Does the impact of extracurricular activities vary by parental socioeconomic status? An analysis of adolescents' cognitive skills

Henriette Bering and Wiebke Schulz

1. Introduction

For a long time, in sociological research family resources and school characteristics have been regarded as the fundamental influences on children's life experiences. In recent years, research has started to also consider the importance of how children spend their out-of-school time, particularly the potential impacts of participation in organized extracurricular activities (EAs). Numerous studies found that children's participation in organized extracurricular activities is positively associated with a variety of school-related skills, including cognitive and non-cognitive skills (Bodovski and Farkas, 2008; Covay and Carbonaro, 2010; Lareau, 2011; Hallam, 2010, Hille and Schupp, 2015), which were shown to foster attainment over the life course (Farkas, 2003). Starkly increased parental investment in children's free time (Kornrich and Furstenberg, 2013; Weininger et al., 2015) render them a mechanism underlying the intergenerational transmission of advantages (Breen and Jonsson, 2005).

So while findings suggest that EAs might play a role in producing unequal skills, many studies also show that participation in these activities are closely associated with families' SES (Covay and Carbonaro, 2010, Matsuoka et al., 2015, Hille et al., 2014, Mikus et al., 2020). While the stratification of participation rates has been robustly established, unequal rewards to EA participation have received much less attention. If EAs are more beneficial to children's development from higher status backgrounds by multiplication of their benefits via social and economic resources, they would reinforce social origin inequalities even if participation rates were equal. Alternatively, EAs could alleviate social background differences if they particularly foster the skills of children from lower status backgrounds by compensating for experiences they would miss out on otherwise. Results are thus far inconsistent – for example, Gorry (2016) finds larger gains in high school graduation for sports for children from low-education backgrounds, Cabane et al. (2015) find that for children from educated families, music is more strongly associated to cognitive skills than sports, while Miksza (2007) finds a slower increase in math achievement for children from higher-SES backgrounds active in music than their peers from lower-SES backgrounds also engaged in music. The equivocal findings in the literature may in part reflect the contradictory nature of the possible mechanisms at work for different activities. In addition to studying how the links of sport and music activities to adolescents' cognitive skills vary by parental SES interactions, we also address the previously understudied issue of a combination of both activities, which is also frequent.

In this paper, we seek to contribute to this debate over unequal effects of extracurricular activities by analyzing the link between the most prevalent EAs—sport and music – and cognitive skills. The central argument of this study is that both equalizing and reinforcing dynamics could be at work, depending on the type of activity and the intensity of participation. We ask: do all children benefit for their cognitive skills to the same extent from EAs, or does the impact of these activities vary between children from different socioeconomic backgrounds? More specifically, we ask: do distinct types of EAs, e.g. music vs sport vs participation in both, differ in how they impact children from different SES backgrounds?

Our analyses are based on data from the German SOEP Youth Survey. Adolescents are asked whether they and since when they have been participating in organized sport and music activities outside the school context. We focus on cognitive skills measured at age 17, which is a consistent measure of human capital. As such, cognitive skills in adolescents can be considered as a longer-term outcome of activities pursued during late childhood and adolescence (Cunha and Heckman, 2007). While some studies treat EAs as one facet of cultural capital (see for example Jæger and Karlson, 2018) and thus include organized activities within broader measures of cultural engagement and leisure time activities, we specifically extricate the skill generating aspect of EAs as a wide-spread, particularly organized form of activity.

The contribution of this study is threefold. First, by analyzing how social background heterogeneities in the impacts of EAs differ between sports and music, we cover the most prevalent EAs in a combined analysis. Studies so far have mostly examined music and sports separately, so our approach more closely represents actual childhood dynamics where children possibly engage in music or sports, or indeed in both activities. We disentangle equalizing or reinforcing mechanisms potentially at play, and provide new evidence on how EAs may contribute to the generation of inequalities. The question of differential heterogeneous effects of doing music, sports or both activities has clear policy relevance, as it can help inform investment decisions into children's EAs from a social inequality perspective, and further develop arguments about the productivity of childhood and youth interventions (see Heckman and Masterov 2007).

Second, in Germany, the relation between family background and academic achievement remains strong (Blossfeld, 2018). But recent decades have seen changes in children's EAs, with an overall increase in participation but particularly among children from more educated families (Hille, Arnold et al. 2014). This trend motivates the question of how EAs as factors outside of school impact children's human capital, and whether these impacts are heterogenous by social background. The German context is well suited to study heterogenous effects of extracurricular activities; sport activities mainly take place outside the educational system through sports clubs (*Vereine*), which tend to be non-profit and often partially publicly-funded. Organized music instruction is provided through music school and music teachers, which are also organizational separate from schools. EAs have no direct impact on educational attainment, in contrast for example to the United States, where extracurricular merits can in some instances be considered an addition to academic achievements in the higher education admissions process.

Third, given our interest in returns to EAs, it is crucial that we address sources of stratified participation. If family characteristics that cause children to participate in EAs are also positively related to cognitive skills, conventional approaches may overestimate the benefits of EAs and differentials therein. We employ a propensity score weighting approach in order to reduce the issues connected to socially unequal selection into EA participation. Because of the detailed background information available in the SOEP data, we utilize propensity score weighting to control for the differences in participation likelihood between children from different family backgrounds. As individual and family characteristics influence both the likelihood of EAs and children's cognitive skills, accounting for differences in pre-treatment variables through propensity score weighting reduces selection biases. Propensity score weighting with the unit of reference being children not engaged in EA allows us to answer the

question: For children who did not participate in EA, what could we expect their cognitive skills to be if they had participated in either music or sports alone, or both activities together? And are these potential effects different between children with higher or lower levels of parental education?

2. Background and hypotheses

A human capital perspective argues that extracurricular activities foster children's cognitive skills by providing an environment in which they can act in new ways (Coleman, 1988). These experiences can be transferred to other contexts, such as schooling (Kaufman and Gabler, 2004). In EA, children may learn to adopt to prescribed structures and adult authorities such as coaches and teachers (Felfe et al., 2016) and cooperate and compete with peers (Mahoney and Stattin, 2000) who would otherwise possibly be outside of their networks. While studies mostly focus on the effect of either music or sport activities on cognitive skills, the proposed links between EA and cognitive skills are generic and stem from two separate lines of research. One focuses on physical changes in the brain itself (see for sport: Tomporowski et al., 2008, for music: Schlaug et al., 2005). Another strand of research focuses on the stimulation of executive functioning, such as skills that allow for planning, multitasking, or self-control. Music activities are associated to better executive functions such as inhibition and planning (Jaschke et al., 2018)) and children's motivation and self-discipline (Hallam, 2010). Similarly, participation in organized sport may benefits children's development of skills such as self-knowledge (Hansen et al., 2003, Felfe et al., 2016).

Direct comparisons of differential effects of sport or music activities are scarce but indicate music activities tend to be more strongly linked to cognitive skills than sport activities (Cabane, Hille, and Lechner 2016; Mikus, Tieben, and Schober 2020). Possibly, musically active adolescents are more likely to take part in lessons alone or in a small group in which cognitive skills are acquired more efficiently. In contrast, sport activities are more often carried out in teams; this context may emphasize social interactions and cooperation, which are suggested to yield benefits for executive functioning. Indeed, studies consistently show a link between sport activities and educational attainment (Gorry, 2016). Both activities in combination tend to be most beneficial (Cabane et al., 2015, Linver et al., 2009), however, direct comparisons are rare and it remains unclear whether part of this link is due to limiting children's time for non-educational and possibly harmful activities such as computer gaming and television (Coulangeon, 2018).

2.1 Unequal effects of EAs

Drawing on research on variations of the impact of additional resources on children's outcomes (Erola and Kilpi-Jakonen 2017), one could think of interactions of EA with SES, particularly parental education, in two ways. According to the compensation perspective, EA is most beneficial for children from low-education backgrounds as they compensate for a lack of family resources and help them reduce the disadvantages they are more likely to encounter (Erola & Kilpi-Jakonen, 2017). While children from low-education backgrounds improve their skills because of the various beneficial features of extracurricular activities, children from educated families more likely already acquired these skills through their upbringing and home

environments. That means for high status children, a ceiling effect is expected, so that for these children no additional gains can be expected. From a compensation perspective, an equalizing dynamic would thus be expected. Opposite to compensation theories, multiplication theories expect that while children from high-education backgrounds are not only more likely to participate in EA, they benefit more from this participation than children from less educated backgrounds as activities reinforces their familial input. Family resources, for example in the form of informational, motivational or financial resources help to reap more benefits from their engagement in activities than children that do not have access to these resources in their family. Educated parents might also be more familiar with the potential payoffs of EA participation and encourage their children's regular practice and consistent engagement more vigorously. Following multiplication theories, EA could therefore be expected to reinforce the existing inequality between children from different backgrounds.

However, research provides only limited insights into systematic variations of the influence of sport and music activities by parental education. The reason is that there is a divide between studies considering musical activities and sport activities. Musical activities are mostly considered in studies testing a specific version of variations across SES, namely cultural reproduction (reinforcing dynamics) or cultural mobility (equalizing dynamics) as part of studies of cultural capital. Because studies on the impact of music are often subsumed into wider measurements of cultural activities or cultural capital more broadly, there is little research so far that pinpoint social heterogeneities in the impact of music lessons specifically on children's outcomes. Xu and Hampden-Thompson (2012) find in a comparative study based on PISA data that high-SES children benefit more from participation in cultural activities than children from low-SES backgrounds. Jæger and Karlson (2018) show unequal benefits of cultural capital, with participation in EAs as one aspect of cultural capital, on educational attainment, although they suggest equalizing dynamics as they find higher returns for low SES children. Measures of possible heterogeneities can be found more frequently in research on sports. Gorry (2016) finds equalizing dynamics in the distribution of benefits from sport participation. Her analysis of educational and labor market gains related to US high school students' participation in sports shows that children whose parents have a lower level of education gain more from sport than children from more educated backgrounds. Morris (2016) shows a positive relation between sports participation and academic achievement, with the biggest gains found for families with low levels of education.

Few studies provide a direct comparison of unequal effects of sport vs. music and one vs. two activities. Covay and Carbonaro (2010) find that higher SES children benefit more from sports participation and low SES children gain more skills through art lessons and music than from sports. These findings are consistent with those of Dumais (2006), who found that higher SES students who participate in sports score higher on teachers' evaluations of math skills, yet participation in music lessons provided low-SES students with higher benefits than high SES students for teachers' evaluations of language art skills and actual reading gains. Cabane et al. (2015) are interested in whether sport or music are more beneficial for a range of childhood outcomes and in additional analyses assess how these are stratified rather than assessing equalizing or multiplication dynamics. They find that for high SES adolescents, music is associated with higher cognitive skills and school grades, for low SES adolescents both sport

and music are equally beneficial. Here, it remains open to what extent either activity has the potential to equalize or reinforce social background inequalities.

2.2 Music as equalizer

Musical activities can be expected to be beneficial for children from lower and higher education backgrounds, as studies show (Degé, 2020), but we expect larger skill payoffs for children from less educated backgrounds because ceiling effects. As there is not a large body of research on potential heterogeneity in effects, this possible explanation is tentative.

Children from lower education backgrounds might benefit from music activities more than their peers from more educated families who have more educational inputs from their families regardless of music participation. Music instruction is typically provided by professional musicians or music teachers, so musical activities bring children into regular contact with highly educated and professional adults, which might be especially beneficial for children who otherwise lack these contacts. Since children from educated backgrounds participate in music more frequently, partaking in these activities might also facilitate interactions with high achieving peers for children from less educated backgrounds. In addition, and central to equalizing dynamics, the learning experiences of music activities, which require constant repetition and are close to abstract thinking needed for example in mathematics in school, might benefit those more who lack similar inputs in the family. Because these experiences are already part and parcel of the upbringing for children from educated backgrounds, they do not benefit anymore (a ceiling effect) and benefits can be expected to be higher for low SES children, who have a higher gain potential.

H1: Music activities are more strongly related to cognitive skills for children from lower education backgrounds.

2.3 Sport as reinforcer

Sport activities may mainly present a reinforcing context for children from families with high parental education and hence provide larger payoffs for these children. A possible reason for this could be that the benefits received from sport engagement depend more on parental resources than they do for music.

In contrast to music, where instruction is more individualized, sport teams tend to be larger organizational units. Thus, there could be less room for individualized learning experiences from sport itself, and parental resources and behavior may condition the extent to which children benefit from these activities. Children from lower education backgrounds might receive less parental support for their sport engagement (Stefansen et al., 2018). Educational aspirations of parents likely determine whether they see it as a means of spending free time or also see an educational aspect. In addition, family resources might be more important in determining the quality of sport activities, as the well-established system of sports clubs (*Vereine*) in Germany offers a diverse landscape of sports and teams. Although overall barriers of entry are relatively low, this wide-ranging supply of sport activities might differ in how well they are able to promote the skills of participating children, and different types of sport and

local sport teams might be socially segregated and equipped differently with resources. Teacher are often amateurs with training courses, and the quality of instruction might thus be more varying than in music lessons, with children from more educated backgrounds having more access to high quality sport activities. Also, more educated parents might be able to better identify and access the type of sport that would best suit their children's developmental needs, as choice of sport has been shown to be influenced by social background (Ferry and Lund, 2018). Overall, we expect participation in sports to reinforce the existing cognitive skill gap between children from families with different levels of parental education.

H2: Sport activities are more strongly related to cognitive skills for children from higher education backgrounds.

2.4 Sport and music in combination

The discussion above suggests that the differential effects of sport and music could balance each other out. However, drawing on a threshold notion, it is possible that two activities have a larger potential for equalizing effects. If the argument that adolescents from low-education backgrounds have more room for improving skills holds, then the combination of both activities should provide more chances to do so. In addition, drawing on research that suggests that free-time activities differ for low- and high-background children (Laidley and Conley, 2018), the occupation with organized activities could provide children from low-education backgrounds with larger payoffs than children with higher levels of parental education. Those from lower education backgrounds tend to spend more time doing sedentary activities that are not only not-education related but might even be harmful for cognitive skills such as watching television or playing computer games. Higher background adolescents are more likely to spend their free time actively (Lareau, 2011). Hence, the sheer structuring of free time may come as advantage to low background adolescents, more so than for higher background adolescents, who are more likely to be engaged in beneficial leisure activities even in non-organized contexts. In sum, these considerations suggest that:

H3: Sport and music in combination are more strongly related to cognitive skills for children from lower education backgrounds.

3. Data

This study is based on data from the German Socioeconomic Panel (SOEP). SOEP is a representative annual survey of households in Germany. In particular, the study uses data from the SOEP Youth Survey, which is administered to all SOEP household members in the year they turn 17 (Naujoks et al., 2018). It contains specifically youth-related questions, such as questions about experiences of growing up and in school, as well as information on leisure time behavior and organized activities. The instrument has been in use since the year 2000 and so far, responses of more than 8,000 individuals were collected (N = 8,381). Since 2006, participants' fluid cognitive skills have also been recorded through a cognitive skill test as an addition to the Youth Survey, measuring through three modules numeric, verbal, and figural

skills (Schupp and Hermann, 2009). Thus, the SOEP Youth Survey provides information about children's extracurricular engagement up to the age of 17 and their cognitive skills at 17.

We exclude individuals based on non-response for questions regarding extracurricular activities (N excluded = 465) and those that did not complete at least one of the modules of the cognitive test (N excluded = 4,667). Because the cognitive skill test has not been part of the SOEP Youth Survey before 2006, this significantly decreases the number of retained individuals. The overall sample consists of 3,249 individual adolescents, nested within 2,386 households. This overall sample builds the basis for our general results, for distinct analyses of particular forms of EA engagement, the sample is slightly smaller, as not all participants answered more detailed questions about their sport and music participation.

Table 1: Sample selection

Step	Remaining number of observations
All individuals who answered the SOEP Youth Questionnaire (2000-2018)	8,381
Drop individuals that were not asked about extracurricular activities or didn't answer the relevant question	7,916
Drop individuals without information on cognitive skills (at least one score)	3,249

3.1 Variables

Extracurricular activities

Part of the SOEP Youth Survey are questions about respondents' current participation in extracurricular activities. Respondents are asked "*Do you actively make music, meaning singing or playing an instrument?"* and "*Do you do any sports?"*, and binary "*yes/no"* answers were recorded (Naujoks et al., 2018). Further, if they answered "*yes*" to these questions, they were asked the following follow-up questions: "*Do you or did you have paid music lessons (outside of school)?" and "Do you take part in sports competitions?"* (Naujoks et al., 2018). As we are interested particularly in organized activities, in contrast to more causal leisure time activities, we focus on children who indicated participation in EAs in an organized, structured way through lessons and competitions. As sports tends to be used synonymously with exercise in Germany, our focus on children engaged in competitive sports reduces the heterogeneity within the group of respondents. Based on the responses to these questions, we coded dummy variables that indicate if respondents participate in music with paid lessons, in competitive sports, do both activities with paid lessons and competitions, or do none of the two activities in an organized form. For further robustness checks, we also include other measurements to reduce the heterogeneity of children's EA experience, such as a minimum duration of EA participation.

Around 46 percent of respondents in the sample participated in organized extracurricular activities, while 54 percent did not or only on a leisure level (see Table 3 for descriptive statistics). Sport is clearly the most frequent activity that children in the sample took part in with about 26 percent indicating their participation, followed by music with 13 percent. About

7 percent of the respondents participated in both music and sports with paid lessons and sport competitions. In addition to direct questions about EA participation, the SOEP Youth Survey also accounts for the frequency of engagement in leisure time activities (see Table 2). This information on frequencies does not differentiate between informal and organized participation, but shows that playing music and doing sports are the activities with the most regular participation patterns that have the potential to take place in as an organized EA, while other informal activities, such as listening to music, watching TV or spending time with friends, are more widespread but not in structured contexts.

Table 2: Frequencies of other leisure activities measured in Youth Survey:

Activity	Daily or weekly	Monthly	Less than monthly	Never	NA
TV, Video	0.935	0.011	0.045	0.008	0.001
Computer games	0.535	0.061	0.199	0.204	0.001
Listen to music	0.966	0.008	0.018	0.007	0.002
Play music	0.341	0.038	0.151	0.468	0.003
Do sports	0.701	0.045	0.127	0.125	0.002
Theater, Dance	0.231	0.066	0.204	0.495	0.005
Technical work, programming	0.161	0.071	0.202	0.561	0.004
Read	0.457	0.129	0.254	0.158	0.001
Volunteer activities	0.187	0.067	0.152	0.583	0.011
Do nothing, hang around, day dream	0.670	0.084	0.180	0.062	0.003
Spend time with boyfriend/girlfriend	0.458	0.033	0.049	0.379	0.082
Spend time with best friend	0.796	0.083	0.043	0.058	0.20
Spend time with clique	0.700	0.106	0.078	0.104	0.010
Internet/social online networks	0.654	0.015	0.032	0.037	0.263
Visiting youth center	0.088	0.045	0.130	0.580	0.159
Go to church/religious activities	0.083	0.092	0.252	0.419	0.154

Cognitive skills

The results from a cognitive test included in the SOEP Youth Survey serve as the dependent variables. The test is divided into three modules, measuring three different dimensions of fluid cognitive skills: numeric, verbal, and figural skills (Schupp and Hermann, 2009). For our main analyses, we use a composite score reflecting children's overall performance on all cognitive tests. In additional analyses, we also look separately at the associations between EAs and the particular dimensions of cognitive skills.

We include children's family background and individual characteristics that are likely to impact children's propensity to take up certain activities. Descriptive statistics on these variables are reported in Table 3. For family background, we use parental level of education, household income, parental occupational class, migration background, and childhood location type. For the measurement of parental education, we use the highest level of the parents' schooling through a dummy variable measuring whether or not at least one of the child's parents has an upper secondary school degree following the dominance principle. The dominance principle is also applied to the measurement of parental occupational class, with the highest occupational class between parents based on the Erikson Goldthorpe Class Categories (EGP) used as an indicator of family background. Families were grouped into a high occupational group when at least one parent is part of one of the first two EGP groups (*Higher and Lower Managerial and Professional Workers*). Monthly household net income is measured in the year that the respondents participated in the SOEP Youth Survey when they were 17 years old.

Children are defined as having a migration background if the SOEP indicates either a direct or indirect migration background, so if they themselves or one of their parents migrated to Germany. Childhood location type is categorized into *large city, midsize city, small town,* and *rural*, as based on the size of community that respondents indicated having grown up in until at least age 15 and thus controls for structural differences between more urban or more rural types of communities.

For individual child characteristics, we use gender, whether children are the oldest sibling in their family, school track recommendation and the school track attended by the child. For sibling order, we use a dummy variable indicating whether or not children are either the oldest of several siblings in their family or an only child, with the reference category being children that have older siblings. Teacher recommendation to the academic school track is used as a dummy variable to account for children's earlier skills to some degree, as research has shown that teachers' recommendation is more independent from family background than the school track that is chosen by children and parents (Pietsch and Stubbe, 2007). Because of the limited amount of data on children's school grades available in SOEP, we cannot control for earlier academic achievement through the inclusion of grades into our models, but exploratory analyses into the relation of school grades at younger ages (9 or 10 years old) and cognitive skills at age 17 suggest that most of the association between grades and later skills can be controlled for by including teachers' recommendation to the academic school track, which is partially based on school grades and highly correlated with them. School track is assessed as a dummy variable indicating whether or not participants attend or have attended the academic school track (*Gymnasium*). In Germany, decisions about school tracks are usually made at the age of 11, so before the measurement of EAs children attend different tracks. The academic track is most demanding and possibly has an effect on test scores (Maaz et al., 2008). In case that participants are still in school, the school track they are currently attending is measured, have they graduated, the track of their leaving certificate is measured. In some cases of missing data, the track of the certificate that participants plan to gain is measured instead (N=91).

Table 3: Descriptive statistics. Dependent and independent variables' frequencies (percent), means, standard deviations (SD) and number of observations (N) in the sample. For numeric variables, minimum and maximum values found in the sample.

Variable	Percent	Mean	SD	Min	Max	N
Dependent variables:						
Total test score		30.774	9.419	3	55	3,197
Numeric skills		12.665	4.898	0	20	3,216
Verbal skills		8.191	3.635	0	20	3,240
Figural skills		9.800	3.425	0	19	3,232
Independent variables:						
Activities:						
None	54.265					3,247
Sport (only)	25.839					3,247
Music (only)	12.904					3,247
Both	6.991					3,247
High Parental Education	33.239					2,840

OECD Equivalent Household Income (1,000€)		1.406	0.811	0.000	17.500	3,097
Parental EGP Group I and II	47.550					3,184
Migration Background	29.917					3,249
Gender (Female)	48.723					3,249
Childhood Location Type:						
Large city	20.705					3,236
Medium city	19.901					3,236
Small town	28.986					3,236
Rural	30.408					3,236
Academic school track (Gymnasium)	39.039					3,248

4. Analytical Strategy

We estimate propensity score-weighted ordinary least squares (OLS) regression models predicting cognitive skills. These estimates express the association between extracurricular activities and cognitive skills; our main interest is whether the link between EA and cognitive skills varies across children's SES backgrounds. The models used the overall results of the cognitive tests, standardized to reflect the distribution within the sample, as the dependent variable and children's EAs as independent variables, categorized into sports only, music only, and both activities. Family and individual characteristics were added as controls.

We use propensity score weighting to reduce the bias that unequal selection patterns into EA produce. While other studies clearly point to associations between EA and cognitive skills, the problem remains that children can choose whether or not to participate in EA and are not randomly assigned to EA. It is possible that there is no causal effect of EA on cognitive skills, but rather that some of the same observed and unobserved individual and family characteristics that cause higher cognitive skills also lead to participation in EA at higher rates. Factors that are related to children's choice of EA also tend to be related to their cognitive skills, and thus, any effect of EA on cognitive skills might in fact be due to these underlying characteristics instead of EA participation, and not addressing this would potentially misrepresent the impact of EA on cognitive scores. This problem is reduced in our analytical approach through the use of propensity score weighting. First, we estimate each participant's propensity score for participating in the different EA categories in reference to no EA participation, conditional on the covariates described earlier. These are a variety family- and child-level characteristics selected based on earlier research (Rees et al., 2008; Hille et al., 2014), including parental level of education, occupational class of parents, migration background, household net income, gender, sibling rank, school track recommendation, school track, and size of community. This accounts for family and individual child characteristics that were shown to greatly impact children's likelihood of partaking in extracurricular activities, while also impacting their cognitive skills (see for example Mikus et al., 2020). Next, we use the calculated propensity scores as inverse probability weights in our models, balancing the covariates with respect to the different EA categories so that those engaged in EA resemble those that do no EA. We thus calculate the average treatment effect in the control group (ATC),

with the control group being those who did not participate in any EA. For each type of EA, this answer the following: For children that did not engage in EAs, what would their cognitive skills be had they participated in EA? When then particularly focus on the interaction with parental education.

5. Results

5.1 Descriptive Results

Comparing children with different activity patterns, we find that children that do not participate in the measured activities tend to have the lowest skill levels on average, followed by those that participate in sports, then musically active children, while the highest average scores were measured for children that participate in both sport and music (see Table 4). This points to a relation of these extracurricular activities to cognitive skills – yet it remains open how much of it actually has to be attributed to the effects of differential selection into these activities. Indeed, looking at the distribution of the different types of activity participation by parental education reveals that children from families where at least one parent attained an upper secondary school degree tend to participate significantly more in both activities jointly and in music, while the participation rates in sports are only slightly lower for children from families with a low level of parental education (Table 5). Thus, family background factors clearly seem to impact the likelihood of EA participation. We now first turn to the results of the OLS regression models, before turning to the propensity score weighted models.

Table 4: Average total cognitive test score by EA participation. Total score standardized within sample

	Mean Total Score (standardized)
None (%)	-0.210
Sport (%)	0.102
Music (%)	0.407
Both (%)	0.478

Table 5: EA Participation by parental level of education (high parental education: at least one parent has an upper secondary school degree, low parental education: no parent has an upper secondary school degree)

	High Parental Education	Low Parental Education
None (%)	35.313	61.530
Sport (%)	27.784	24.697
Music (%)	23.118	9.393
Both (%)	13.786	4.380

5.2 Propensity Score Analysis

We used propensity score weighting to balance the covariates of children engaged in the different EA to those that are not active in any EA. We checked how effective the propensity score weighting was by calculating the absolute standardized mean differences between the EA groups. Table 6 shows the standardized mean differences in the sample before and after

weighting. A standardized mean difference of 0 would indicate a perfect balance (Im et al., 2016). A common suggestion is to consider standardized mean differences below 0.25 as adequately balanced, other sources recommend a threshold of 0.1 (Harder et al., 2010). For almost all covariates, the balance is visibly improved. The standardized mean difference is under a threshold of 0.1 for all covariates except household income. As even for this covariate, the standardized mean difference is clearly smaller after propensity score weighting and under the suggested 0.25 threshold, we conclude that the propensity weighting effectively reduced most of the imbalance in covariates between the treatment groups.

Table 4: Absolute standardized mean difference (SMD) before and after propensity score weighting

Covariates	SMD	
	Before	After
High parental education	0.388	0.073
Income	0.610	0.185
Parental EGP Group I and II	0.358	0.034
Gender (Female)	0.265	0.033
Oldest sibling/only child	0.034	0.028
Migration Background	0.158	0.038
Academic school track	0.407	0.050
Recommendation to academic school track	0.411	0.026
Childhood Location Type: (ref. category: Large City)		
Medium city	0.019	0.025
Small town	0.031	0.018
Rural	0.025	0.039

After this covariate balance was achieved, we estimate the effect of participation in different EA on cognitive skills using the propensity scores as weights. All covariates used in the propensity score weighting process were also included linearly in the weighted model. First, we present the results of the main effects of EAs on cognitive skills, and secondly, we analyze the interaction between EA and high parental level of education.

In regard to the main results, we find that all EAs are positively associated with cognitive test scores, but the estimated differences in test scores in comparison to the reference group (no activities) varies (see Table 7, Model 1). Engagement in music and joint participation in both music and sports are associated with the highest cognitive score difference with around 25 percent of a standard deviation (0.280 and 0.230 respectively, $p<0.001$). Sport activities are related to a smaller yet still significant positive skill difference (0.115, $p<0.05$).

The interactions between EAs and parental level of education suggest a reinforcing impact of sport and participation in both EAs, but an equalizing dynamic for music. We find that children from a high parental education background benefit more from sports than children from low education backgrounds, but slightly less from music (Table 7, Model 2). The interaction between sports participation and high parental education background is positive, while the interaction is negative for music. For joint engagement in both music and sport, we find a higher positive effect for children from educated family backgrounds, as indicated by a positive interaction between this activity category and high parental education background.

However, these interaction terms are not statistically significant and can only point to potential patterns. Looking at the predicted values of cognitive scores by EA and parental education, we find statistically significant skill differences between children from high and low education backgrounds for those engaged in sport only and those doing both music and sport, while this gap is reduced for children engaged in music (see Figure 1). Thus, for children from low education backgrounds who did not engage in EAs, our results suggest that had they in fact participated in music or both activities instead, their cognitive skills would be closer to those of children from high education backgrounds, while sports are related to only slightly higher cognitive skills for this group (see Figure 1). For children from high education backgrounds, participation jointly in music and sports is related to the highest expected cognitive skill levels, but engagement in only one activity, regardless of which activity, shows similar intermediate predicted skill levels.

These findings support our hypotheses. Music seems to play a role in reducing gaps in cognitive skills between children from different family backgrounds, and thus partially equalizing disadvantages for children from low education backgrounds. Sport, on the other hand, does not have this equalizing effect on children's cognitive skills, but reproduces or potentially enlarges the skill differences observed between children of different social origins not engaged in EA. Similarly, children from more educated families seem be benefit more from engagement in two activities than their peers from less educated backgrounds.

Table 5: Results of propensity score-weighted linear regression models predicting total cognitive test score by EA participation. Standard errors in parentheses. N=2,583.

	Model 1			Model 2 (with interactions)		
	b		se	b		se
Activity (ref. category: None)						
Sport	0.115	*	(0.045)	0.092		(0.051)
Music	0.230	***	(0.045)	0.241	***	(0.051)
Both	0.280	***	(0.045)	0.238	***	(0.052)
Activity x High Parental Education						
Sport				0.095		(0.105)
Music				-0.050		(0.107)
Both				0.162		(0.104)
Gender (Female)	-0.181	***	(0.032)	-0.183	***	(0.032)
Oldest sibling/only child	0.017		(0.033)	0.017		(0.033)
High parental education	0.247	***	(0.043)	0.188	*	(0.078)
OECD equivalent household income (in 1,000€)	0.013		(0.028)	0.018		(0.028)
Parental EGP group I and II	0.036		(0.038)	0.036		(0.038)

Migration Background	-0.282	***	(0.040)	-0.280	***	(0.040)
Teacher recommendation for academic school track	0.325	***	(0.043)	0.329	***	(0.043)
Academic school track	0.441	***	(0.046)	0.442	***	(0.046)
Childhood Location Type: (ref. category: Large City)						
Medium city	0.099		(0.053)	0.097		(0.053)
Small town	-0.003		(0.049)	-0.004		(0.049)
Rural	0.104	*	(0.049)	0.104	*	(0.049)

* p<0.05 ** p<0.01 *** p<0.001

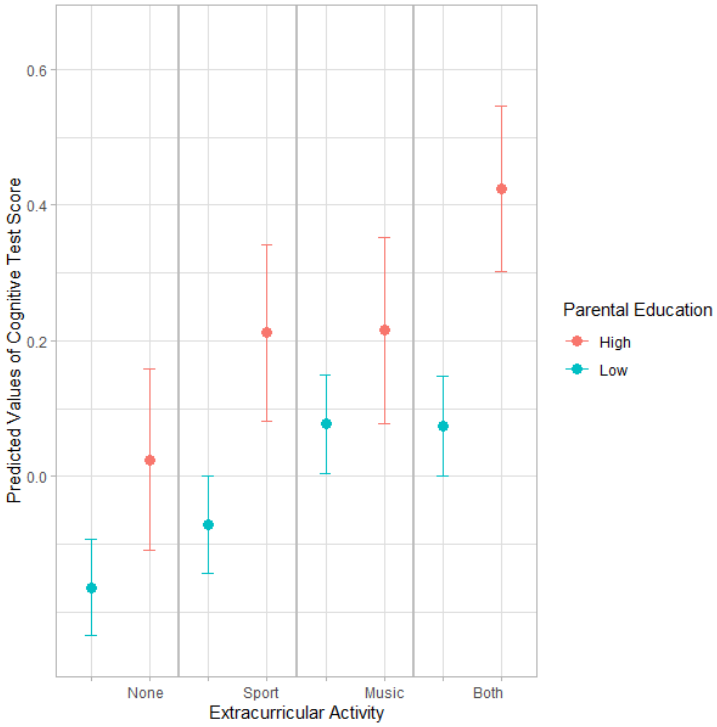

Figure 1: Predicted values of cognitive test scores by extracurricular activity and parental education, based on propensity score-weighted regression models.

Robustness checks

We tested the robustness of our results by calculating models with different specifications of EA. First, we looked at any participation in EA, regardless of whether or not children engaged in them in an organized setting, so with and without music lessons and sport competitions (see Appendix Table A9.) We expect the association between cognitive skills and this broader measure of EA to be weaker, since we expect unorganized musical and physical activity to provide less benefits and cognitive stimulation than organized, structured EA. Here, we find a positive association between EA and cognitive skills for music (0.268, p<0.001) and participation in both activities (0.139, p<0.01), and a much smaller, non-significant association with sport. Looking at the interaction between parental education and EA participation, we find

that while for children from low education backgrounds there is a positive relation between engagement in EAs and cognitive skills, with music again showing a greater positive relation than sport, we do not find a clear association between EA and cognitive skills for children from higher education backgrounds when EAs are defined more broadly. When EA included informal participation, there is actually a negative or no relation between EA and cognitive skills for children from high education backgrounds. These findings support our definition of EAs as those activities that take place in formalized settings with clear organizational structures, through music lessons and competitive sports, as those show the clearest associations with cognitive skills.

Additionally, we also used a more restrictive definition of EA including a minimum duration of participation of at least three years (Appendix Table A11). Not differentiating length of participation might potentially bias the interaction because a certain threshold might be required to gain from EA. Thus, we were able to examine whether longer exposure to EAs are associated to higher cognitive skills. The results of these analyses show similar dynamics as our general models, indicating that EA participation of less than three years is associated to similar associations with cognitive skills. We could not test whether even longer durations of participation show any other dynamics, as EA duration is imprecisely measured in the SOEP Youth Survey. Only the duration of the most recent EA is recorded, e.g. the sport they currently play, but since children also switch between specific activities during childhood, this measure potentially underestimates the length of participation.

Further, we analyzed in separate models the association between EA and the three dimensions of cognitive skill measured through the cognitive tests of the SOEP (see Appendix Table A2-4). These are numeric, verbal, and figural skills. We find that engagement in sports is associated particularly with numeric skills, while music shows a greater positive relation to verbal and figural skills.

6. Discussion and Conclusion

In this study, we examined the role of extracurricular activities for human capital during adolescence, focusing on variations in the interplay of parental education and EA for cognitive skills. Numerous previous studies have established that EA are positively associated to cognitive skills, however there is still no consensus whether EA benefit all adolescents in equal measures. Our analysis focuses on so far understudied questions as to whether unequal effect depend on the type of activity, i.e. music versus sports, including combined activity as well. Specifically, we expected that sport activities might multiply inequalities by boosting the skill payoffs of EA particularly for children from high-education backgrounds. On the other hand, engagement in music may be a factor in equalizing social background differences, if children from families with low levels of parental education show larger skill benefits than their peers. In addition, we expected that a combined engagement in music and sports may provide the highest chances for compensation, as it not only provides many experiences that could influence cognitive skills but also might crowd out other potentially harmful leisure activities.

Our results support our hypotheses with regard to the unequal benefits of music and sports. We find that children from high-education backgrounds indeed seem to benefit more

from sports than their peers from families with low levels of parental education, while music is related to higher levels of cognitive skills especially for children from low-education backgrounds. For a combination of the two activities, our results are more mixed, and point to a different dynamic than we expected: children from high-education backgrounds seem to benefit more from participation in both music and sports together than those from low-education backgrounds, exacerbating cognitive skill gaps.

These results point to the importance of differentiating between different types of EA in how they might impact children unequally. Additional analyses of broader definitions of leisure activities also point to a distinct effect of organized activities. In contrast to unorganized, informal engagement in sport and music, organized participation in music lessons and competitive sports shows a clear positive association with cognitive skills. This supports our claim that organized EA in particular as a wide-spread childhood practice are important to examine from a social inequality perspective.

Through the use of propensity score weighting, we aim to reduce the effect of unequal selection into EA by family SES. However, our approach cannot fully account for unobserved differences between children that might have impacted both their decision to engage in music or sport and their cognitive skills. Also, the data used only provides one measurement of cognitive skills, so that the development of cognitive skills throughout childhood cannot be accurately evaluated. A promising avenue for further research consists in combining propensity score matching approaches with a longitudinal design that accounts for potentially unequal development of cognitive skills in childhood and adolescence. Another limitation is that while we can distinguish between the type of EA that children engage in, i.e. music versus sports, more detailed information on levels of engagement, exposure, or specific types of music or sports are not available. Thus, the mechanisms that lead to our heterogenous results remain unclear and speculative, and necessitate further research.

While our research remains unique in investigating the role of type of EA in generating inequalities, it contributes to the growing literature on the impact of childhood dynamics on the reproduction of inequalities. Among others, research has found particular effects of parenting, home learning environments, and childcare arrangements on children's outcomes (Chan and Koo, 2011, McMullin et al., 2020, Dotti Sani and Treas, 2016).

To conclude, our analyses suggest that beyond unequal access to extracurricular activities, children from different backgrounds engaged in the same types of activities do not necessarily benefit to the same extent from their engagement. This calls for more research into the mechanisms that contribute to this heterogeneity, and how targeted policies might counteract some of these dynamics.

References

Blossfeld, P.N., 2018. Changes in inequality of educational opportunity: The long-term development in Germany. Springer VS, Wiesbaden, 234 pp.

Bodovski, K., Farkas, G., 2008. “Concerted cultivation” and unequal achievement in elementary school. Social Science Research 37, 903–919.

Breen, R., Jonsson, J.O., 2005. Inequality of Opportunity in Comparative Perspective: Recent Research on Educational Attainment and Social Mobility. Annual Review of Sociology 31, 223–243.

Cabane, C., Hille, A., Lechner, M., 2015. Mozart or Pelé? The Effects of Teenagers’ Participation in Music and Sports. IZA Discussion Paper No. 8987.

Chan, T.W., Koo, A., 2011. Parenting Style and Youth Outcomes in the UK. European Sociological Review 27, 385–399.

Coleman, J.S., 1988. Social Capital in the Creation of Human Capital. American Journal of Sociology, S95-S120.

Coulangeon, P., 2018. The Impact of Participation in Extracurricular Activities on School Achievement of French Middle School Students: Human Capital and Cultural Capital Revisited. Social Forces 97, 55–90.

Covay, E., Carbonaro, W., 2010. After the Bell: Participation in Extracurricular Activities, Classroom Behavior, and Academic Achievement. Sociology of Education 83, 20–45.

Cunha, F., Heckman, J., 2007. The Technology of Skill Formation. NBER Working Paper No. 12840, 1–36.

Degé, F., 2020. Music Lessons and Cognitive Abilities in Children: How Far Transfer Could Be Possible. Frontiers in psychology 11.

Dotti Sani, G.M., Treas, J., 2016. Educational Gradients in Parents' Child-Care Time Across Countries, 1965-2012. Journal of Marriage and Family 78, 1083–1096.

Dumais, S.A., 2006. Elementary School Students' Extracurricular Activities: The Effects of Participation on Achievement and Teachers' Evaluations. Sociological Spectrum 26, 117–147.

Farkas, G., 2003. Cognitive Skills and Noncognitive Traits and Behaviors in Stratification Processes. Annual Review of Sociology 29, 541–562.

Felfe, C., Lechner, M., Steinmayr, A., 2016. Sports and Child Development. PloS one 11, e0151729.

Ferry, M., Lund, S., 2018. Pupils in upper secondary school sports: choices based on what? Sport, Education and Society 23, 270–282.

Gorry, D., 2016. Heterogenous effects of sports participation on education and labor market outcomes. Education Economics 24, 622–638.

Hallam, S., 2010. The power of music: Its impact on the intellectual, social and personal development of children and young people. International Journal of Music Education 28, 269–289.

Hansen, D.M., Larson, R.W., Dworkin, J.B., 2003. What Adolescents Learn in Organized Youth Activities: A Survey of Self-Reported Developmental Experiences. Journal of research on Adolescence 13, 25–55.

Harder, V.S., Stuart, E.A., Anthony, J.C., 2010. Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research. Psychological methods 15, 234–249.

Hille, A., Arnold, A., Schupp, J., 2014. Leisure behavior of young people: Education-oriented activities becoming increasingly prevalent. DIW Economic Bulletin 1. Deutsches Institut für Wirtschaftsforschung, Berlin, 13 pp.

Hille, A., Schupp, J., 2015. How learning a musical instrument affects the development of skills. Economics of Education Review 44, 56–82.

Im, M.H., Hughes, J.N., Cao, Q., Kwok, O.-M., 2016. Effects of Extracurricular Participation During Middle School on Academic Motivation and Achievement at Grade 9. American Educational Research Journal 53, 1343–1375.

Jæger, M.M., Karlson, K., 2018. Cultural Capital and Educational Inequality: A Counterfactual Analysis. Sociological Science 5, 775–795.

Jaschke, A.C., Honing, H., Scherder, E.J.A., 2018. Longitudinal Analysis of Music Education on Executive Functions in Primary School Children. Frontiers in neuroscience 12, 103.

Kaufman, J., Gabler, J., 2004. Cultural capital and the extracurricular activities of girls and boys in the college attainment process. Poetics 32, 145–168.

Kornrich, S., Furstenberg, F., 2013. Investing in children: changes in parental spending on children, 1972-2007. Demography 50, 1–23.

Laidley, T., Conley, D., 2018. The Effects of Active and Passive Leisure on Cognition in Children: Evidence from Exogenous Variation in Weather. Social forces; a scientific medium of social study and interpretation 97, 129–156.

Lareau, A., 2011. Unequal childhoods: Class, race, and family life. Univ. of California Press, Berkeley, 331 pp.

Linver, M.R., Roth, J.L., Brooks-Gunn, J., 2009. Patterns of adolescents' participation in organized activities: are sports best when combined with other activities? Developmental psychology 45, 354–367.

Maaz, K., Trautwein, U., Lüdtke, O., Baumert, J., 2008. Educational Transitions and Differential Learning Environments: How Explicit Between-School Tracking Contributes to Social Inequality in Educational Outcomes. Child Development Perspectives 2, 99–106.

Mahoney, J.L., Stattin, H., 2000. Leisure activities and adolescent antisocial behavior: the role of structure and social context. Journal of adolescence 23, 113–127.

Matsuoka, R., Nakamuro, M., Inui, T., 2015. Examining elementary school children's extracurricular activity and their non-cognitive development using longitudinal data in Japan: ESRI Discussion Paper Series No.318, Economic and Social Research Institute.

McMullin, P., McGinnity, F., Murray, A., Russell, H., 2020. What You Do Versus Who You Are: Home-Learning Activities, Social Origin and Cognitive Skills among Young Children in Ireland. European Sociological Review 36, 610–625.

Miksza, P., 2007. Music Participation and Socioeconomic Status as Correlates of Change: A Longitudinal Analysis of Academic Achievement. Bulletin of the Council for Research in Music Education, 41–58.

Mikus, K., Tieben, N., Schober, P.S., 2020. Concerted Cultivation in Early Childhood and Social Inequalities in Cognitive Skills: Evidence from a German Panel Study. Research in Social Stratification and Mobility. https://doi.org/10.1016/j.rssm.2020.100547.

Morris, D.S., 2016. Extracurricular Activity Participation in High School: Mechanisms Linking Participation in Math Achievement and 4-Year College Attendance. American Educational Research Journal 53, 1376–1410.

Naujoks, T., Giesselmann, M., SOEP Group, 2018. SOEP-Core v33.1 - BIOAGE17: The Youth Questionnaire: SOEP Survey Papers 585: Series D. DIW/SOEP, Berlin.

Pietsch, M., Stubbe, T.C., 2007. Inequality in the Transition from Primary to Secondary School: School Choices and Educational Disparities in Germany. European Educational Research Journal 6, 424–445.

Rees, D.I., Lopez, E., Averett, S.L., Argys, L.M., 2008. Birth order and participation in school sports and other extracurricular activities. Economics of Education Review 27, 354–362.

Schlaug, G., Norton, A., Overy, K., Winner, E., 2005. Effects of music training on the child's brain and cognitive development. Annals of the New York Academy of Sciences 1060, 219–230.

Schupp, J., Hermann, S., 2009. Kognitionspotenziale Jugendlicher: Ergänzung zum Jugendfragebogen der Längsschnittstudie Sozio-oekonomisches Panel (SOEP). SOEP survey papers. http://panel.gsoep.de/soep-docs/surveypapers/diw_ssp0230.pdfhttp://hdl.handle.net/10419/106427.

Stefansen, K., Smette, I., Strandbu, Å., 2018. Understanding the increase in parents' involvement in organized youth sports. Sport, Education and Society 23, 162–172.

Tomporowski, P.D., Davis, C.L., Miller, P.H., Naglieri, J.A., 2008. Exercise and Children's Intelligence, Cognition, and Academic Achievement. Educational psychology review 20, 111–131.

Weininger, E.B., Lareau, A., Conley, D., 2015. What Money Doesn't Buy: Class Resources and Children's Participation in Organized Extracurricular Activities. Social Forces 94, 479–503.

Xu, J., Hampden-Thompson, G., 2012. Cultural Reproduction, Cultural Mobility, Cultural Resources, or Trivial Effect? A Comparative Approach to Cultural Capital and Educational Performance. Comparative Education Review 56, 98–124.