentration (w2, std) | 0.105 | (0.076) |
| *Organized leisure activities: :* | | |
| Sport (w2) | 0.308† | (0.178) |
| Music (w2) | 0.197 | (0.149) |
| Other (w2) | 0.023 | (0.149) |
| *Cognitive stimulation at home:* | | |
| Number activities (w2) | 0.149 | (0.161) |
| Letter activities (w2) | -0.070 | (0.166) |
| Reading to child (w2) | 0.117 | (0.169) |
| Poem activities (w2) | -0.088 | (0.246) |
| Painting (w2) | 0.069 | (0.160) |
| *Socio-demographic variables:* | | |
| Tertiary educ. degree (family, yes=1) | -0.245 | (0.169) |
| Migration background | -0.917*** | (0.195) |
| HH income (log, in 1000) | -0.078 | (0.186) |
| West-Germany (yes=1) | -0.037 | (0.182) |
| Mothers' working hours (h/week) | -0.001 | (0.005) |
| No. siblings in hh | -0.050 | (0.082) |
| Single parent hh (yes=1) | -0.741** | (0.265) |
| Girl | -0.101 | (0.146) |
| Child's age (month) | 0.012 | (0.016) |
| Educational activities (sum, preschool) | -0.033** | (0.012) |
| Child's health | 0.121 | (0.116) |
| N | 1242 | |

*Note.* Estimates based on observed data. Standard errors (SE) in parentheses; hh=household. Source: NEPS SC2 v6-0-1.

†$p < .1$. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

## Results of the Sensitivity Analyses

Table A6

*Average marginal effects of family background predicting weekly (vs. monthly) stimulating activities at home (logistic regression, weighted data)*

| | Reading | Number activities | Letter activities | Teaching songs | Painting |
|---|---|---|---|---|---|
| Tertiary educ. degree | 0.055* | -0.001 | -0.035 | 0.026 | -0.036 |
| (family, yes=1) | (0.022) | (0.018) | (0.024) | (0.042) | (0.033) |
| *Control variables (family):* | | | | | |
| HH income (log, in 1000) | 0.023** | 0.032 | 0.016 | 0.002 | 0.008 |
| | (0.008) | (0.021) | (0.028) | (0.048) | (0.034) |
| Migration background (yes=1) | -0.008 | 0.012 | 0.010 | 0.132*** | -0.027 |
| | (0.016) | (0.017) | (0.031) | (0.036) | (0.027) |
| West-Germany (yes=1) | 0.005 | -0.017 | 0.008 | 0.073 | 0.030 |
| | (0.011) | (0.020) | (0.026) | (0.042) | (0.028) |
| Maternal working hours (p, h/week) | 0.000 | -0.000 | 0.000 | 0.001 | 0.001 |
| | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) |
| No. siblings in hh | 0.002 | -0.006 | -0.004 | 0.004 | 0.001 |
| | (0.005) | (0.006) | (0.009) | (0.017) | (0.016) |
| Single parent hh (yes=1) | -0.016 | 0.042 | 0.051 | -0.007 | -0.032 |
| | (0.015) | (0.025) | (0.032) | (0.055) | (0.041) |
| *Control variables (child):* | | | | | |
| Girl | 0.005 | -0.000 | 0.043* | 0.051 | 0.052* |
| | (0.010) | (0.013) | (0.020) | (0.033) | (0.025) |
| Child's age (month) | -0.001 | -0.000 | 0.001 | 0.005 | -0.002 |
| | (0.001) | (0.002) | (0.002) | (0.003) | (0.003) |
| Child's health | -0.008 | -0.008 | 0.006 | 0.009 | 0.004 |
| | (0.009) | (0.013) | (0.014) | (0.027) | (0.019) |
| N | 1632 | 1632 | 1632 | 1632 | 1632 |

*Note.* Estimates based on weighted data. Standard errors in parentheses; hh=household. Source: NEPS SC2 v6-0-1.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table A7

*LDV regression of children's math score (w4, std) on organized leisure (OA) and parental cultural capital*

| | Math (m1) | SE |
|---|---|---|
| Tertiary degree (fam) | 0.275** | (0.103) |
| *Parental cultural capital:* | | |
| Books at home | 0.060 | (0.040) |
| Cultural activities (parent) | -0.087 | (0.068) |
| *Meditators:* | | |
| Sports (w2) | 0.071 | (0.117) |
| Music (w2) | 0.260* | (0.100) |
| Reading to child (w2) | 0.050 | (0.109) |
| *Control variables (family):* | | |
| HH income (log, in 1000) | 0.198 | (0.115) |
| Migration background | 0.182 | (0.114) |
| West-Germany (yes=1) | 0.046 | (0.134) |
| Mothers' working hours (h/week) | -0.003 | (0.003) |
| No. siblings in hh | -0.085 | (0.050) |
| Single parent hh (yes=1) | 0.026 | (0.175) |
| *Control variables (child):* | | |
| Girl | -0.078 | (0.089) |
| Child's age (month) | -0.016 | (0.011) |
| Educational activities (sum, preschool) | 0.013 | (0.010) |
| Child's health | 0.006 | (0.078) |
| *Lagged dependent variable:* | | |
| Math (w2, std, WLE) | 0.511*** | (0.049) |
| N | 343 | |

*Note*. Based on imputed sample. Standard errors (SE) in parentheses (clustered: day-care facility); hh=household. Source: NEPS SC2 v6-0-1.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table A8
*LDV regression of children's vocabulary skills (w3, std) on organized leisure (OA) and parent-child reading*

| | Vocabulary (m1) | Vocabulary (m2) | Vocabulary (m3) |
|---|---|---|---|
| Tertiary educ. degree (family, yes=1) | 0.170* | 0.136 | 0.062 |
| | (0.086) | (0.095) | (0.093) |
| *Mediators:* | | | |
| Sport (w2) | | | -0.151 |
| | | | (0.119) |
| Music (w2) | | | 0.190 |
| | | | (0.101) |
| Reading to child (w2) | | | 0.407** |
| | | | (0.147) |
| *Control variables (family):* | | | |
| HH income (log, in 1000) | | 0.230 | 0.206 |
| | | (0.123) | (0.123) |
| Migration background | 0.141 | 0.156 | 0.170 |
| | (0.149) | (0.146) | (0.150) |
| West-Germany (yes=1) | -0.141 | -0.185 | -0.218 |
| | (0.109) | (0.115) | (0.120) |
| Mothers' working hours (h/week) | | -0.002 | 0.000 |
| | | (0.003) | (0.003) |
| Cultural activities (parent) | | | |
| No. siblings in hh | | -0.047 | -0.036 |
| | | (0.053) | (0.048) |
| Single parent hh (yes=1) | | 0.018 | 0.080 |
| | | (0.236) | (0.213) |
| *Control variables (child):* | | | |
| Girl | 0.104 | 0.105 | 0.104 |
| | (0.084) | (0.084) | (0.085) |
| Child's age (month) | -0.001 | -0.001 | 0.001 |
| | (0.011) | (0.011) | (0.011) |
| Educational activities (sum, preschool) | | 0.010 | 0.008 |
| | | (0.008) | (0.008) |
| Child's health | | -0.139 | -0.147 |
| | | (0.078) | (0.078) |
| *Lagged dependent variable:* | | | |
| Vocabulary (w1, std) | 0.652*** | 0.622*** | 0.593*** |
| | (0.052) | (0.055) | (0.058) |
| N | 343 | 343 | 343 |

*Note.* Based on imputed sample. Standard errors in parentheses (clustered: day-care facility); hh=household.
Source: SC2 v6-0-1.
* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table A9
*LDV regression of children's cognitive skills (w4, std) on concerted cultivation (OA measured with time spent in OA)*

| | Math (m1) | Math (m2) | Reasoning (m3) | Reasoning (m4) | Concentr. (m5) | Concentr. (m6) |
|---|---|---|---|---|---|---|
| Tertiary educ. degree | 0.347*** | 0.332** | 0.269* | 0.251* | 0.020 | -0.015 |
| (family, yes=1) | (0.100) | (0.102) | (0.103) | (0.107) | (0.117) | (0.124) |
| *Mediators:* | | | | | | |
| OA hours (w2) | | -0.009 | | 0.003 | | 0.009 |
| | | (0.019) | | (0.021) | | (0.026) |
| Reading to child (w2) | | 0.132 | | 0.097 | | 0.172 |
| | | (0.104) | | (0.156) | | (0.134) |
| *Control variables (family):* | | | | | | |
| HH income (log, in 1000) | 0.263* | 0.254 | 0.299 | 0.293 | 0.406** | 0.396** |
| | (0.127) | (0.128) | (0.156) | (0.158) | (0.135) | (0.135) |
| Migration background | 0.138 | 0.149 | 0.047 | 0.055 | -0.103 | -0.090 |
| | (0.114) | (0.113) | (0.170) | (0.172) | (0.157) | (0.156) |
| West-GE (yes=1) | 0.091 | 0.085 | 0.232 | 0.218 | 0.049 | 0.019 |
| | (0.128) | (0.130) | (0.161) | (0.166) | (0.120) | (0.121) |
| Mothers' working hours (h/week) | -0.004 | -0.003 | -0.007 | -0.007 | -0.002 | -0.001 |
| | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.004) |
| No. siblings in hh | -0.071 | -0.061 | -0.074 | -0.068 | -0.027 | -0.015 |
| | (0.052) | (0.054) | (0.061) | (0.063) | (0.058) | (0.059) |
| Single parent hh (yes=1) | 0.028 | 0.051 | 0.222 | 0.239 | -0.103 | -0.073 |
| | (0.165) | (0.169) | (0.279) | (0.277) | (0.265) | (0.265) |
| *Control variables (child):* | | | | | | |
| Girl | -0.033 | -0.028 | -0.031 | -0.027 | 0.394*** | 0.400*** |
| | (0.086) | (0.086) | (0.100) | (0.101) | (0.095) | (0.095) |
| Child's age (month) | -0.017 | -0.017 | -0.012 | -0.012 | -0.000 | 0.000 |
| | (0.011) | (0.011) | (0.012) | (0.012) | (0.014) | (0.014) |
| Educational activities | 0.015 | 0.015 | 0.022 | 0.022 | 0.025* | 0.024* |
| (sum, preschool) | (0.010) | (0.010) | (0.012) | (0.012) | (0.010) | (0.010) |
| Child's health | -0.020 | -0.024 | -0.094 | -0.097 | 0.109 | 0.102 |
| | (0.078) | (0.078) | (0.097) | (0.096) | (0.086) | (0.087) |
| *Lagged dependent variable:* | | | | | | |
| Math (w2, std, WLE) | 0.522*** | 0.521*** | | | | |
| | (0.050) | (0.050) | | | | |
| Cognitive abilities (w2, std) | | | 0.242*** | 0.238*** | | |
| | | | (0.044) | (0.043) | | |
| Concentration (w2, std) | | | | | 0.259*** | 0.254*** |
| | | | | | (0.058) | (0.059) |
| N | 343 | 343 | 343 | 343 | 343 | 343 |

*Note.* Based on imputed sample. Standard errors in parentheses (clustered: day-care facility); hh=household. Source: SC2 v6-0-1.
* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table A10

*Multicollinearity Diagnostics for the LDV regressions*

| | DV Math | DV Reasoning | DV Concentration |
|---|---|---|---|
| Variable | VIF | VIF | VIF |
| Math skills (std, w2) | 1.20 | | |
| Reasoning skills (std, w2) | | 1.08 | |
| Concentration skills (std, w2) | | | 1.13 |
| Sports | 1.20 | 1.19 | 1.19 |
| Music | 1.16 | 1.15 | 1.15 |
| Reading to child | 1.21 | 1.23 | 1.22 |
| Tertiary educ. degree (family) | 1.37 | 1.36 | 1.40 |
| HH equiv. income (log, in 1,000) | 1.37 | 1.36 | 1.36 |
| Migration background | 1.07 | 1.08 | 1.07 |
| West Germany (yes = 1) | 1.31 | 1.31 | 1.31 |
| Mother's working hours | 1.24 | 1.24 | 1.24 |
| No. siblings in hh | 1.17 | 1.17 | 1.17 |
| Single parent hh (yes = 1) | 1.12 | 1.12 | 1.12 |
| Girl (yes=1) | 1.08 | 1.08 | 1.09 |
| Child's age (months) | 1.13 | 1.11 | 1.11 |
| Educational activities (sum, preschool) | 1.10 | 1.05 | 1.06 |
| Child's health | 1.04 | 1.04 | 1.04 |

*Note*. VIF calculated with the STATA code mivif by Daniel Klein. Source: NEPS SC2 v6-0-1